UNIVERSITÀ DEGLI STUDI DI MESSINA
Dipartimento di Scienze Cognitive, Psicologiche, Pedagogiche e degli Studi Culturali

DOTTORATO DI RICERCA IN SCIENZE COGNITIVE
XXX CICLO

A hypothesis on linguistic and pragmatic disorders in subjects with autism

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Introduction

Classic studies described the core problem of Autism Spectrum Disorder (ASD) now as a deficit in the Theory of Mind, now as a deficit in executive functions or in inferential abilities. Recent studies, on the contrary, spotted and emphasized the presence of some anomalies in early communicative behaviours of children with autism. Although the diagnosis of autism is usually made around 18-36 month of age, recent studies (that I will talk about in the main part of the thesis) show earlier anomalies in the ontogenetic development of children later diagnosed with ASD.

The precocity of these signs suggests a cognitive alteration that is rooted in the interactive process between the child and his social world. Children later diagnosed with ASD show problems in eye-contact; in joint attention; in reacting to their own names; in pointing; in considering others as potentially helpful (or simply interesting) to them. Children with autism don't perceive the world as we do (Pennisi 2014); they are not interested in what is interesting for TD subjects. During a TV show, TD children will mainly look at faces; on the contrary, the most part of children later diagnosed with autism will mainly look at the background, or maybe at subtitles, or at the furnishing of the set.

In order to study autism, I started from the perceptual anomalies of this clinical population. At the beginning I was intrigued by the incredible perceptions of autistic *enfants savant* and by perceptive problems related to this pathology. If it's true, as posited by Arnheim (2015) and widely accepted by modern neuroscience (Kandel 2012), that perception is a creative cognitive process, we could consider it as a social process too. Through the case of autism, I will describe the social aspects of perception. I will show what it means for a human being to be unable to

synchronize his universe of perceptual saliences with the one of others and how this anomaly can be transferred into other cognitive processes such as language.

The study of autistic perception brought me quickly to the study of language. How can children who don't perceive the world as I do learn language? How can we relate linguistic anomalies in subjects with autism with the alteration of their perceptual biases? Are these phenomena related in such a way?

My idea is that linguistic anomalies could be better understood if we see them in relation to perceptual biases. In fact, if I don't perceive the prosodic cues that my mother is giving to me through her *baby talk*, it will be too hard for me to learn language. If my body doesn't react as others' body do when hearing the word *You*, it will be hard for me to understand the linguistic content of others' utterances. Without a common perceptual background, when my mother will point her finger at a smilig doll I will focus my attention on her watch… that watch with fantastic numbers and a hypnotic, rhythmic noise of lancets!

As I will try to show in this thesis, the pointing and the fixation of reference come from the same cognitive attitude: being interested and attracted by the same perceptual cues.

In this thesis I will describe the most part of linguistic anomalies in subjects with ASD. Then I will try to overcome some prejudice linked to autism, like the idea that patients are unable to understand metaphors. Above all, I will try to describe the linguistic phenotypes of subjects with autism, supporting the idea that the alteration of perceptual biases in subjects with autism is caused by a neurodevelopmental impairment of the system of perceptual saliences.

An alteration in the detection of salience will prevent the baby to understand prosody and *baby talk* and to normally develop language.

This idea has two main consequences:

- Pragmatics is not–as commonly considered–a refinement of language at high level of competences, but an essential component for the ontogenetic development of language.
- In order to develop in a normal way, language needs not only the presence of other speakers, but even a perceptive system that is able to synchronize the speaker's mind, before the learning of first words.

The thesis is organized in six chapters: the first chapter is about linguistic anomalies in subjects with autism; in the second chapter, I give an exact definition of *clinical pragmatics*; the third chapter discusses pragmatic anomalies in subjects with ASD; the fourth chapter describes and analyses the ontogenetic development of language in subjects with ASD; the fifth chapter put in correlation pragmatic anomalies in subjects with ASD with perceptual biases; the sixth chapter is an attempt to collocate my idea about linguistic anomalies in subjects with autism in the theoretical background of embodied cognition through the analysis of the fixation of personal reference. Each chapter is introduced by a brief description of its content.

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Chapter 1

The linguistic alterations in autism

§1.0 Introduction to the chapter

In this chapter I will show that the main linguistic problem that subjects with autism struggle with is intrinsically pragmatic, and that every linguistic anomaly in autism depends on this core issue.

First of all, I will show that all the attempts to identify linguistic profiles failed due to the deep inter-subjective differences in linguistic phenotypes of subjects with autism (§1.1). Then, I will show that all semantic anomalies in the clinical population are attributable to pragmatic deficits and are not intrinsically semantic (§1.2). In the third paragraph (§1.3), I will analyse the methodological questions linked to the study of linguistic comprehension in subjects with ASD. I will posit that the problem seems to be aporetic. In §1.4 I will give a brief description of echolalia, but I will postpone to chapter 6 my explanatory hypotheses regarding this phenomenon.

In the last paragraph of this chapter (§1.5), I will analyse some studies about what Vygotskian calls *inner-speech*. Since I know that talking about inner-speech in a chapter mainly dedicated to strictly linguistic phenomena could be seen by some philosophers as a risky move, I will analyse some experimental studies conducted on subjects with ASD that are based on the vygotskian concept. In my opinion, these studies are an index of how much the cognition of TD subjects is conditioned by the social cognition. In fact, even when it's simple to

perform a cognitive task without recurring to cognitive social tools (such as language), TD subjects tend to use them. On the contrary, subjects with ASD do not. This difference is a plausible explanation to the extraordinary performances of subjects with ASD in specific tasks such as the mathematical ones.

§1.1 Failure of the essays to identify linguistic profiles

From the beginning of the history of the diagnostic category of Autism Spectrum Disorders (ASD), language has been considered a highly affected area of cognition in this clinical population.

Already Leo Kanner noted that, among his eleven patients, three didn't speak [Kanner 1943]. Then, Rutter, Greenfeld and Lockyer [1967], while observing the general cognitive development and the level of social integration in 63 adolescents with «infantile psychosis», noted a great heterogeneity of linguistic profiles, not just related to single skills, but also regarding the trajectories of development of language: some children improved, others did not, others even worsened [Rutter et al. 1967].

The attempt to individuate linguistic phenotypes sometimes overlapped with those to individuate diagnostic subgroups of the various autisms of the spectrum. For example, in 1996, Ramberg and collaborators identified substantial differences in verbal quotient and pragmatic skills in subjects with high functioning autism and in subjects with Asperger Syndrome (AS). In the following years, Isabelle Rapin and Michelle Dunn isolated three linguistic profiles in subjects with ASD, adding to the previous model a low-functioning profile, characterized also by phonological and syntactic deficits and by a poorer lexicon. An analogous model was proposed by Jill Boucher in 2003.

Another attempt to identify linguistic profiles of the clinical population was proposed by Helen Tager-Flusberg and Robert M. Joseph in 2003. These two researchers mainly worked on the relationship between the quotient of linguistic intelligence (VIQ) and that of non-linguistic intelligence (nnVIQ). In doing so, they found three profiles:

- nnVIQ>VIQ
- VIQ>nnVIQ
- nnVIQ=VIQ

In all cases, the severity of linguistic symptoms was associated with that of linguistic deficits.

Those above are just some of the attempts to classify the heterogeneity of homogeneous subgroups of linguistic phenotype. None of these attempts has ever achieved a systematic value nor in any way satisfactory of the distinctive characteristics of each subgroup.

On the contrary, all linguistic profiles identified have in common just one characteristic: the show deficit in pragmatic skills [Ramberg et al. 1996; Rapin and Dunn 1997]. Already Kanner spoke of a «non-communicative» use of language [Kanner 1943] and in 1981, Tager-Flusberg decreed the substantial ineffectiveness of formal approaches. Although lexical, phonological and morphological deficit are not present in all subjects with ASD, pragmatic deficit are universal in this clinical population [Kelley et al. 2006], including subjects with AS [Tager Flusberg 2005]. Semantic deficits are, on the contrary, controversial because they seem to be linked to some specific categories such us deictics or words related to emotional or intentional states, also in subjects with the better outcomes [Kelley et al. 2006].

§1.2 Features of autistic semantics

Because of her interest in the hypothesis of a semantic deficit in subjects with autism, Tager-Flusberg, in the eighties, investigated autistic semantic thorough a series of specific experiments. She mainly investigated two aspects of autistic cognition:

- the presence of semantic categories;
- the working of semantic memory.

§1.2.1 Can subjects with autism understand and create semantic categories?

Tager-Flusberg's first investigations regarding the presence of semantic categories in autistic cognition clearly revealed the presence of some kind of semantic categorization.

Today, this might not seem a great discovery, but Tager-Flusberg's works answered a debate born following the diffusion of news related to the case Nadia. In §1.2.1.1, I will briefly present this famous case study. The case of Nadia inspired different scientific debates; one of these was regarding the link between visual intelligence and language; for more on this debate see Pennisi (2016d), but in this work I will discuss this case study because one of the others questions posed by it was relative to the existence of semantic categories in autistic cognition. With great simplicity, Tager-Flusberg showed that also subjects with what we could improperly call "low-functioning" autism have semantic categories. This debate is important because it clearly shows how easy it is for the normocentric approach (Pennisi 2014) to transform anomalies in deficits and how is important to consider the modality of existence of patients (Binswanger 2001) to avoid misunderstandings not just regarding their existential comprehen-

sion, but also for the understanding of cognitive underpinnings of psychopathologies and—as a consequence of this—of typical cognition. In §1.2.1.2 I will show that the photographic style of drawing is not peculiar just of Nadia, but that it is frequent in the autistic population. In §1.2.1.3 I will present the hypothesis of Fay and Schuler (1980) and of Menyuk (1978) that suggested the absence of even basic semantic categories in the autistic population. Finally, I will show how Tager-Flusberg showed the inconsistency of these hypothesises (§1.2.1.4).

§1.2.1.1 The case of Nadia

Nadia was born in 1967, in Nottingham. Her short life (she died at the age of 48) was partially played under the light of the media's reflectors: she, in fact, precociously showed an incredible, innate ability to draw, miserably and uncannily lost when she was 8.5 years old.

Nadia's mother described her daughter as a passive baby; at around 9 months of age, Nadia started to use some single words, but she was—in general—very slow in the development of the classic milestones. She learnt to independently walk only at the age of 2 and during her second year of life she started to lose her previously acquired language skills until she became almost completely mute at 2.5 years of age (Selfe 2011).

When she was 3, she started to draw and her productions were immediately (without either training or practice) extraordinary for their photographic realism (i.e., fig. 1 was drawn by Nadia at 3.5 years of age).

Figure 1

In 1974, Nadia received a diagnosis of autism for the first time. At that point, the psychologist Lorna Selfe started to intensively study the child and – thanks to this – we have today some specific data about Nadia's drawing and language skills. Nadia drew above all animals (cockerels, horses, pelicans, dogs, etc.). She used to observe books of pictures for hours, and in different moments—without books—she used to draw the same subjects in different sizes.

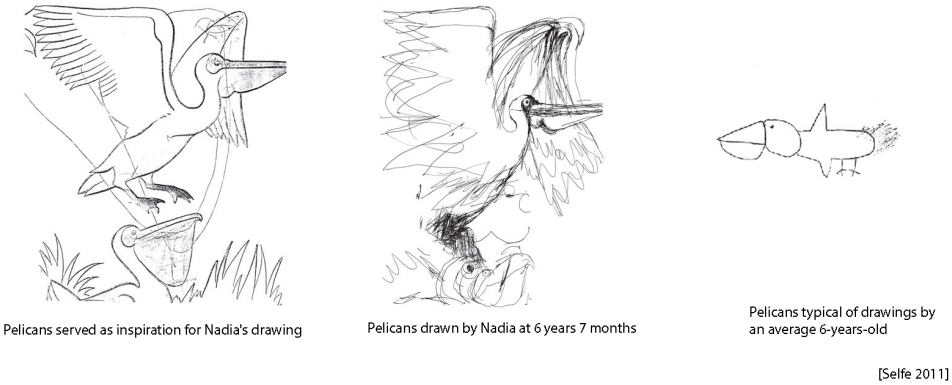


Figure 2

The productions were very close to models (fig. 2), but were not always mirror images; sometimes, Nadia drew legs and shoes directly inspired from real life (fig. 3).

At that time, she just used ten words in English and fewer in Ukrainian; a few two/three words phrases, often used as echolalia out of context. According to Selfe (2011), her verbal age was between 1 year and 18 months.

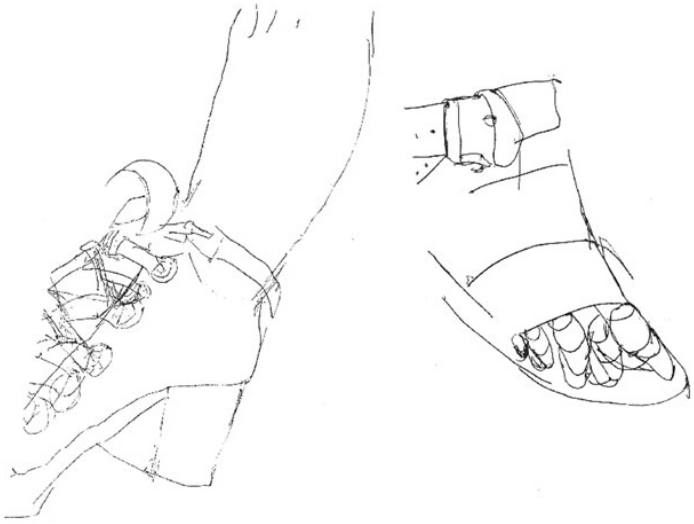
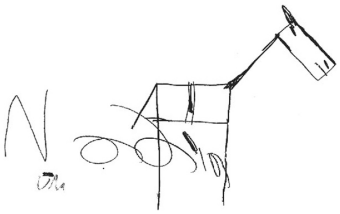


Figure 3

When Nadia was between 8 and 9 years of age, there had been three significant changes in her life: her talent in drawing started to decline (fig. 4); her mother died; and she started to improve her language. For the debate around the relationship between these three changes see Pennisi (2016d).

Now I will show that this photographical style of drawings is frequent in the autistic population (§1.2.1.2).

Horse and rider drawn by Nadia when she was 5 years and 6 month old.



Horse drawn by Nadia when she was 22 years old.

Figure 4

§1.2.1.2 The photographic style of drawing in autistic population

A talent similar to that of Nadia was that of Stephen Wiltshire published by Oliver Sacks (1995). Stephen Wiltshire is now 42 years old and is a British architectural artist with autism. He is able to draw incredible panoramic of cities, with just short time of exposition to the subject of draw. His drawings are full of photographic details and he can start a representation from any part of the representation (*ivi*). I will not dwell on this case because it is already well-known. On the contrary, I will show the case of some Sicilian children. Their works came to my attention thanks to their support teacher, Clelia Celisi.

In fig. 5, I show a drawing of Stefano that, at the time in which the drawing was produced, he presented a functional diagnosis of "Autistic syndrome with absent language". Usually the child presented deficits in fine fine motor skills, however, his support teacher noted that these latter

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were absent during drawing activities. The dinosaur wasn't a copy, but drawn by memory after viewing a documentary.

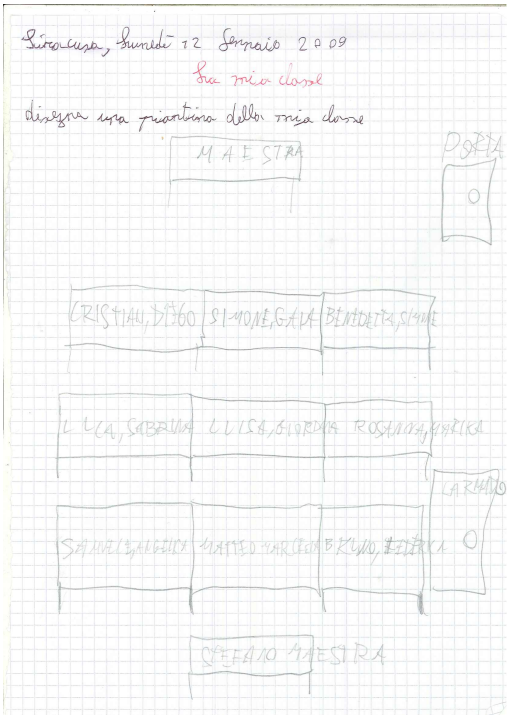

Figure 6

But the photographic style of drawing of Stefano[1] is not just related to the manual reproduction of something previously observed. One day, his teacher assign a task to all the class: children had to draw their classroom. In fig. 6, we can observe the drawing of one of the better students of the class (Luca, a typically developing child). In fig. 7, we can see the drawing made by Stefano. The teacher led him use the computer to perform the task because the child refused to use paper and pencil, but the program used (Paint) allowed to choose the colour and the shape of the each figure.

Figure 7

According to the child's support teacher, Stefano's drawing is more precise not just thanks to the presence of colours (probably simply due to the facilitation produced by the use of the pro-

[1] I will insert some name of children just for facilitate the lecture of the text, but they were all changed for privacy reasons.

[2] For similar exempla, see Grandin 2009; Tammet 2014.

gram), but also in the desks disposition. In reality, Stefano's desk is really located on the right, next to the cupboard. Moreover, the other desks were not attached as suggested by Luca's representation, but they were slightly detached to allow for the passage of children.

Analogous results were obtained by the task to represent the map of the entire school. We will come back to the difference between these two drawings

in chapter 6. Presently, I just want to show that

Figure 8

the photographic style of drawing is frequent in subjects with autism. So, let's analyse together the case of another Sicilian child with autism: the case of Filippo.

Filippo was an eleven-year-old child (he is now an adolescent), with the functional diagnosis of "Asperger Syndrome with a normal IQ". He is the author of fig. 812. Figs. 8 and 9 are clearly inspired by Japanese cartoons but they are not

Figure 9

reproductions of some specific subject. Fig. 10 is a representation of a dinosaur made by the child with a graphic tablet. Usually graphic tablets need a little period of training to be effectively used, but according to what was said by Filippo's mother, that was the first time that Filippo had used a graphic tablet.

Fig. 11 is a drawing of Filippo's support teacher made by the child during a break at school in a few minutes. Also fig. 12 was made during a break at school and it seems to be totally abstract.

What strikes us of these drawings is also what makes them similar to those of Nadia:

- the absence of a training before the acquisition of drawing skills
- the photographic style of drawing.

Although to a lesser extent, also fig. 5 approaches to this trend.

Not all children or adults with ASD show this trend. But this photographic style of drawing doesn't require just a fine perception of details and higher perceptual skills rather than TD subjects, it also requires fine motor skills.

Figure 10

In my opinion, although not all subjects with ASD show the great talent of Nadia, Stephen Wiltshire, Stefano or Filippo, it is not because of differences in perceptual skills, but because of differences in fine motor skills. In other words, visual perception seems to be deeply different in subjects with ASD, but not all subjects with ASD have drawings skills to clearly show this in daily life.

Figure 11

This idea is scientifically supported by data on the Embedded Figures Task (EFT, Witkin et al. 1971). The EFT provides that the experimental subject found a simple shape embedded in more complex figures such as showed in fig. 13.

In 1983, Amitta Shah and Uta Frith showed that children with ASD are more accurate than TD children in this test. In 1997, Therese Joliffe and Simon Baron Cohen replicated these data and moreover showed that both subjects with autism and with AS are

faster than TD subjects in the EFT. Two years later,

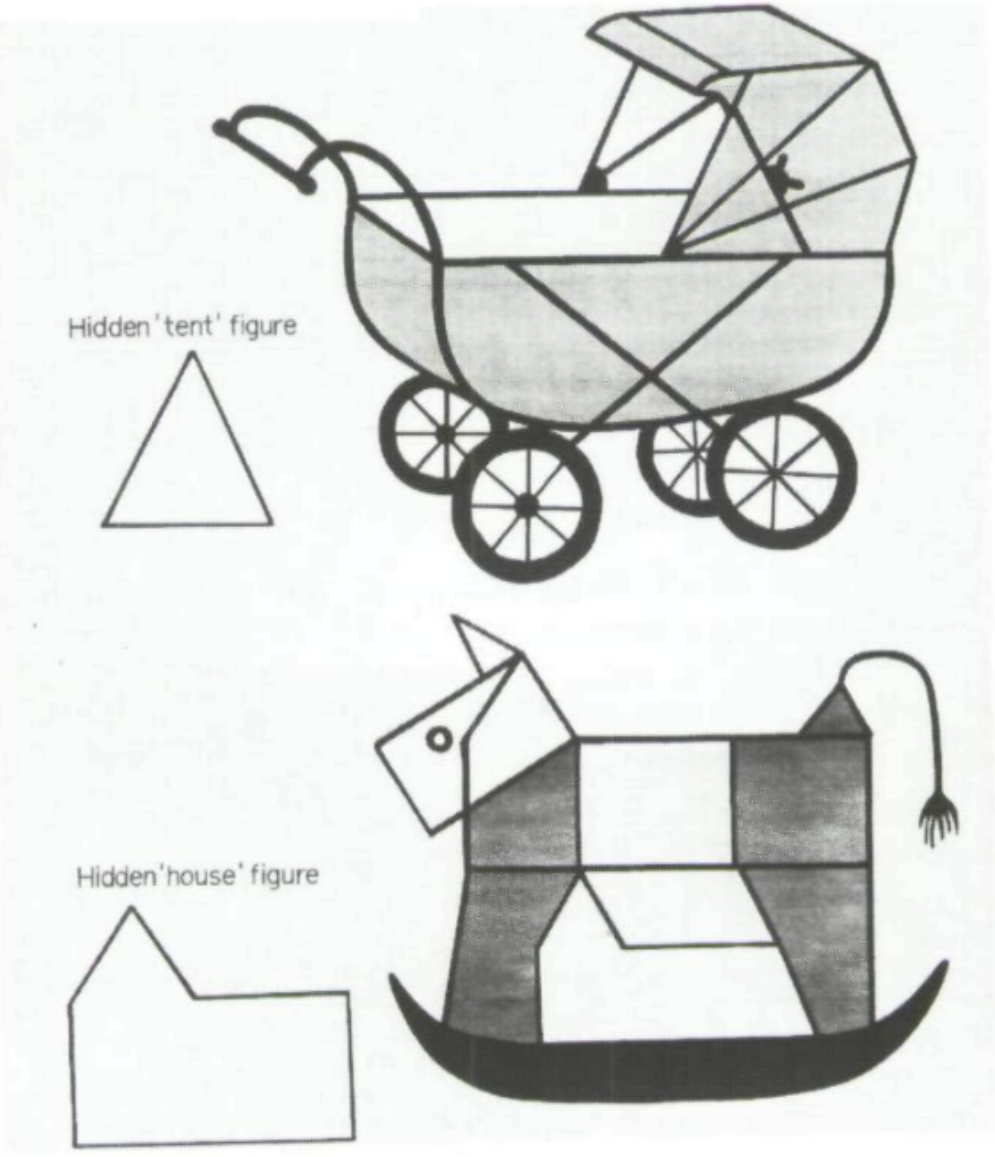

Figure 12

these data were again replicated by Howard Ring and his collaborators (Ring et al. 1999); this last study also showed, by some fMRI measurement, that at cerebral level, subjects with ASD seem to use a different network than TD subjects in performing this test. Another replication of the superiority of subjects with ASD in the EFT was made in 2012 by Brosnan et al.

Although not all differences in catching perceptive details by vision could be considered the main difference between the autistic cognition or the typical

one, there is no doubt that it is an area of strength in people with autism. I'll conclude this paragraph with a citation of Temple

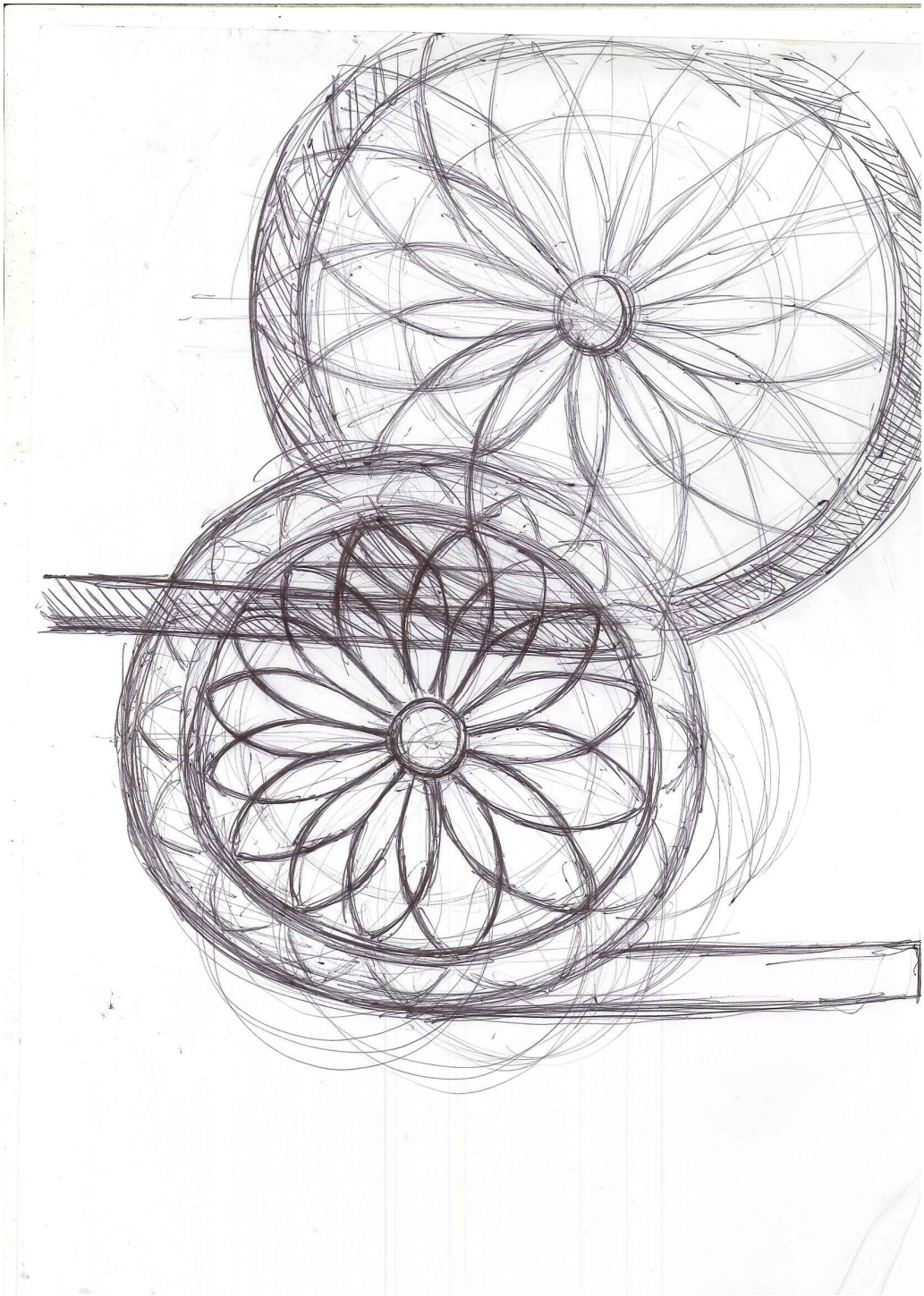

Figure 13

Grandin, and in the next paragraph I will show how in the past, this superiority of autistic cognition was treated as a deficit.

> *As a child my favourite repetitive behaviour was dribbling sand through my hands over and over. The reason I liked to do this was my fascination with the shapes and reflections off of every tiny grain. Each little grain looked like a tiny rock, and I was like a scientist putting it under a microscope.* (Grandin, T. 2009:15).

§1.2.1.3 From strength to deficit: the hypothesis of semantic deficit

Nadia was intensively studied by Lorna Selfe (1977; 2011). At the beginning Selfe interpreted Nadia's talent as an effect of her incapability to conceptually consider her objects of representation (Selfe 1977). Her thesis was supported by some features of Nadia's talent:

- contrary to TD subjects that start to draw from some specific point of the picture (i.e. the eyes or the face) she could start her drawings from any point of the representation (Selfe 1977; 2011). This is also true for Stephen Wilthire (Sacks 1995);
- as shown in fig. 3, sometimes her subjects were cropped;
- she lost her talent after having acquired language.

So, in 1977, Lorna Selfe posed that Nadia was unable to form internal representations of objects and, consequently that she was unable to categorize and her drawings were untrammelled by cognitive processes.

To verify her hypothesis, Lorna Selfe administered some tests to Nadia: the fundamental task was to link cards that could be mentally associated. The results were that Nadia was perfectly able to link cards with perceptual matching (such as identical pictures or pictures with different silhouettes of the same object), but unable to link cards with conceptual matching (such as armchairs, deckchair, kitchen chairs, etc.).

Regarding Nadia, Lorna Selfe spoke about a "frozen intelligence": "I suggested that Nadia's 'view specific' drawings may have been a symptom of

pathological development rather than the drawings of 'frozen intelligence'" (Selfe 2011; chapt. 1). And she compared the case of Nadia to that of Stephen Wiltshire because, contrary to Nadia, he improved his drawing and language skills.

Despite these differences, there were some critics that, starting from observations analogous to those of Lorna Selfe (1977), considered the idea that subjects with autism have cognitive deficits that impede them to semantically organize all perceptual data (Fay and Schuler 1980; Menyuk 1978). Others researchers had a point of view a little bit more optimistic, according to which subjects with ASD can develop cognitive associations and concepts just through perceptive similarities and not by semantic similarities (Ricks and Wing 1976).

The hypothesis of a deficit in categorization is not totally farfetched. In fact, even parents of children with ASD frequently have the impression that their children didn't catch basilar categoric differences. This is what the Italian journalist Gianluca Nicoletti said about his child with autism Tommy:

> *Tommy has difficulties in distinguishing between human beings and animals and maybe objects, I don't believe that he will never have the possibility to imagine something different from what he daily memorize in his experience. His categories are basilar, like a pantheon of an aborigine. In his universe there is Tommy as subject, his house, the iPad, the tandem that he uses with his father, maybe there is also his father, but I don't believe that he has a different rank than others forms of existence that I just listed.* [Nicoletti 2013, the translation from Italian is mine].

But the expression of Lorna Selfe, "frozen intelligence" catches, in my opinion, the gist of this problem. Nadia didn't increase during her life. As I will show in the next paragraph, mental retardation could cause difficulties in the use of macro-categories that are unrelated with the autistic phenotype. Probably Na-

dia's problems with categorization were related to the mental retardation of her condition, not with her autism. In the next paragraph, I will briefly present a series of experiments with which Helen Tager Flusberg clearly showed that the anomalies in categorization of subjects with autism don't show an inability to categorize, but simply some different trends of storing of mental labels.

§ 1.2.1.4 Semantic categorization in subjects with autism

In 1986, Helen Tager Flusberg refused Selfe's Theory regarding Nadia's inability to categorize with a simple observation: Nadia drew subjects belonging just to two categories: animals and human beings. According to Tager-Flusberg, this betrays an albeit minimal semantic competence (Tager Flusberg 1986).

Deciding to investigate the hypothesis of a semantic deficit, Helen Tager-Flusberg did a series of experiments similar to those that Lorna Selfe administered to Nadia. In this way, she showed that children with autism, TD children and children with mental retardation have analogous performances:

- in tasks that require them to link cards belonging to the same category (Tager-Flusberg 1985a);
- in tasks that require participants to orally indicate the category to which a card belong (Tager-Flusberg 1985b)
- in tasks that require participants to take off a table all cards belonging to the same category (*ivi*).

On the contrary, children with autism and TD children showed analogous performances that were superior to those of children with mental retardation in tasks that require participants to link inputs (cards or oral inputs) belonging to the same superordinate level category (such as Biological VS Artificial in which

inputs were specific fruits, vegetables and animals for the first and specific clothes, vehicles or furniture for the second) (Tager-Flusberg 1985a).

From these data, we could infer that undoubtedly subjects with autism can categorize the world.

§ 1.2.2 The semantic memory of subjects with autism

For TD subjects, it is easier to recall lists of words when they are semantically interrelated rather than when they are not semantically interrelated. This bias is absent in subjects with autism (Tager-Flusberg 1991; Hermelin and O'Connor 1967).

In this section I will show that the memory of subjects with autism seems to be less oriented to functional exigencies than that of TD subjects. As a consequence, it appears to be more oriented to an encyclopaedic logic of the acquisition of knowledge. As result of this trend, the language of this clinical population appears to be more static and less flexible than that of TD subjects. I will clearer explain this last concept in §1.2.2.2.

The different ergonomic attitude to store concepts in the semantic memory of autistic cognition becomes evident through following phenomena:

- prototypes has a minor effect in subjects with ASD rather than in TD subjects;
- subjects with autism show great difficulty in learning words in which the reference change with context;
- moreover, and conversely, subjects with autism show great difficulty in correctly interpreting a same reference if it is expressed through different terms
- and finally subjects with autism frequently use neologisms.

In §1.2.2.1 and §1.2.2.2 I will discuss respectively the minor effect of prototypes and the use of neologisms. At this moment I will not examine the difficulty in change reference with context and that in correctly interpret a same reference when expressed through different terms: because of the importance of this two last topics in the autistic pathology, I will entirely dedicate §3.5 and §6 to the problems related to the fixing of references.

§1.2.2.1 Minor effect of prototypes in autistic semantic

In 1996, Dunn et al. showed that subjects with autism tend to use more less-prototypic words than TD subjects in tasks that require participants to say how much words as possible belonging to a specific category. For example, when category was *animals*, subjects with ASD recall strange cases as *yak*, *ocelot* or *hedgehog* (Dunn et al. 1996).

The different use of prototypes is not just an experimental acquisition, but is also frequently reported in biographies written by parents of children with autism. For example, Clara Claiborne Park many times highlights this phenomenon in her daughter's behaviour:

> *She can immediately learn a word like «igloo» and remember it, although its relevance in Elly's experience was nill. She can learn and apply with exactness words such as «oak», «elm» and «maple», but she cannot understand and learn words theoretically closer to her experience. When she was 5 years old, terms such «home», «sister», «granny», «teacher» or «stranger» were beyond her reach; «friend» and «stranger» still are beyond her reach* [Claiborne Park 1967:171; the translation from Italian is mine].

In this quotation, it emerges a preference of Elly for words regarding botanical categories rather than for words usually easily acquired by children because they are closer to their daily experience. This trend betrays, in my opinion,

a clear presence of categories but also a weaker salience of social inputs. Another area of strengths of Elly's semantic memory was that of geometrical terms:

> *When she was five years old […] simply ideas implicit in word: "where has Becky gone?" or "Do you like candies?", questions to which a normal child of three years old usually can react, were beyond her understanding. But her teachers can say: "Elly, draw a red triangle" and she did it. When she learnt other words that mean shapes, they were so easy for her that it seems improper to speak about learning. Her sisters showed her some polygonal forms one morning in summer, just to play with her: the pentagon, the hexagon, the heptagon, the octagon… she had no excitation, nor need to exercise or repetition. They pronounced words just one time, afterwards she simply knew them. Six months after she asked me for an heptagon. I thought that she said "hexagon" because we frequently drew hexagons and spoke about hexagons. But it was not a hexagon. With an heroic effort to be clear, she said: «Heptagon – seven sides!». It was as though she had mastered those concepts and was just waiting for words to describe it* [*ibid.*, p. 172, translation from Italian is mine].

The higher saliency of geometrical inputs is frequently attested in subjects with autism. Geometry reaches two areas of strengths of autistic cognition: the visual one and the mathematical one.

§1.2.2.2 Use of neologisms

The use of neologisms in subjects with autism is reported both by empirical data collected with scientific methodologies and in biographical memories.

For example, Werth et al. (2001) reported the case of Grace, a 29-year-old woman that received a diagnosis of autism and that started to live in a special institute when she was 21 years old. Grace has the habits of recording some audio letters for her family. In some of these audio letters were a lot of neologisms that experimenters categorized as follow:

- neologisms understandable for Grace's family;

- neologisms understandable for anyone who speaks Grace's language;
- and finally incomprehensible neologisms.

The biographical literature is full of these kinds of examples, e.g., Hilde De Clercq, mother of Thomas, a child (now an adult) with autism. In her book on Thomas (De Clercq 2006), she clearly tells how her son creates some neologisms to referring himself to different shape of glasses. According to her, Thomas cannot understand that objects with such different shapes as for example glasses for wine, glasses for water, glasses for aperitif (etc…) can be called all by the name "glass". So, the need to distinguish between these different shapes induces Thomas to create new words to referring to each shape. To doing so, Thomas simply memorize a salient situation for the linguistic acquisition and stores in his mind the full episode, without conceptualizing it:

> *"Thomas calls the glasses by these names: «the furthest»; «the shake»; «theglassofBoma» and «the daily special». To understand the differences, it needs to have lived with him.*
>
> *Thomas calls a glass as «the furthest» for the following reason. One day he wanted to drink; I took a glass from the sideboard but it wasn't the one he wanted. I indicated him different others glasses, and when I was tiptoed […] I understood that it was just the desired ones. I said «Woow, you wanted just the furthest». From that day, this glass is named «the furthest»." From his hyper-selective and perfectionist point of view, Thomas is right. Glasses with a so different aspect cannot have all the same name.*
>
> *The next glass is «the daily special». Thomas's favourite show is F.C. The Champions. When Xavier, one of characters, enter the bar, he says: «For me the daily special»; the barman come back with a glass of beer and says: «Here's your daily special».*
>
> *Another character is named Boma, he always drink a Devil (a brand of beer), and so this kind of glass is named «theglassofboma». Sometimes this glass is called also «my beer», and you probably understand why* (De Clercq 2006:30-31, the translation from Italian is mine)*".*

Another example from the biographical literature is about Daniele. Daniele is an Italian man with autism, and he invented the term «aini» to referring to some vocalizations produced by himself to communicate with his parents:

> *It was during the period in which he was trying to study and doing themes that he started with his «aini». This is the term that he invented to indicate vocalizations and gestures that he does […]. Daniele answers with his «aini» to each of our noises, cough or to some movements. I. e. he does his «aini» to each people of our family, nor with strangers, nor with his older brother who got married when he was very young (and so that Daniele considers a stranger). He does his «aini» also in presence of strangers, but just if we are present, oblivious to people's dismay and to our discomfort, but he doesn't do it when he is in presence of strangers without us* (Hanau and Cerati 2015).

So neologisms are probably produced when the language of the subject can't reach a concept. Subjects with autism are sometimes described as recorder. But I will show, in different occasions, that these descriptions (usually based on misunderstanding of the photographic style of drawings or of echolalic behaviours of these patients) are absolutely misleading. Neologisms are a linguistic phenomenon that clearly show a strong productive attitude.

§1.3 The comprehension of language

> *To live with Elly was […] easy until, when she was about two and a half years old, we gradually started to realize things were not so easy. She wasn't changing. She gave little to do, as always, but the quantity of things that parents expect from a child that is almost two years old increases. As she grew, although we were not concerned for her speech, we expected that she would understand that simple things that we tell her. On the contrary, if we asked for or forbade something, if we offered her a cookie, if we asked her to come to us or to go away, she didn't react. It was as if she couldn't hear. Was it always so? [Claiborne Park 1967:25, the translation from italian is mine].*

The analysis of linguistic production mainly requires a descriptive effort; on the other hand, the analysis of linguistic comprehension mainly requires an interpretative effort. For this reason, studies on comprehension are always controversial. As shown by some pragmatics deficits that we will analyse in §3, it's possible that some verbal children with ASD are more able to speak that to understand what others say (Rapin and Dunn 1997; Volden et al. 2011). However it's very difficult to evaluate these observations with clarity. As shown by Jacqueline W. Wynn and Tristram Smith (2003) children with ASD that are from 2 to 6 years old react in different ways to procedures that show if learning is better from comprehension tasks or from productive tasks. More recently, Elaine Y. L. Kwok and collaborators (2015) proposed a meta-analysis on data relative to the relationship between linguistic comprehension and production in subjects with ASD. They revealed that when this relationship is investigated by the *Sequenced Inventory of Communication Development* (SICD) (Hedrick et al. 1984) and the *Mullen Scales of Early Learning* (MSEL) (Mullen 1995) it seem that these patients are more able to produce rather than to understand language; on the contrary, if this relationship is investigated by the *Vineland Adaptive Behavioral Scales* (VABS) (Sparrow 2011), this trend seems exactly the opposite. I think that this study clearly shows that it isn't impossible to mathematize the relationship between comprehension and production of language in the autistic population.

Let's observe some other tools used in the past to the study the comprehension of language in subjects with autism.

In the seventies, Thomas Bever and R. S. Chapman studied interpretative strategies in TD children and discovered some semantic biases such as,

for example, the *Probable-Event Strategy* (PES). This bias showed that 2/3-year-old children tend to interpret ambiguous sentences such as:

a) The dog walks the mum

in a more probable way, such as:

b) The mum walks the dog.

Starting from these observations, in 1981, Tager-Flusberg investigated comprehension in children with ASD (Tager-Flusberg 1981a). In doing so, she discovered that at 8 years old they still failed the correct interpretation of the sentence.

Frequently, the order of words seems to be not as indicative for subjects with ASD as it is for TD subjects:

> *Elly's idea of the order of words […] is pretty vague. When a normal child says: «Give Becky a green lollipop» […] we know who is the receiver of the lollipop because it is signalled by the order of words. When Elly says it, however, […] it could mean what it is, but also that Becky is the one who gives the lollipop* (Claiborne Park 1967:182, the translation from Italian is mine).

Frequently comprehension is studied through the Stroop effect, in which the subject must react to ambiguous stimuli (such as the word "red" written in blue) according to the semantic modality or to the chromatic one (according to request of the experimental procedure). Usually, if an interference is present (frequently manifested as longer reaction times), experimenters consider that the stimulus in the not required modality was understood.

With this method, Eskes et al. (1990) showed that subjects with ASD and TD subjects have the same reactions. This indicates that comprehension problems in subjects with ASD are related to the context and not to the meaning of each single word.

Unfortunately, the problem seems to be aporetical in nature.

Moreover there is a gap between what is understandable by scientific methodologies and what caregivers and friends of subjects with autism can understand of their language and—consequently—what these patients can understand from their caregivers and what they can understand from unknown doctors and researchers. Nicoletti, for example, speaks about the «Tommese». The «Tommese» is a language clearly known by Tommy's family and probably totally incomprehensible for other people and so not considerable to be a language in scientific sense. In light of this, it's probable that there is not a total overlapping between what caregivers and what researchers/doctors consider "comprehension of language":

> *I understand all that [Tommy] says and so I cannot more judge what is his level of verbal communication with strangers. I'm aware that I'm already shaped by «Tommese»: this is what we call his language, in family, and sometimes we think to write his vocabulary, so few are the words he uses. Effectively, in his language words have not great importance, sometimes he uses one words for more concepts. […] the expression «help» which is one that he pronounces better, is used from he in many occasions, both to ask for help and to affirm a contrariety* (Nicoletti 2013).

If Tommy uses «help» in many occasions, in what way does he interpret its meaning? Can we consider "help" among the expressions that Tommy understand? Often the interpretation of the ability to comprehend linguistic expressions is not linked to the meaning itself, but to its use in context. But often, also if a subject doesn't understand with precision the meaning of words, it can understand the general sense of the communicative interaction and decides to react or—on the contrary—decides to not react.

Although Nicoletti makes no secret his physical clashes with his son, in a certain sense, their relationship is one of the more positively described in the biographical literature of autism. Unfortunately, not all families can

find the same togetherness, not all forms of autism are high functioning, not all subjects with autism reach the same level of expressivity of Tommy.

Laura, mother of an autistic woman of 21 years old, when her daughter was 7 years old, decided to entrust the children to the full-time care of a special school for subjects with psychiatric disorders. This is what Laura wrote about the evening before the dropping of her daughter:

> *My daughter will always be a mystery for me: about her, I know that she can ride a bicycle, she swims, she can buy something at the supermarket, she can communicate some physical and material desires such as "cue cards", she does a lot of house work, she likes washing plates, walking and taking trips, and she voraciously eats everything. […] My saddest and most meaningful memory of this failure of our relationship is that of the last evening she spent with us, before going to England to her «special school». She was still tender and soft, still beautiful. I put her in the bed, I hugged and kissed her […] and I spoke to her with the absurd belief that a miracle could happen: «Tell me "mum", "mum", just once, tell me, tell me, try to say one word, a sound, let me understand that you love me, in such a way». I remember that I started to cry. At that point she laughed, hysterically, mechanically, she was too enjoyed for my tears. I knew well that this was a typical autistic behaviour, but one thought is read this in a text, another thought is suffered in your skin. For me it was the end, the evidence of a total divergence: there would never have been comprehension between us* (Hanau and Mariani Cerati 2015, the translation from Italian is mine).

§1.4 Echolalia

Echolalia is "a meaningless repetition of the words of others" (Grossi et al. 2013:903) in non-appropriate contexts.

Usually we can distinguish between immediate echolalia and delayed echolalia. In the first case, the subject repeats what another person had just said; in the second case, on the contrary, the subject repeats something heard in the past. Autism seems to be the pathology with the highest rate of echolalia (Bartak et al. 1975; Shapiro et al. 1970).

Today we still don't have a clear explanation of echolalia. At the beginning, researchers considered it as fundamentally linked to the general rigidity of autistic cognition (Kanner 1943; Carluccio et al. 1964).

For long time, in the eighties, the theory of Adriana Shuler and Barry Prizant (1985) was very influential. This theory linked echolalia with the tendency of autistic cognition to perceive details as very salient, more salient than as considered by TD subjects (Prizant 1985). According to this theory, the subject answers with echolalic behaviours because it doesn't understand the general meaning of the last sentence of the communicative partner and answers with something that it remembers (so, either what it just heard, or something heard in the past). So echolalia is, in this case, a failed attempt to react to the environment.

This is how Hilde De Clerq describes Thomas's echolalia:

> *"One day, I was getting ready to go shopping. Thomas hears Jeroen, his brother, saying «Oh mum, where are you going so beautiful?» Some days after, I was wearing exactly the same clothes and Thomas repeated, with the same intonation of Jeroen: «Oh mum, where are you going so beautiful?». To verify my suspects, some day after, I got dressed in exactly the same clothes, but I changed my boots. This time Thomas didn't speak. «Beautiful», for Thomas, means something very specific: black boots, pink skirt, necklace, earrings and hair up... all together."* (De Clercq 2006:34; the translation from Italian is mine)

More recently, Dario Grossi et al. (2013) confronted results of a procedure of induction to echolalia with results of an evaluation of echolalic incidence in ecological context with a sample of 18 subjects with ASD between 17 and 36 years of age. After they posed that:

> *"The echolalic phenomenon is an expression of dependence on the environment and may occur in a situation in which the autistic person is participating in a communicative act and, lacking inhibitory control, repeats the other's communication rather than selecting an answer* (Grossi et al. 2013:903)*".*

A longitudinal study on a single subject, on the contrary, seems to show that Aaron, a six-year-old child with autism, tends to modulate his echolalic productions to mark different attitudes (Sterponi and Shankey 2014). Effectively, studies based on the analytical observation of a single patient seem to confirm this trend (Stribling et al. 2007).

The literature on echolalia is very rich. I will not deeply analyse the topic because it's very complicated and I prefer to focus this work on other linguistic phenomena. However, I think that also echolalic phenomena could be explainable with my idea of the alteration of perceptive saliences that I will develop in next chapters.

§1.5 Inner speech in autism

The concept of "inner speech" is firstly attributable to Vygotskij (1934), but it is still a strong focus of interest also in cognitive sciences and specifically in the psychopathology of language. In a review on inner speech published in 2014 by Perrone-Bertolotti and colleagues, researchers define it as a *little voice inside the head of each of us*. Maybe a more precise, still recent, definition could be that proposed by Norbert Wiley (2006) for which the *inner speech* is *the act of using language to talk to oneself internally.* In order to adapt the expression "inner speech" to all the uses that have been made by the studies that I will cite, I would like to specify that this linguistic thought had to take place or internally or simply in solitude; in other words it should not be explicitly shared with other conspecifics. So, in this context the expression "inner speech" will mean *the act of using language to talk to oneself internally or in solitude*.

For Vygotskij, the inner speech is a special kind of verbal activity, that is opposite to the external one mainly in relation to its function: the inner speech is what transforms the language into thoughts, because it is born from an insufficient individualization of a language that is, at the beginning, social (Vygotskij 1934).

Inner speech is engaged in the construction of autobiographical memories and self-awareness (Morin 2012; Motta and colleagues 2013) and "it serves as an internal rough draft for oral and written speech" (Morin 2012). Moreover, it's engaged also in working memory (Morin 2012; Perrone-Bertolotti 2014); executive functions, task-switching and problem solving (Morin 2012).

Now I will show some studies dedicated to the anomalies in the use of inner speech in subjects with autism. These anomalies seem to show that autistic cognition, contrary to the typically developing one, doesn't spontaneously use social language to perform some tasks. Now we will view together what are these tasks (§1.4.1), then we will reflect on the meaning of this difference (§1.4.2).

§1.5.1 Different uses of inner speech in subjects with autism: what tasks are special?

In 2007, Winsler and collaborators tested the interference between inner speech and executive functions in subjects with autism. They confronted the performances of 33 subjects with autism with that of 28 subjects typically developed between the age of 7 and 18. Children were videotaped while they were performing some tests on executive functions like for example the Wiscosin Card Sorting Test. Obviously, the clinical population scored significantly lower than control group because the deficit in executive func-

tions in autism is well-known. But the real test was the presence or the absence of self-speech in subjects during the performance. There were three measures of self-speech: utterances irrelevant to the task, utterances relevant to the task and partially inaudible utterances like muttering, whispers or verbal lip movements. Seventy percent of subjects with autism showed self-speech while they were performing the tasks and none of these verbal behaviours were irrelevant to the task. Moreover, similar to the control group, children with autism performed a higher number of correct answers while performing self-speech than while they didn't perform it. But, despite these analogies, there was also a statistically relevant difference in the use of self-speech regarding partially inaudible utterances during the Wiscosin Card Sorting Test: these were significantly less in autistic population than in control group.

But the self-directed speech is not yet a real inner speech.

In 2014, Larson and Suchy asked a group of adolescents with high-functioning autism and a control group of adolescents typically developed to learn a sequence of movements to be played in a console. The sequence was the Push-Turn-TapTap task of the Behavioural Dyscontrol Scale-Electronic Version (Kraybill and Suchy 2011), which is a clinical measure for executive functions, functional independence of neural networks, etc. Participants had to play three conditions. The first was the *Natural Learning Condition*, in which participants were instructed to perform the motor sequence as best and as quickly as possible. The second was the *Task-Congruent Verbalization Condition*, in which participants had to verbalize words coherent with their movement. So for example, if they were pushing a button in the console, they had to say the word "push". On the contrary, in the third condi-

tion, the *Task-Incongruent Verbalization Condition*, subjects had to verbalize something incongruent to their movements on the console. This experiment produced two very interesting results: the first was that the *Task-Incongruent Verbalization Condition*, while negativly impacting the control group's performance, didn't influenced the autistic performance. The second important result for our argumentation was that the *Task-Congruent Verbalization Condition* improved performances in both groups, but to a greater extent in autistic group. From these two data, experimenters inferred that subjects with autism could use self-speech to guide their behaviour, but that they didn't do this spontaneously.

In 2010, Lucy Holland and Jason Low, did a sequence of experiments that explained more in detail the spontaneous use of inner speech in subjects with autism during tasks that employ executive functions, or that provides arithmetic tests or task-switching performances. The conceptual principles at the basis of the three experiments of this study were the same: experimenters asked participants to perform some tasks while they were employed in secondary task that alternatively inhibited inner speech or visuospatial resources. In all cases, participants were thirteen children with autism and thirteen typically developed children of ten years of age. The first experiment required that children execute two different arithmetic tasks in two different conditions: the first task was to complete an entire list of additions; the second task provided to perform alternatively an addition and a subtraction. The first condition, named *Silent condition* provided that participants silently complete the tasks; the second, named *articulatory suppression condition*, required participants to perform the tasks while articulating out loud the days of the week. According to experimenters, this second condi-

tion impeded the use of inner speech as help for performing arithmetic tasks. The results showed that subjects with autism did not suffer from the imposition of the articulatory suppression condition.

If, contrary to typically developed subjects, participants with autism didn't employ the inner speech for performing the tasks, is plausible hypothesize that they usually use different cognitive resources. Because previous studies conducted with non clinical population showed that often visuospatial abilities are frequently employed in arithmetic tasks; and because lots of studies showed intact (enough altered) visuospatial abilities in subjects with autism, experimenters decided to test the role of visuospatial abilities in arithmetic tasks using a similar paradigm.

So, the second experiment required participants to perform the same arithmetic tasks of the previous experiment under a *visuospatial suppression condition*. In this condition participants, while they were performing the arithmetic tasks, had to reproduce some specified pattern with some blocks in time with a metronome out of their visual field, with their non-preferred writing hand. According to experimenters, in this way is impossible for performers to use the visuospatial sketchpad component of the working memory. This time, the performance of the clinical group, as that of the control group, is highly affected by the *visuospatial suppression condition*.

The third experiment was, in my opinion, is the most important for our discussion. This time, participants were asked to perform a simplified version of the Tower of Hanoi. This is made up of a wooden base with three pegs upon which it’s possible to move some disks in order to create some pattern. The test provides a target pattern in photo that participants have to perform with the least possible number of steps and it was considered by

experimenters a measure of planning abilities. The test was performed in three condition: a *silent condition,* an *articulatory suppression condition* and a *visuospatial suppression condition.* Subjects with autism - contrary to that typically developed - were not affected by the *articulatory suppression condition*, but were affected by the *visuospatial suppression condition*.

The classical overlapping of competence between visuospatial abilities and linguistic abilities in the non-clinical population, seems to be absent in the autistic population, at least as it regards to the executive functions and the task switching.

So, from these data, we can summarize that subjects with autism:

- seem to use less the self-directed speech;
- don't spontaneously use inner speech, but—at least at a basic level—try to do it if they are prompted to do it;
- their performances in tasks that require arithmetic, executive functions and planning skills are not negatively affected by the suppression of the inner speech (contrary to subjects' typically developed performances).

§1.5.2 How to consider the anomalies in the use of inner speech?

What do these studies mean? Why insert them in a chapter dedicated to linguistic anomalies? According to Vygotskij (1934), the activation of a narrative sequential structure, in the inner speech, is personalized. A subject that is performing the following arithmetical task:

c) 3 x 4 = 12

while it is using its inner speech, it is not deconstructing the narrative structure of its thought, it is just expressing it by a different cognitive structure. The inner speech maintains all elements linked to the predicate and change

all elements linked to the subject of the original social thought (Vygotskij 1934).

Introspective narratives of subjects with autism show that often their cognition is structured in a different way to that of TD subjects. Daniel Tammet, for example, describes a very individualized way of think, he conceives in his mind concepts by synesthetic associations. The thought that he describes seems to maintains the classical narrative sequence of linguistic thought, but the elements are represented differently:

> *I was born on 31 January 1979 – a Wednesday. I know it was a Wednesday, because the date is blue in my mind and Wednesdays are always blue, like the number nine or the sound of loud voices arguing. I like my birth date, because of the way I'm able to visualise most of the numbers in it as smooth and round shapes, similar to pebbles on a beach. That's because they are prime numbers: 31, 19, 197, 97, 79 and 1979 are all divisible only by themselves and one. I can recognise every prime up to 9973 by their 'pebble-like' quality* (Tammet 2006:9)[2].

Obviously introspective data have to be considered with caution. But I will use them not just as scientific evidence, but rather just as insights to start some reflections that will be a common thread throughout the thesis. I will try to show that through the analysis of linguistic anomalies in subjects with autism, we can discover how social is human cognition and in what aspects. Moreover, this sociality is not necessary for the individual fitness, but it is for the social fitness.

Phenomenological description of Daniel Tammet and Temple Grandin show that they have different cognitive strategies to interpret the world, and that these strategies are personal, not entirely in sync with those of conspe-

[2] For similar exempla, see Grandin 2009; Tammet 2014.

cifics. Through the analysis of linguistic anomalies of subjects with autism, we could try to reconstruct what is out of sync.

Tammet's and Grandin's forms of thought are perhaps not properly social. What I will try to show in the rest of my thesis is that anomalies that we described in the use of inner speech of subjects with autism don't denote that they don't individualize a language that is social at the beginning; on the contrary, I think that they—contrary to TD subjects—at the beginning (in their normal structure of thought) don't use a primarily social dimension as that linguistic. Schematically:

- inner speech is not a sufficient individualization of a language that at the beginning is social (Vygotskij 1934);
- subjects with autism don't spontaneously use inner speech when performing mathematical tasks, executive functions tasks, planning tasks;

but this doesn't mean that:

- subjects with autism don't sufficiently individualize language while perform mathematical, executive functions and planning tasks.

On the contrary, I will try to show in the rest of the thesis that:

- subjects with autism don't use the social dimension of language as primary form of cognition; their problem in the acquisition of language is probably born just from their inability to use social form of cognition.

So, when experimenters found that, for example, they are not affected by the articulatory suppression condition, itis not because they don't individualize language, but rather because they, contrary to the mean of TD sub-

jects, don’t spontaneously use a social, shared dimension of language as primary form of thought and so the suppression of this last doesn’t affect their performance. So, in a certain sense, is because we are social in nature that math is too difficult!

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Chapter 2

Clinical Pragmatics

§2.0 Introduction to the chapter

In this chapter, I will discuss the meaning of the term *clinical pragmatics* and I will posit that we need to include non-linguistic communicative behaviour in this field of studies.

In §2.1 I will show that the definition of *clinical pragmatics* is controversial just as much as the definition of *pragmatics* is; then, I will compare the definitions made up by two of the most important academics in this field of studies: Louise Cummings and Michel Perkins. In the following paragraph, I will clarify the difference between *pragmatics of language* and *pragmatic of communication* and I will define *clinical pragmatics* as *the study of the way in which the social use of linguistic and non-linguistic communicative skills and their relationship with context can be damaged* (§2.2). In (§2.3) I will show, through a series of practical exempla, what are *pragmatic deficits*. In order to make the boundaries of my field of investigation as clear as possible, in §2.4 I will present a review of the state of the art on pragmatics disorders. After a brief description of the normotipical development of pragmatic skills, following Louise Cumming (2017), I will organize pragmatic disorders into *pragmatic disorders related to neurodevelopmental impairments*; *pragmatic disorders related to congenital perceptive impairments* and *pragmatic disorders acquired in adulthood*. I will conclude the chapter with a critical discussion of the thesis of Bruno Bara, who strongly supports a strictly linguistic view of clinical pragmatics (§2.5). According to him, the reason behind the fact that non-linguistic and linguistic communication share

some features is that they share the same environment (social interaction). I don't agree with Bara: in my opinion, linguistic and non-linguistic communication share some structures that allow human beings to synchronize their minds to the core theme of the communication. As I will posit in following chapters, the cognitive structures I just referred to are the ones primarily responsible for linguistic alterations of subjects with autism.

§2.1 Definitions of Clinical Pragmatics

Clinical pragmatics is a relatively new discipline. According to Louise Cummings (2009), some of the first studies in this direction could be considered those of Rapin and Allen (1983) and of Bishop and Rosenbloom (1987) about the Semantic-Pragmatic Syndrome without Autism. These studies individuated the diffusion of some patterns of linguistic anomalies typical of subjects with ASD also in subjects without ASD; researchers called this pathology profile "Semantic-Pragmatic Syndrome without Autism" (Rapin and Allen 1983; Bishop and Rosenbloom 1987).

Probably the birth of this new field of studies was linked to dissatisfactions manifested in the sixties and in the seventies of the Twentieth Century from clinicians on classical syntactic and semantic categories used to describe and identify communicative deficits in their patients (Gallagher 1991). In the same period the diffusion started of the first studies on the pragmatics of language (Austin 1987; Bates 1976; Searle 1969) that had a great impact on the study of linguistic disorders (Gallagher 1991).

In that stage of research, there was the habit of indicatively localizing pragmatics in the right hemisphere and all other linguistic functions in the left hemisphere (Paradis 1998); but in the eighties, like today, both clini-

cians and philosophers of language considered this schematization as merely indicative.

There is no definition of clinical pragmatics agreed upon by all experts. As noted by Cummings (2009), it's impossible to elaborate a definition of clinical pragmatics that is appropriate to all scientific contexts. Probably, one of the major difficulties in this direction is the same definition of *pragmatics*.

It's true that pragmatics is often considered "the trash of semantics" (Bianchi 2003; Domaneschi 2014), or rather the container inside of which to amass all linguistic facts that are not strictly pertinent to semantics or syntax, or even the performative component of the chomkian distinction between competence and performance (Katz and Langedoen 1976:10); it's also true that the reasons for this definitional vagueness are attributable to the impossibility to understand if a behavioural manifestation detected during a communicative act is pragmatic or not. If we don't know the exact aetiology of a behaviour, each definition will be circular. Moreover, these difficulties are exacerbate from the uncertainty of the concept of *context*, strictly linked to that of *pragmatics*.

To partially get around this problem, in her *Clinical Pragmatics*, Louise Cummings proposed a working definition:

> *Clinical pragmatics is the study of the various ways in which an individual's use of language to achieve communicative purposes can be disrupted. The cerebral injury, pathology or other anomaly that causes this disruption has its onset in the developmental period or during adolescence or adulthood. Developmental and acquired pragmatic disorders have diverse aetiologies and may be the consequence of, related to or perpetuated by a range of cognitive and linguistic factors* (Cummings 2009:6).

In the following pages the author discusses some key points of her definition:

- the communicative purposes are never clearly defined;
- it's unclear if a lot of pragmatic deficits are innate or acquired, so in the definitional phase it's better to avoid correlating the pragmatic nature of deficits with the chronological age of patients or with their level of cognitive development;
- not all pragmatic deficits have been naturalized;
- this research field includes all studies on linguistic competences, but it excludes those on performance and on non-linguistic communication such as gestures, facial expressions or eye contact, etc.);
- pragmatic deficits may be primary or secondary.

We will come back on the Louise Cummings's definition of clinical pragmatics. Now let's consider the distinction between primary and secondary deficits. This distinction derives from those between Primary Pragmatic Disability (PPD, Perlins 2000:22) and Secondary Pragmatic Disability (SPD, *ibid*.; Cummings 2009:3 and 2009:32-34).

The distinction between PPD and SPD was elaborated by Michael Perkins in order to solve problems related to difficulties in defining clinical pragmatics (Perkins 2000). The basilar concept is that it's difficult to define clinical pragmatics because all concept related to pragmatics are aleatory. If we build the language of clinical pragmatics starting from empirical data, we will have more defined concepts. Only cognitive processes directly linked with language and pragmatics will be considered pertinent to pragmatics (Perkins 2000:9). The basic idea, yet expressed in Perkins (1998) was that it doesn't exist a cerebral module of pragmatics, but that speech

acts, conversational maxims and all other pragmatic practices require the collaboration of different cognitive systems:

> *My own view is that pragmatic ability is most usefully seen as an epiphenomenal consequence of the way in which linguistic and non-linguistic cognitive systems interact. In other words, phenomena such as speech acts, conversational maxims, and so on, are not primary cognitive entities themselves but are instead the secondary consequences of interactions between more fundamental cognitive systems* (Perkins 2000:10).

So, to Perkins, pragmatics is an epiphenomenal consequence of the interaction between cognitive and sensory-motor systems, linguistic and non-linguistic (Perkins 2000).

To demonstrate the validity of his idea, Perkins argues that a pragmatic deficit can be caused by:

- different linguistic deficits (morpho-syntactic, lexical, prosodic, etc.);
- different non-linguistic deficits (inferential abilities, social cognition, Theory of Mind[3], etc.).

The definition of aetiology is necessary to understand what kind of compensative strategy we need to stimulate in the patient toward therapy (Perkins 2000). For example, a patient with aphasic anomy could compensate his deficit with an exaggerated use of body gestures and prosody; a subject with comprehension and expressive deficits could be prompted to become more informative. The expression *pragmatic disability* is too vague to reach these goals. For this reason, Perkins defines PPD as a deficit of pragmatic competence linked to deficit in the working of not linguistic cognitive systems such as inferential abilities, social cognition, ToM, executive functions, memory, comprehension, appropriate expression of emotion general

[3] From now ToM

knowledge of world (procedural, situational, encyclopedic, etc…). A SPD, on the contrary, is a communicative deficit linked to linguistic dysfunctions (prosody, phonology, morphology, syntax, lexicon) or sensorimotor dysfunctions (*ibid.*).

Perkins doesn't have a strictly modular conception of pragmatics. He admits the reciprocal interdependence of basilar system of pragmatics, but also their partial functional and structural overlapping and, consequently, the extreme difficulty that a real specific diagnosis of pragmatic deficits could lead to. Moreover, a pragmatic deficit can sometimes derive from primary and secondary deficits; in this case we will speak of *complex pragmatic disability* (CPD) (*ibid.*).

Although not perfect (for its limitations see Cummings 2009:32-34), Perkins's schematization is the more versatile for our purposes. Because autism is a neurodevelopmental disorder, the distinction between primary and secondary effects of the pathology on pragmatics, not for diagnostic purposes, but for research purposes, will be fundamental.

§2.2 Pragmatics of language and pragmatics of communication

Maybe the hottest theme of debate regarding what is pertinent and what is not pertinent to clinical pragmatics concerns the non-linguistic forms of communication.

As *non-linguistic communication* I will mean all bodily languages (oriented or not by culture) that contribute to inferential processes of communication (eye contact, proxemics, bodily expression or visual of emotions, etc.).

In general, we can synthesize that there is a dichotomy between who includes and who excludes the non-linguistic communication from clinical pragmatics. On one side of our dichotomy we'll find philosophers and linguists, who usually tend to put language in the centre of the debate and to exclude non-linguistic communication from their studies. Conversely, on the opposite side of our dichotomy we'll find clinicians that usually consider the non-linguistic component of communication in their patients as central. Partially in line with Perkins's distinction between linguistic and non-linguistic pragmatics (Perkins 2007:9), in next paragraphs we will distinguish between supporters of the pragmatics of language (§2.2.1) and supporters of the pragmatics of communication (§2.2.2).

§2.2.1 Pragmatics of language

As we previously saw, Louise Cummings is a fervent supporter of the pragmatics of language. According to her, non-linguistic communicative gestures (such as eye contact or manual gestures) also actively contribute to communicative inferences, but – according to her – this participation to the communicative act cannot be considered linguistic, so isn't pertinent to pragmatics:

> *Certainly, non- linguistic behaviours such as gesture and eye contact can facilitate a listener's interpretation of a speaker's utterance.[…] However, a behaviour that contributes to the successful interpretation of a speaker's utterance is not thereby pragmatic in nature (syntactic and cognitive processes also play a signi cant role in the interpretation of utterances, yet we wouldn't think of labelling these processes 'pragmatic')* (Cummings 2009:6).

Moreover, Cummings poses the inclusion of non-linguistic communication in the first place in the classification of most common mistakes in

clinical pragmatics (*ibid.* p. 218). Her argumentation is that not all that contributes to interpretative processes is part of *pragmatics*.

In support of her argument, Cummings considers, for example, the case of syntax: surely syntax processes contribute to communicative processes, but they are not part of pragmatics. In her critics to the inclusion of non-linguistic communication in pragmatics, Louis Cummings explicitly cites a study of Chandler et al. (2002), in which researchers consider among pragmatic phenomena gestures, eye contact, facial expressions, bodily expressions, intonation, etc. According Cumming, none of these phenomena could be considered pertinent to clinical pragmatics:

> *However, none of these so-called pragmatic deficits is even describing a linguistic behaviour. It is only a very loose conception of the field of pragmatics, specifically one that identifies pragmatics with wider communication (verbal and nonverbal communication included) that makes it seem that these nonverbal behaviours are pragmatic in nature* (Cummings 2009:219).

Once again the problem is to avoid that pragmatics becomes the trash of semantics, syntax, etc. The problem is not simple.

It was Charles Morris to use the term *pragmatics* for the first time. In 1938, he published *Foundations of the Theory of Signs*, in which he organized the science of signs into: syntax (study of relations among signs); semantics (study on relationship between signs and meanings); and pragmatics (study of relationships between signs and users) (Morris 1954). The original definition, although strictly linked to language, wasn't ontologically dependent on this latter. After, the work with a major echo on the definition of pragmatics was *Pragmatics* by Stephen Levinson (1943), who, after having analysed and criticized fourteen definitions of pragmatics, declared that most promising definitions – while limited – were those which conceived

pragmatics as what that on which rests the meaning when we subtract from it the semantic aspects: «meaning minus semantics» (*ibid.*, p. 32).

In a certain sense, the operation conducted by pragmatics in linguistics and in philosophy of language was to report studies on meaning, including in them the role of communicative context, on a more concrete plane of reflexion (Thomas 1995:21).

However, Louise Cummings is not alone. Others studies show the same attitudes: they admit the importance of the non-linguistic component of communication, but exclude it *a-priori*:

> *My definition of 'general pragmatics' will be further restricted to the study of linguistic communication in terms of conversational principles […]. This means that certain topics which may justly be considered part of pragmatics will be put into the background.[…] Another exclusion is the attitudinal function of intonation, and of non-verbal communication through gestures and paralanguage* (Leech 1983:11).
>
> *The broadest interpretation of pragmatics is that it is the study of understanding intentional human action. Thus it involves the interpretation of acts assumed to be undertaken in order to accomplish some purpose. The central notions in pragmatics must then include belief, intention (or goal), plan, and act. Assuming that the means and/or the ends involve communication, pragmatics still encompasses all sorts of means of communication, including nonconventional, nonverbal, nonsymbolic ones. To narrow our study to linguistic pragmatics, or the pragmatics of language use, we need only stipulate that the principles of pragmatics must account systematically for acts invo1ving linguistic expressions.* (Green 1996:2-5).

Jacob Mey, conversely, shows a shyly open attitude to the idea of including the non-linguistic communication in pragmatics, when he explicitly declares that to exclude the non-linguistic communication from pragmatics it means, in such a way, to exclude the users of language:

> *Restricting pragmatics to purely linguistic matters is not an acceptable point of view for those who want to include the whole of human language use. […] So-called 'extralinguistic' factors can only be excluded from a pragmatic evaluation on the*

> *penalty of the user. A truly pragmatic consideration has to deal with the in their socio/ context; it cannot limit itself to the grammatical encoded aspects of contexts, as the 'grammaticalization requirement' seems to imply.*
>
> *Communication in society happens chiefly by means of language. However, the users of language, as social beings, communicate and use language on society's premises; society controls their access to the linguistic and communicative means. Pragmatics, as the study of the way humans use their language in communication, bases itself on a study of those premises and determines how they affect, and effectualize, human language use* (Mey 2001:6).

However, his overture is shy because after this premise he maintains a glottocentric perspective when he defines what *pragmatics* studies: "pragmatics studies the use of language in human communication as determined by the conditions of society" (*ibid.*, p. 6).

Although this definition still doesn't consider linguistic and non-linguistic communication for pragmatics of the same importance, it has the merit of explicitly amplifying the object of study of pragmatics, including in it also non-linguistic aspects of communication that are culturally oriented, such as proxemics. Although Mey doesn't explicitly treat proxemics in his introduction to pragmatics, he inserts it in the encyclopaedia of which he is editor (Mey 2009: 799-801).

Mey's position is coherent with the tradition of semiotic studies from which it born the term *pragmatics* (as we previously saw). Louise Cummings considered Mey's position as responsible for the derailment of linguistic pragmatics toward communicative pragmatics (Cummings 2009:218).

In Italy, the major part of studies on pragmatics still has language as the main focus (cfr. Bianchi 2003; Domaneschi 2014; Andorno 2005; Caffi 2009; Capone 2003). Cognitive pragmatics, on the contrary, is more orient-

ed toward the inclusion of non-linguistic communication in pragmatics (Bara 1999; Bianchi 2009; Adornetti 2013).

§ 2.2.2 Pragmatics of communication

In 1998, an empirical study conducted on two patients (a man with Broca's aphasia and a woman with congenital deafness) showed that, despite their linguistic deficits, these two patients maintained their pragmatic non-linguistic competences (Dronkers et al. 1998). Authors invited other researchers to reflect on the limits of the idea that pragmatics is just an appendix of language and started to consider it as a function correlated to language, but with a specific autonomy (*ibid*., p. 181).

According to the socio-pragmatic theory of language acquisition, the sharing of attention has the function to create a context that make the socio-communicative symbols salient for a child, regardless of whether they are gestural or linguistic (Tomasello 1992). To Tomasello (2009), gestural communication and linguistic communication have to be considered in a relationship of continuity both at an evolutionistic and an ontogenetic level. The cognitive background that they have in common is the shared intentionality. If this hypothesis is true, the study of linguistic communication cannot disregard non-linguistic communication, at least regarding autism.

Perkins did a recognition of clinical studies that claims the importance of considering these two aspects of human communication complementary and reciprocally necessary (Perkins 2007:9-10). Let's consider the case of gestures. An experiment conducted on TD children seems to show that at 5 years old, infants still use gestural communication of adults to understand complex messages from a pragmatic point of view (Kelly 2001). Fusaro et al. (2012) found a positive correlation between the quantity of gestures pro-

duced with the head by 14-month-old children during interactions with their parents and their pragmatic flexibility at 32 months of age.

Regarding the linguisticity of gestures, Adam Kendon (2000) individuated the possibility that gestures, in some contexts, assume a lexical function. He explicitly argued that if we consider language as a complexity of systems dedicated to the expression of thought, gestures are fully linguistic (*ibid.*, p. 61-62). Moreno-Cabrera (2011) investigated the possibility that gestures assume a syntactic function during conversation.

Also some studies on clinical cases induced some researchers to suppose that non-verbal language and language had to be studied in an integrated system of signs. Let's consider some examples.

In 2012, Howard et al. individuated, in a 5-year-old child with developmental deficits of language, some elements of regularity between the performances of idiosyncratic gestures and some verbal manifestations of the same performances. Cicone et al. (1979) showed how four aphasic subjects were able to amplify their linguistic possibilities toward the integration of gestural communication.

Analysing these positions, Perkins observed that usually those who support a view of linguistic pragmatics comes from linguistic or philosophic studies on language; on the contrary, those who support a communicative view of pragmatics usually is a clinician and needs some tools to classify deficits and bodily compensations (Perkins 2007:10).

The DSM-IV distinguished between social deficits of autism (eye contact, facial expressions, bodily positions, proxemics) and communicative deficits of autism (delayed or lacked language, inability to pretence play, in-

ability to imitate). On the contrary, in the DSM-V this distinction disappeared.

The point is that, although a sort of independence is undeniable between non-linguistic and linguistic communication, ASD are an evident case of impairment of a part of both systems. The studies of Howard et al. (2012) and Cicone et al. (1979) clearly show that it exists as a network that in such a way link these two systems.

§2.2.3 Our working definition

For these reasons, we sill consider *clinical pragmatics* to be *the study of the way in which the social use of communicative linguistic and non-linguistic skills and their relationship with context can be damaged*.

As recently considered by Louise Cummings, clinical research has always highlighted more the holistic nature of the interpretation of speech (Cummings 2014a; 2014b).

§ 2.3 What are «pragmatic deficits»?

As those of *pragmatics* and *clinical pragmatics*, the definition of *pragmatic deficit* is problematic.

Louise Cummings links the concept of *pragmatic deficit* to some key concepts of fundamentals pragmatic theories, specifically: speech acts, implicatures, presuppositions, deixis, non-literal language, linguistic coherence and cohesion and finally, context (Cummings 2014a: 4–21).

Often, linguistic inferences are hard for patients with pragmatic disorders. Let's consider, for example, the following dialogue:

d) I'm sorry, do You know what time it is?

e) Yes.

The illocutionary act linked to (d) is not asking if the listener know the hour, but asking for the time. So, the answer (e) is a failure of the pragmatic understanding of (d). The lack of production or interpretation of speech acts, implicatures, presuppositions, deixis, non-literal language, linguistic coherence and cohesion and finally the failure to integrate the context for the understanding of linguistic message are considered pragmatic deficits.

How can we transform these theoretical concepts into clinical evaluations or empirical data suitable for scientific and philosophical research?

If we need to measure linguistic skills in a strict sense, the quantitative measurement is maybe easier for two reasons: semantics, syntax and morphology are concepts which are less vague than *pragmatics*. The second reason is that it is easier to count (i.e.) the number of words produced by a child, than to count the number of metaphors it produces. Condouris et al. (2003), confronted three standardized tests for the evaluation of linguistic abilities (in a strict sense) (*Clinical Evaluation of Language Fundamentals,* PPVT and *Expressive Vocabulary Test*) with other more ecological measurements. From this study a substantial equivalence of these procedures emerged.

Can we say the same thing for pragmatic evaluations?

For a more exhaustive review on pragmatic tests see Norbury (2014). Here we will select among them just some of the most interesting.

The most-used test in scientific research to evaluate pragmatic skills of children is the *Children's Communication Checklist-2* (CCC-2)(Bishop 2003), a questionnaire composed by 70 questions for parents of subjects between 6 and 16 years of age. It tests:

- Speech, syntax and semantics: i.e. if patient uses words to refer himself to entire class of objects than to single objects;
- Coherence: i.e., if patient can clearly explain a past event;
- Appropriateness: if patient says things interesting to the listener or not;
- Stereotyped language: if patient uses some forms of stereotyped expressions
- Use of context: if patient appears disoriented when a word is used in an unusual way;
- Non-verbal communication: if patient gets too close to his partner or if understand his parnter's implicit suggestions of topic;
- Social relationships: if patient is anxious in presence of other peers
- Interests: if patient speaks only about their own interests, or if it is able to speak about others' interests.

Until now not much research in clinical pragmatics have been focused on assessments and measurement of progress.

A much-used alternative to the CCC-2 is the *Test of Pragmatic Language* (TOPL) (Phelps-Terasaki and Phelps-Gunn 1992); it is commonly used to test inferential skills in children between 5 and 14 years; it is administered directly to children by a clinician. The patient is shown some images and it reads some vignettes; then some questions on characters are administered to him. Also this test is too often used in scientific research, but Loanne Volden and Linda Philips (2010) showed that between the TOPL and

the CCC-2, this latter seems to be better in detecting pragmatic deficits in subjects with ASD.

There are also some questionnaires for auto-evaluation. For example, a test for adults is that created by Andreas Riedel et al. (2014), the *Freiburg Questionnaire of Linguistic Pragmatics* (FQLP). It is composed of 13 multiple choice questions in which the subject has to declare how much—from 1 to 4—it agrees with affirmation such as "I intuitively comprehend metaphors and/or sayings I have never heard before" or "In an ideal language, there would be no ambiguity of meaning".

To measure inferential abilities researchers use both standardized and non-standardized tests.

Bodner et al. (2015) examined with great accuracy the relationship between results of various tests. They used the Pittsburgh Inference Test (PIT), which was specifically developed for adolescents and adults with ASD. It focuses on inferences of physical causation, inference on intentional states, and inferences on emotional states. This last distinction is very important because it takes into account the difference between cognitive and affective ToM. Moreover, experimenters analysed the relation between PIT and the Test of Language Competence-Expanded Edition (TLC-E) (Wiig et al. 1989), which is a measure of high-level metalinguistic functions, in which there is also a sub test on causal inferences (Making Inference subtest[4]). They found a moderate correlation between PIT and TLC-E score in subjects with ASD, which, however, became lower if we consider just the PIT physical subscale. So, PIT appears more complete for the evaluation of inferential abilities than TLC-E.

[4] Participants must ask some question about a description of an event of which they heard a description. To execute the task, participants must make causal inferences.

Mathersul et al. (2013) made an interesting critical analysis of limitations of more-commonly used tests. First of all, they noted that many of the most classic studies on the ability in subjects with ASD to making inference have little ecological validity, i.e. the SST or the *faux pas test* (Baron Cohen et al. 1999) are *text-based*; the *attribution of mental states to animated shapes* (Castelli et al. 2000) has more ecological validity but it's still insufficient. Reading Mind in the Eyes task (RMEt) (Baron Cohen 2003) could not be just a ToM (Theory of Mind) measure but also a measure of complex emotion recognition and results about that are often contrasting (i.e. Craig et al. 2004 VS Couture et al. 2010). For these reasons, in a cross sectional study (ASD vs TD), Mathersul et al. (2013) used the Awareness of Social Inference Test (TASIT; McDonald et al. 2002), usually employed to test ToM abilities in clinical populations with traumatic brain injury, schizophrenia or dementia. The main difference between TASIT and other more classical tests is that TASIT uses video vignettes, which are more ecological inputs. It tests first and second order representations (respectively, what a speaker beliefs and what a speaker thinks or want that the partner thinks) and provides three parts. The first assesses basic emotion recognition and the ability to infer conversational implicatures; the second and the third asses more complex competences in ToM that provides ambiguous episodes that could be explained just by considering the context (facial expressions, vocal intonation and gestures or objects). The first part provides dynamic, naturalistic and complex stimuli and participants must choose the perceived emotion from a closed number of descriptors. The second part provides 10 neutral scripts (5 sincere and 5 sarcastic and the difference can only be understood by context) and 5 paradoxical scripts (that make sense only if the

listener assumes that they are sarcastic); the third part, instead, provides 16 video vignettes of literally untrue comments; to understand if their sense is sarcastic or if there is a deception, the listener must use visual contextual cues of objects or preliminary information provided by the narrator. In parts two and three participants must answer 4 questions for each vignette; each question covers one of these domains: beliefs, meaning, intentions, and feelings. As noted by the same experimenters, a limitation of TASIT is that it has a forced-choice response format that could suggest a response to the subjects.

Perhaps the more ecological standardized test used to investigate general pragmatic deficits is the Pragmatic Rating Scale (PRS, Landa et al. 1992), that, in the ASD population it shows a general pragmatic impairment (Lam 2012). The PRS provides that an examiner without specific competences in speech pathology has a (almost) 15-minute-long free play session with the subjects and gives them measurement on 19 pragmatic anomalies; although the test is not specifically focused on the ability of making inferences, it has the advantage of being rather ecological.

But also non-standardized procedures are interesting, because they provide us with us an idea of how the concept of *inference* is practically interpreted in the most advanced research.

The theoretical advantage of standardized tests is the possibility to compare results from different studies. However, often the same test in different procedures produces very different outcomes. Moreover, inference of mechanisms of everyday life are more problematic from standard tests rather than from more ecological experimental procedures. Neither non-standardized procedures nor standard tests will give us an exhaustive re-

sponse to our question, but comparing the results of both kinds of measurement will be useful.

Grynszpan and Nadel (2015) used a measure of the ratio in using cognition verbs (think, believe, know) to verbally describe a social situation previously observed in a computer to measure the ability of making intentional inferences; the input was verbal and non verbal.

Cassidy et al. (2014) architected a very interesting setting for ecological valence. They showed participants some video clips representing people that received a gift. The videos were focused just on emotional expressions and participants had to infer what gift people received from three categories: chocolate (related to a positive expression); a homemade gift (related to feigned positive expression) and monopoly money (related to a confused expression). Experimenters asked to participants what emotion the actor manifested and what gift they received according to them. This kind of test may tell us if participants are able to infer emotions from others' faces in an ecological context, if they are able to understand the socially appropriate reaction and if they can infer events from a correct interpretation of others' emotion. Because experimenters used an eye tracker during the procedure, this procedure could also investigate the relationship between the pattern of scanning face and the ability to make emotional inferences.

Krawczyk et al. (2014) developed a series of 24 two-slides-sequences to investigate analogical inferences. Participants had to find analogy between the two slides in which there were some relational correspondences. The test provides different levels of relation, differences between living and non-living sequences and the presence or absence of distractors. This test let the experimenters investigate the relation between the ability to make ana-

logical inferences and the level of complexity of a situation; the presence of living (note: not intentional) agents and the presence of a distractor in the scene.

To study autistic ability of making inferences about irrational actions, Marsh et al. (2014) made eye-tracking recoding during the presentation of nine stimuli conditions, analysing predictive saccades. In the video observed by participants, a ball was moved by an actor with a visible face according to a rational straight, a rational curve or an irrational curve (first three conditions); by an actor without a visible face according to a rational straight, a rational curve or an irrational curve (other three conditions); and the ball moved on its own according to a rational straight, a rational curve or an irrational curve (last three conditions). This kind of test, because it measures the saccade-origin, gives us some indications about the participant's ability to make inferences about the goal of a rational or irrational action and performed by an intentional or non-intentional agent.

Paganini and Gaido (2013) adapted the RMEt for a cross-cultural study changing the black and white photos of white/Caucasian adults of the Baron Cohen's test with 15 colour images representing eyes of humans of different ages, sexes and nationalities. In the same study, to confront the ability of making emotional inferences with that of making physical inferences, experimenters elaborated different types of input both static and in motion designed to represent common physical laws. In both tests participants had to choose from four possibilities and one "I don't know" answer.

Sansosti et al. (2013) and Saldaña and Frith (2007) studied bridging inferences. Bridging inferences are inferences we make while reading and that require the reader to bridge the current text idea to one that occurred

earlier in the text. In the task proposed by experimenters, participants had to read a short two-sentence text that, to be understood, required bridging inference that integrates the two sentences.

David et al. (2010) built an experimental paradigm to test the ability of subjects to infer the visuo-spatial viewpoint of the subjects. An avatar must choose an object among two. The preference is expressed by facial expressions, gestures and body orientation. Subjects had to infer the preference of the avatar and had to express their preference in imagining to be in the place of the avatar. While the first task tests the ability to infer others' intentions from the avatar's body language, the second tests the ability of imagining another perspective and inferring the correct gesture to answer the question.

Both standardized and non-standardized procedures seem to be oriented toward a more ecological validity.

Finally, some recent good surveys regarding how to measure pragmatic skills are those of Hyter (Hyter 2017) and that of Saldert (Saldert 2017).

Yvette Hyter provided a brief survey of the most-used tools by speech pathologist to treat and measure pragmatic anomalies (Hyter 2017). The researcher highlights, many times, the need to consider cultural differences in pragmatics and consequences that they have on transcultural replicability of results and on the own application of treatment protocols. Despite these difficulties, Hyter delivered lists and descriptions of most-used tools for examining and treating multiple aspects of pragmatics in children: observation profiles and checklists for the evaluation of conversation; discourse analysis procedures to analyse the narrative and expositive skills; ToM tasks; etc...

From Hyter's work, the need to further investigate pragmatics cultural differences emerges; to investigate pragmatics from a progressively more holistic point of view and to replicate data in which today we are working with a larger number of participants, in order to work with more certitude regarding our object study.

Charlotta Saldert performed a work for adults analogous to that that Hyter did for children (Saldert 2017). As Hyter, Saldert did a survey of main tools for assessment and evaluation of pragmatic deficit in clinical population. Obviously, tests and tools are different, but in both cases researchers report that overall literature shows some evidence regarding the positive outcome of assessments. However, Saldert, contrary to Hyter, noted a discrepancy between scientific literature (both regarding starting measurements and efficacy of treatments) and general reports of clinicians in their every-day practice (*ibid*). Therefore, research needs to take concrete aspects of pragmatics into more consideration.

§ 2.4 What is practically clinical pragmatics: the state of the art

From the analysis of the state-of-the-art research on clinical pragmatics, two main points emerge: (1) the awareness that this field of research is very promising; (2) the need for the development of a clearer methodology to investigate cognitive underpinnings of pragmatics. As I will show, the most difficult problem in this sense is to translate the ever-different contingencies (not only of various diseases, but also of different patients which are put in front of us) into universal rules.

In section §2.4.1 I will consider the development of pragmatic skills in typically developed children; in section §2.4.2 I will confront some diseases that affect pragmatic skills in developmental age following cognitive impairment; in section §2.4.3 I will observe pragmatic deficits caused by congenital perceptual impairments and, finally, in section §2.4.4, I will analyse studies on alterations of pragmatic skills acquired in adulthood as a consequence of some pathologies.

§2.4.1 Typical pragmatic development in childhood

According to Gabriella Airenti's research on the progressive emergence of pragmatic skills during the development of a subject, we could consider—from an ontogenetic point of view—pragmatics as a predecessor of language (Airenti 2017).

More specifically, turn-taking is the first feature acquired by infants and its ontogenetic predecessor is joint attention, which seems to emerge as early as 6 months (*ibid.*). At 9-12 months joint attention skills permit the development of pointing (*ibid.*). If in front of simple abilities as those just cited the literature seems clear, regarding the acquisition of speech acts, data is more controversial and Airenti shows the reasons why. First of all, a lot of linguists don't accept considering non-verbal communicative acts as *speech acts*, as for example John Dore (1978), and—secondly—there is no joint agreement regarding the exact definition of a "speech act". Airenti concludes that ‘it is incorrect to say that there is an age at which children acquire specific speech acts’ (*ibid*., p. 10).

The fundamental ability to quickly acquire lexicon is reference, mainly trained by the ability to consider the others' eye-gaze as indicator of direction to understanding the focus of discussion and by the capacity to inte-

grate the meaning of conversational context in interpersonal interactions (*ibid.*). Deixis seems instead to be acquired between 1.5 and 3 years of age. Regarding the acquisition of non-literary language, Airenti takes into consideration a very important milestone against all classical models of developmental pragmatics: the acquisition of metaphor and metonymy are context-related (in this direction see Pennisi 2016). The latest pragmatic skill usually acquired is irony. Its predecessor seems to be the early understanding of humour. The major difficulty that irony requires is linked to the necessity of understanding others' intentions and beliefs; on the contrary, to understand metaphors a general previous knowledge about the topic in question could substitute the absence of a fully developed theory of mind.

An important element that emerges from Airenti's model of developmental pragmatics is that we shouldn't take for granted that comprehension always precedes the ability to produce some pragmatic behaviours. Her idea is confirmed by some studies regarding the use of metaphors in autistic populations (for a review see Pennisi 2016). Airenti's model is a very important attempt to build a model of developmental pragmatics. Today we still don't have a clear idea about how and when pragmatics develops in each subject. However, it could be useful to consider that probably the reasons of this state of the art are not related to the quantitative shortage of data, as theorized by Airenti, but rather to the kind of measurement used in these studies (we will consider this problem in more depth in §3). We will have different ages of reference regarding the acquisition of irony if we use the Happé's *Strange Stories Test* (Happé 1994) or if we use an oral test. If, for example, Angeleri and Airenti (2016) reported that the ability to understand irony, while continually improving throughout childhood, may be pre-

sent as early as three years of life; on the contrary Banasik (2013), with a different kind of measurement, found that irony comprehension doesn't grow with age after four years old.

These studies clearly show that more systematic reflexions regarding how to translate concepts (as these, born in the fully philosophical context of pragmatics) into something measurable and apt to inter-subject comparisons should be produced in the next years. In this light, the depth provided by the philosophical background of pragmatists highlighted by Cummings (2016; see also previous paragraph), rather than being an obstacle to the advancement of the discipline, it could instead become a huge cultural advantage.

§2.4.2 Pragmatic disorders related to neurodevelopmental impairments

A very important cognitive profile for studies in clinical pragmatics is that presented in patients with Pragmatic Language Impairment (PLI). As proposed by Mieke Ketelaars and Mariëtte Embrechts (2017) their main symptom is ‘an impairment of the social use of verbal and nonverbal communication’ (Ketelaars and Embrechts 2017:31). In this work, authors provide a very thorough description of the pathology, considering both the differential diagnosis with similar disorders such as autism and the complicated problems related to treatment of PLI.

Pragmatic symptoms of PLI totally overlap with those of Autism Spectrum Disorders (ASD); in fact, according to DSM-V, the differential diagnosis between these two pathologies depends on the presence in ASD of motor stereotypes and restricted interests. The lacking of social abilities typical of ASD is not necessary to diagnose PLI, but the communicative difficulties linked to pragmatic difficulties could also affect social competences.

Joanne Volden's essay on ASD (Volden 2017) provides a very thorough description of the autistic spectrum and—confronting it to Ketelaars and Embrechts's work on PLI—the close similarity, from a linguistic point of view, between these two pathologies will become clear for the reader. The detailed description of the clinical pragmatics of ASD proposed by Volden is an important contribution for this relatively new discipline. There are many descriptions of the pragmatic profile of ASD, but they are usually focused on autism; on the contrary, Volden's description is focused on pragmatic problems and could be considered a useful starting point for "metapragmatics", an expression that the author draws from Collins et al. (2014) and that is defined as 'the ability to explicitly reflect on pragmatic skills' (Volden 2017:78).

Developmental pragmatic deficits that don't have traumatic or tumour aetiology are often similar. As shown in Loukusa (2017), a linguistic profile that is very close, although less severe, to that presented in patients with PLI and ASD is that of patients with Attention Deficit Hyperactivity Disorder (ADHD). As previous deficits, ADHD is characterized, from a pragmatic point of view, by difficulties in taking turns, tendency to insistently talk without monitoring the level of interest of the listener, inability to adapt communication strategies to the context and above all great troubles in maintaining attention to what the interlocutor is saying (Loukusa 2016). Pragmatic deficits in ADHD easily emerge in the Children Communication Checklist (CCC, Bishop 1998) and its second edition (CCC-2, Bishop 2003). The same scales are commonly used for testing pragmatic deficits in ASD, PLI and other intellectual disabilities (ID). Loukusa's study highlights also that, as for ASD, pragmatic deficits of subjects with ADHD could be

partially explained conjecturing a deficit in executive functions, which however in both pathologies is not sufficient to fully explain these anomalies (Willicut et al. 2005).

We can more deeply differentiate the pragmatic profile of patients with ASD, PLI and ADHD from those with ID accurately described by Gary Martin, Michelle Lee and Molly Losh (2017). From their description of pragmatic profiles of patients with Down syndrome, Fragile X syndrome and Williams syndrome, it emerges that these pathologies leave more areas of pragmatic strengths to their patients than ASD, PLI and ADHD. Narrative abilities, for example, seem intact (if not superior than that of age-matched control subjects typically developed) in subjects with Down syndrome and Williams Syndrome. Martin et al.'s (2017) work gives two important contributes to clinical pragmatics: the first is that it tries to overcome the descriptive approach, very common in clinical pragmatics essays, pointing to an analysis of the theoretical implications; the second is that it critically considers previous descriptive works on the topic, suggesting some very interesting future lines of research such as the pragmatic profile of girls with Fragile X syndrome (rare because of the higher incidence of the disorder in males) or such the direct comparison of clinical groups in empirical studies.

A more complex case is that of children who survive brain tumours. Kimberley Docking, Philippe Paquier and Angela Morgan (2017) provide a review on studies regarding residual linguistic and pragmatic functioning in brain tumour survivors younger than sixteen/twenty years old, in which the pathology could affect cognitive function both by increased intracranial pressure and directly infiltrating or compressing the central nervous system.

But language and cognition could be affected also as collateral effect of surgical or radio/chemotherapy treatments. More common linguistic anomalies reported in children who survived brain tumours are similar to that observed in subjects with ASD: deficit in emotion recognition and expression, difficulties in maintaining friendships with peers, difficulties in re-telling narratives on macrostructure levels.

In a certain sense, what emerges from an overall analysis of developmental clinical pragmatics is that ASD encompasses all possible pragmatic alterations detectable in childhood. In addition, pathologies less known such as cerebral palsy show symptoms that we can in each case individuate also in the autistic spectrum. Cerebral Palsy (CP) is 'a group of disorders of the development of movement and posture that cause activity limitations' (Caillies 2017:165). Linguistic deficits are often associated with CP, obviously, because there is a strong link between speech and language. Less obvious is the presence of pragmatic alterations. Reviewing the literature, Caillies clearly shows the need to better investigate this research area: studies are few in number and inconsistent with each other. This line of study will not only better describes communication alterations in CP, but also explains whether the presence of pragmatic deficits is specific for the disease or related to the linguistic inexperience that CP entails. In this direction Caillies proposes an empirical study, but—although the attempt to fulfil our cognitive deficiencies is laudable—it cannot be considered conclusive (as the same author admits) for two reasons: the first is that it doesn't clearly show the link between the hypothesis and the methodology and the second is that data is not statistically analysed.

§2.4.3 Pragmatic disorders related to congenital perceptive impairments

Until now, we have spoken about classical themes and pathologies considered in clinical pragmatics. However, in Cummings (2017b) patients usually less considered in pragmatic studies are also considered, as for example, those who have congenital hearing loss treated with cochlear implantation (HL), studied by Louise Paatsch, Dianne Toe and Amelia Church (2017). This Australian research group proposes an intervention model named CONVERSE, finalized to treat some weak area of this clinical population. Paatsch et al. (2016), in fact, show that while these patients have good abilities in taking turns and generally understand the gist of conversations, they show some interrelated challenges: the majority of those is alteration in eye-gaze patterns. The ability to coordinate eye-gaze with conversational features highly contributes to the reciprocal emotional understanding. During conversation, we look at others when their turn is starting; so impairment in this area can affect the understanding of more subtle pragmatic nuances during conversation. Moreover, this clinical population shows other impairments as absence of requesting feedback during conversation, inability to repair a breakdown during conversation and inability to sustain topics.

Perceptual alterations are always related to language alterations. It's in fact plausible to hypothesize, as done and verified by Rebecca Greenway and Naomi Dale (2017), that if HL could affect pragmatics, also congenital visual impairment (VI) will influence the acquisition of pragmatic skills. Patients with HL are a very heterogeneous clinical population (*ibid*), that for many pragmatic aspects resembles those with ASD. For subjects with HL, language is an area of strength, probably thanks to the over-use made of it

by caregivers in order to facilitate the understanding of environment (*ibid*). Unfortunately, to be understood, pragmatics usually needs the integration of both visual and acoustic information. Maybe for this reason, subjects with HL show some pragmatics difficulties such as: a delay in the development of pretence play; difficulties in the development of join attention; difficulties in ToM; obviously, impossibility to correctly use eye-gaze; heterogeneous delay in the use of their first word; in some cases use of echolalia; delay in deixis acquisition; sometimes delay in the correct use of personal pronouns; less initiative in starting conversations. While for children with ASD it is very difficult to acquire these pragmatics skills, in HL patients, it seems that these pragmatic skills could be taught. This population appears particularly important to better understand patients with major difficulties such as ASD.

§2.4.4 Pragmatic disorders acquired in adulthood

Developmental pragmatic disorders are very similar and ASD catches and concentrates in itself all possible symptoms of developmental pragmatic alterations; on the contrary, pragmatic affections in adulthood are more heterogeneous.

Studies in adulthood are less than those in childhood (Jagoe 2017), but they could offer a very important contribution to neuropragmatics because the adult brain doesn't present damages derived from alterations in growth. Pragmatics could be altered in patients with aphasia, schizophrenia, brain injury, Alzheimer, Parkinson, etc. But, as highlighted by Caroline Jagoe (2017) and Louise Cummings (2005), it will be useful not just to study the deficits that these pathologies entail for the patients, but also the area of

strength maintained, i.e. the preserved ability to communicate (also despite evident language deficits) of patients with aphasia (*ibid*).

A very interesting attempt to study strengths of patients with pragmatic alterations is that made by Gloria Streit Olness and Hanna K. Ulatowska (2017). The originality of their work is due to the application of Mey's categorization in component view, perspectivist view and functional view of pragmatics (Mey 2001) to aphasiology. Through a complex and complete qualitative evaluation of different kinds of narratives produced by subjects with aphasias (both in monologue situations and during conversation) authors showed the intact ability of these patients to consider and use limits and affordances provided by a specific context in which narrative is coming. This study is important not just for its high ecological validity, but also because it has to be considered as a methodological guideline for the production of clinical pragmatic researches that don't only have a descriptive purpose, but that are also focalized on theoretical implications of pragmatic data.

In fact, as shown in Blake (2017), studies iforn clinical pragmatics are gradually (but clearly) showing that it's impossible to reduce communication (linguistic or not) at simple labels and locate them in some brain areas. Empirical studies always give results that are task-dependent and all efforts of researchers to isolate a single cognitive ability, easily loose ecological validity. Studies on patient with right-hemisphere damage (RHD), for example, show that the performance of subjects dramatically worsens in non-ecological context (Blake 2017). Therefore, for clinical pragmatists it is almost impossible to isolate pragmatic competence in tasks that don't let the subject support their alteration with compensative strategies without losing

ecological validity. However, could we safely argue that the compensatory strategies used by patients to comply with apparently compromised pragmatic functions are not themselves pragmatic skills? From a localizationist point of view, Blake's chapter—dedicated to patients with RHD—was required to prove an incontrovertible loss of pragmatic skills consequent to the impairment of certain brain areas. In the history of cognitive science, the right hemisphere has always been considered that of the emotional reactions, and thus clearly the highest-rated candidate for naturalization of pragmatics. However, Blake himself admits that his study shows the complexity of the problem raised by the first promising correlations between the right hemisphere and emotional functions of pragmatics. To lateralize pragmatics in the right hemisphere would be a superficial simplification. The inability to naturalize such an entity present in human communication as indefinable as pragmatics is probably the most daunting obstacle with which recursively clinical pragmatic clashes.

Not only is the cerebral localization of pragmatics controversial, but it is also the aetiology of its alterations. As we have just seen, clinical pragmatics in childhood demonstrate that ontogenetic development of pragmatic behaviours is still unclear. Also, studies conducted in adulthood are able to pinpoint the cause of damages. Studies conducted on schizophrenia, for example, show that pragmatics is the most compromised area of communication in these patients (Bosco and Parola 2017). Nevertheless, as for ASD or other developmental pathologies, studies are incongruent when trying to link classical pragmatic symptoms of schizophrenia (schizophasia, inability to use paralinguistic communication, deficit in correctly interpreting speech acts, deficit in understanding and using irony, etc.) with some cognitive

causes, such as a deficit in Theory of Mind (ToM) or in executive functions. Although both these cognitive processes appear to be affected by schizophrenia and independent from Intelligence Quotient, correlations between ToM and pragmatics or between executive functions and pragmatics seem controversial (*ibid*).

Despite the overall symptomatology of pragmatic disorders in adulthood it is more heterogeneous than that of childhood, from a clinical point of view, pragmatics, is overall configured as a block where the symptoms move together: it is rare that a patient who shows difficulty in understanding metaphors is good at seeing the irony of a situation. Patients with traumatic brain injury (TBI), for example, show the classical pattern of symptoms of clinical pragmatics: difficulty with comprehension of metaphors, sarcasm, irony, idioms and humour (Turkstra and Pololitis 2017). What clearly emerges from a synthetic approach to clinical pragmatics that take into account the general pragmatic profile of all patients is that different causes could bring to similar effects (*ibid*). To cope with this difficulty, Turkstra and Pololitis (2017) suggest that an emergent field of studies could help in the investigations of the cognitive underpinning is the second-person neuroscience approach (*ibid*): that is the application of neuroscience methodology for the study of spoken language in experimental tasks with two participants.

Precious exceptions in the comparative approach are pragmatic deficits that usually occur in old age such as Alzheimer's dementia (AD). Because AD affects attention, executive functions, language, perceptual-motor function, social cognition, learning and memory, these patients appear to be deeply affected also in pragmatic communication (Guendouzi and Savage

2017). The exceptional nature of pragmatic alterations linked to AD is that despite these patients seem unable to catch and interpret contextual and paralinguistic signals to understand irony, sarcasm and metaphors, they still appropriately respond appropriately to greetings. They are still polite in speaking, respect turn-taking, adapt their linguistic register to the situation, correctly and spontaneously use phatic expressions and maintain good narrative abilities (*ibid*). Jackie Guendouzi and Meghan Savage, in their study on pragmatics of Alzheimer's dementia explain these residual functions as embedding of skills acquired earlier than those lost (*ibid*). This hypothesis appears convincing because it fully respects the cognitive dynamics of AD, in which episodic and autobiographic memory appears more compromised than the working memory and in which older memories appear stronger than the newer.

Similar to AD are non-Alzheimer Dementias (non-AD). Differences between these two clinical populations, from a pragmatic point of view, are mainly two: patients with non-AD seem affected by a reduced social engagement during conversation and data regarding residual taking-turn skills are controversial (Roberts et al. 2017). If future researches demonstrates that taking turns in patients with non-AD is similar to those of non-clinical subjects or to subjects with AD, we could maybe use Guendouzi and Savage's (2017) hypothesis about AD also to explain non-AD pragmatic symptoms. If an in-depth study of the differences between AD and non-AD ever arises, it could become a valuable tool for a better understanding of the relationship between pragmatic alterations and social engagement. Moreover, this could become important in understanding ASD which is mainly characterized by a lack in social engagement better.

Another pathology usually considered in clinical pragmatics is Parkinson's disease without dementia (PD), which affects 1% of the elderly population (Driver et al. 2009). Thomas Holtgraves and Magda Giordano (2017) reviewed all pragmatics alterations connected to PD and found that in the early state of the pathology, these patients show difficulties with non-literal language and implicatures, and that these problems are greater when the real meaning of sentences require a major pragmatic competence because the meaning is very indirect. Some correlations between these problems and executive functions (more deeply for working memory) and these problems and ToM. Regarding ToM, it seems that cognitive aspects usually degenerate before empathic aspects. Also for PD, more researchers are recommended.

Finally, we will observe fluency disorders such as stuttering, cluttering and atypical disfluency. All these diseases, although they don't directly affect pragmatics of patients, are the cause of frequent breakdowns in their linguistic flow and a real obstacles in their capacity to be engaged in social relationships. If there is no evidence of ToM or executive functions deficit in these patients (Scott 2017), fluency disorders could affect pragmatic skills of the patient in two ways: first of all, the feeling of shame or embarrassment could induce patients to avoid social contact (*ibid*). A second problem that is very frequent is long pauses in which patients are constrained to find words. This often needs listener's patience; but these long breaks are often mistaken for an inability to communicate, especially when the listener are not aware of the disease (*ibid*).

§2.5 The deep sense of clinical pragmatics

Why do we study clinical pragmatics? As shown by Pamela Snow and Jacinta Douglas from a very original point of view (studies on this topic are few in number), the quality of life of subjects with some pragmatic language impairments appears to be really compromised (Snow and Douglas 2017). If pragmatic impairments are both developmental and acquired, they fully affect the social life of patients. Different forms of social relationships will be affected by pragmatic deficits in different ways. During conversations, the awareness of patients' difficulties is usually helpful for reciprocal understanding (Snow and Douglas 2017; Caillies 2017; Guendouzi and Savage 2017; Scott 2017) and in these years great progress has been made, although there are no standardized protocols to intervene specifically in this direction and not all researchers agree with the idea that standardization could be useful for all patients (Cummings 2017b). So, one practical reason to study clinical pragmatics is that of trying to ameliorate the patient's life.

But, we shouldn't forget the philosophical origins of clinical pragmatics.

All the interesting data that we saw in previous paragraphs and those that we will more analytically consider on autism in the next paragraphs risk becoming purposeless, boring and infinite lists of symptoms, anomalies and deficits if they are not inserted in a theoretical context that tries to contribute to some of the oldest questions of the philosophy of language. A few examples of classical debates enriched by clinical pragmatics could be "What deficits really affect language?" or in other words, 'What are the main components of language at neural, cognitive and structural levels?'; or 'Is pragmatics an evolutionary and/or ontogenetic precursor of language, or does

pragmatics exist because we speak?'; or even 'Is it possible to hypothesize an independence between pragmatics and language?'.

As pointed out by Brigitte Stemmer, clinical pragmatics shows its deeply philosophical origins in her attempt to answer the classical question: 'How does the human brain create a human mind?' (Stemmer 2017:579), or, in more concrete terms, 'How does the brain give rise to mental phenomena such as attention, memory, language, emotions or [...] to typical and atypical pragmatic behaviour?' (*ibid*).

The risk that many of clinical pragmatic studies run is that of loosing the deep sense of its discipline. Because often data is inconsistent, a lot of researches in clinical pragmatics are focused on many minor details, without a clear idea of the final purpose of the pragmatics: the study of the mind. Stemmer's study is contrary to this trend. The topic of her work is neural underpinnings of pragmatic disorders; but, in carrying out her research, Stemmer took into serious consideration the possibility of naturalizing and localizing all cognitive processes usually considered in pragmatics. Despite taking into consideration studies that also point out the need to consider the brain as organized in networks (and not in areas), the author is very safe in declaring a truly reliable position on these issues. For example, regarding the possibility to individuate neural underpinnings of the Theory of Mind (ToM), she highlights that areas usually described as involved in ToM abilities are engaged also in other functions, and—on the other hand—that networks apparently unrelated to these skills (such as the default mode network) today we know to be involved in social reasoning as well.

A similar attempt is that of Louise Cummings (Cummings 2017b), who discusses, not neural, but cognitive aspects of pragmatics. Obviously,

the two topics are quite related, but, in discussing cognitive rather than neural aspects of clinical pragmatics, the work setting has a more overtly philosophical cutting. In her essay, Cummings posits that if the cognitive approach is a latecomer to the study of pragmatic disorders, it is also because pragmatists usually have a philosophical background that—on one hand—provides depth to their reflexions, but on the other hand, it leaves them imprisoned within the limits of traditionalistic academic classifications. This view involved the tacit exclusion of cognitive sciences from the study of pragmatics. But, as showed by Stemmer (Stemmer 2016), the study of pragmatics is the study of the brain; moreover, we shouldn't forget that not only is philosophy a true part of cognitive sciences (in fact it is a vertex of the famous hexagon), but also and above all that cognitive sciences (strictly related to the current use of the word *cognition*) derive from the awareness reached by philosophers themselves regarding the insufficiency of the classical philosophy alone to study the human mind and to answer classical philosophical debates (Gardner 1985). Cognitive issues are not in contrast with philosophical issues, rather cognitive issues are the historical evolution of more classical philosophical issues: cognitive issues are philosophical issues.

§.2.5.1 Why it is important to consider non-linguistic communication in clinical pragmatics

Our working definition helps us to avoid a separation between words and communicative contexts. The separation between words and communicative contexts is equivalent—paraphrasing Heidegger—to the evaluation of a fishes' ability to live out of the water (Heidegger 1987:268).

We have now to consider our discussion about what is clinical pragmatics in definitions, what is clinical pragmatics concretely and what is the deep sense of the discipline. If we study clinical pragmatics to better understand the human mind, it is totally useless, if not harmful, to exclude non-linguistic communication from this research field.

Often those who suppose an evolutionistic (and not just ontogenetic) line of continuity between non-linguistic and linguistic forms of communication (continuistic perspective, as opposed to dis-continuistic perspective) are more inclined to consider non-linguistic communication fully part of pragmatic and vice versa.

For example, Bruno Bara in his famous book con cognitive pragmatics explicitly critics the continuistic perspective. His idea is based on the observation that hard evidences doesn't exist for the continuistic perspective:

> *In contrast to the hypothesized continuity between prelinguistic communication and language, I claim that the two systems are separate. Since both constitute situated cognitions that take place in the same context, they share certain characteristics. These common characteristics are proof not, however, of continuity, but of the fact that both language and gestures realize the same communicative function: it is the world that imposes constraints.*
>
> *The Darwinian theory posits a similar case, which has been termed convergent evolution*[5]*. This term indicates the fact that the environment may influence the evolution of the species living in that environment, so that those different species will exhibit similar morphological features, even though they did not inherit them from a common ancestor. For instance, dolphins and swordfish have many features in common: elongated bodies, fins, and so forth. Such similarities do not, however, constitute proof that the dolphin descend from the swordfish or vice versa. It is simply evidence that both species live in water, and that interaction with the environment in which they evolved has conditioned their forms, modelling in a similar fashion the morphology of animals belonging to such diverse species as fish and mammals* (Bara 2010:248).

[5] In the Italian (original) version of the book, here is reported the word "exaptation" in brackets (Bara 1999:281).

In this theory the intervention of environment on the organism and on the species toward the concept of *exaptation* clearly emerges. However, the classical evolutionistic approach, that founded on the exclusive action of natural selection, doesn't consider some factors that are also too important for the fitness of the organism and, consequently, of the species. The Evo-Devo approach (Minelli 2007) showed that the laws of natural selection, if considered alone, are insufficient to totally explain natural evolution. This last, in fact, can "choose" among a series of variables of the same species, what is apt for reproduction and what isn't apt for reproduction; but natural selection cannot produced something totally new. In other words, natural selection is strictly linked to limits posed by genetics. If genetics doesn't create (for example) a human being with green skin, natural selection will never select this phenotype.

So, communicative functions also depend on constraints posed by genetics.

If we apply this approach to our debate on linguistic or communicative pragmatics, we need to consider the existence of some constraints that link linguistic and non-linguistic communication at a cognitive level. In ASD, communicative deficits are always both linguistic and non linguistic. If we assume the Evo-Devo perspective, we will consider them as consequence of a same alteration. This alteration cannot be an abstract ToM. Deficits in ToM are a consequence, functional consequences of other structural problems.

Neuroscientific, electrophysiological and behavioural data yet showed a pervasive alteration of perceptive and interoceptive systems in subjects with ASD. We will analyse these in next chapters.

In my opinion, the constraint that linguistic and non-linguistic communication have in common in the case of ASD are systems of interoception and proprioception.

Substantially, if we were to follow Bara's argumentation, we would infer that language (the dolphin) doesn't derive from pre-linguistic communication (swordfish), but that the features that these two systems have in common depend on their sharing of environment, that is the communicative intraspecific interaction (the water for the dolphin and for the swordfish).

If we, on the contrary, accept the Evo-Devo approach, also the concept of *exaptation* will be clearer. We usually use the term *exaptation* to indicate an evolutionistic phenomenon according to which some structures of an organism that doesn't solve a specific function or simply structures that solve some functions are used from the organism to solve some new function and this caused an advantage in terms of *fitness* for the individual (Gould and Vrba 2008).

From this perspective, it's possible to hypothesize that the link between linguistic and non-linguistic communication is that a structure used is non-linguistic communication is damaged in ASD and this damage is reflected also in linguistic communication because the two systems use the same structure. Moreover, as showed by Pierre Changeux (1983), the relationship between structure and function can become extremely fluid when alterations are about the cerebral organization.

So, our working definition of clinical pragmatics includes non-linguistic communication because of the cerebral structures that these two systems share.

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Chapter 3

Pragmatic alterations in autism

§ 3.0 Introduction to the chapter

The third chapter is about pragmatic alterations of subjects with autism. I describe and make a critical analysis of the scientific literature on this topic, which puts in question some considerations widely accepted by the recent literature. In §3.1, i. e. I will show that metaphor is not totally inaccessible to autistic cognition; on the contrary, irony and sarcasm can't be understood by this clinical population (§3.2). In this chapter I will talk about three core concepts of autistic pragmatics: inferential abilities (§3.3); prosody (§3.4) and the fixing of personal and temporal reference (§3.5). In relation to inferences, I will posit that the empirical data reported in literature contrast with the idea that subjects with ASD have a general impairment in inferential abilities. I found out that the deficits that impair this skill are linked to the content, and not to the act of doing inferences. I Specifically posit that physical causation inferences are not critical for subjects with ASD; intentional inferences are more critical than physical causation inferences, while emotional inferences are more critical than both physical and intentional causation inferences.

In §3.4 I will deeply analyse literature on prosody. Unfortunately, subjects with autism show great difficulties both in interpreting and in producing various kinds of prosodic information. Moreover, such difficulties often trigger a vicious cycle of failure of the cooperative attitudes of communication: in fact, as I will

show in (§4.4.2.2), communicative partners usually react to prosodic anomalies through an unaware change in prosodic cues.

I will conclude the chapter by describing the question of fixing reference (I will refer to personal and temporal reference in particular). I will postpone the interpretation of these deficits to the chapter 6 because of the need to build up the theoretical premises: I will develop them in the following chapters.

§3.1 Metaphor

One of the features of the autistic cognition that is more suggested by the philosophical literature on autism is the natural tendency of these patients to literally interpret the meaning of linguistic productions. We can cite some paradigmatic examples of this trend.: for example, Ricks and Wing (1975) recount of when a child with autism was asked what ate for dinner and he answered: "Meat and cabbage and potatoes and gravy and salt and jam tart and custard and orange juice and cup of tea" (Ricks and Wing 1975:2010). Another funny example is that reported by Hobson in 2012, in which a child started anxiously looking for his tongue because an adult asked to him if he had lost it (Hobson 2012).

In 1995, Minshew et al. showed empirically that there is a substantial independence between basilar mechanical and procedural linguistic skills and interpretative skills. In fact, researcher showed that subjects with ASD and TD subjects matched for IQ and verbal IQ don't have the same perfomance on the *Test of Language Competence* (TLC, Wiig and Secord 1985); on the contrary, subjects with ASD had worse performance. One of the skills mainly tested from the TLC is just the understanding of metaphors.

Still today, the scientific literature tends to consider the ability to understand metaphors in subjects with ASD. For example, Gabriella Runbland and Dagmara Annaz (2010) showed that subjects with ASD are less able to understand a metaphorical conclusion of a story than TD subjects.

Also transcultural studies confirm this trend. For example, a minor understanding of metaphor was showed also in Chinese children (Zheng et al. 2015) and in Taiwanese children (Huang and Taguchi 2015).

However, not all studies confirm this trend. Anat Kasirer and Nira Mashal (2004), for example, found different data. These two Israeli researchers matched 17 adults with ASD and 17 TD adults. Both groups were about 22 years old. Researchers administered the group two tests: one evaluated comprehension and the other evaluated the creative production of metaphors. In the comprehension test there were 20 conventional expressions such as *defence line*; 20 new metaphorical expressions such as *transparent moment* and finally 20 control meaningless expressions such as *sport lemon*. For such expression the test proposed a literal interpretation, a metaphorical interpretation, an unrelated interpretation and the alternative "this expression is meaningless". The production test, on the contrary, asked participant to complete some sentences with metaphorical conclusions that had to be understandable for peers. Some TD judge evaluated the pertinence of productions.

With this paradigm, experimenters showed equivalent abilities in understanding metaphor between groups and major creativity of ASD group in the production of metaphors. Experimenters concluded from these results that, with age and with semantic acquisitions, subjects with autism recover this deficit.

This interpretation is in line with works previously analysed in this paragraph. In fact, Rundbland and Annaz (2010) showed a high difference in verbal age between groups (measured by the *British Picture Vocabulary Scale, BPVS,* Dunn and Dunn 1997). Huang et al. (2015) found a positive correlation between understanding of metaphors and semantic skills.

Moreover, other studies showed that it is more appropriate to speak about different cognitive strategies than about deficit regarding the understanding of metaphors in subjects with autism (Chouinard and Cummine 2016; Melogno et al. 2012).

To conclude the topic, I think that it is inappropriate to consider the metaphorical thought totally affected in ASD. For instance, in *The Autistic Brain* (2014), Temple Grandin speaks about the visual thinker, the pattern thinker, etc. If this is true, it's easy to hypothesize a tendency to better individuate some kind of shapes by subjects with autism. Temple Grandin herself often uses metaphors in her books; i. e. when she speak about links in the brain as highways (*ibid*).

§ 3.2 Irony and sarcasm

When classical experiments on the hypothesis of a deficit in ToM in autism started, the understanding of irony was considered a key test to discriminate between subjects with and without autism. Irony was inserted as area to evaluate in the *Strange Stories Test* of Francesca Happé (Happé 1994). Practically, with "irony" we intend the understanding of a following episode:

> *"Ann's mother has spent a long time cooking Ann's favorite meal; fish and chips. But when she brings it in to Ann, she is watching TV, and she doesn't even look up, or say thank you.*

Ann's mother is cross and says, "Well that's very nice, isn't it! That's what I call politeness!"

Is it true, what Ann's mother says? Why does Ann's mother say this? (Happé 1994:151)"

I consider irony and sarcasm in the same paragraph because in tests usually used by researchers to test these abilities there are no substantial differences between the two. Simon Baron Cohen, for instance, considers as an example of sarcasm the following sentence: "How clean your room looks today!" (Baron Cohen 2001:15) uttered by an exasperated mum to her child. The most part of studies on the inability of subjects with ASD to understand irony and sarcasm is linked to the theory of a deficit in ToM (Happé 1994; Joliffe and Baron Cohen 1999; Peterson et al. 2012).

Also regarding irony, however, it's better to avoid superficial simplifications. In a study published by Tiziana Zalla et al. (2014), for example, irony was studied also considering the ability to integrate in the interpretative process classical social stereotypes. In this way, experimenters showed that great part of misunderstood irony is linked to the tendency of subjects with autism to don't consider social stereotypes.

§3.3 Inferential abilities in subjects with autism

Michael R. Perkins describes *pragmatics* like epiphenomena that depends on the interaction between linguistic and non-linguistic cognitive systems (Perkins 2000:10). According to Perkins's idea, inferential abilities are primary components of pragmatic abilities.

In 2009, Loukusa and Moilanen published a very important review on inferential abilities in subjects with ASD. Among the inclusion criteria of the study for the sample, they had to test "the ability to infer pragmatic meaning or the ability to utilize contextual information in language interpre-

tation" (Loukusa and Moilanen 2009:892). Practically, the most used test to measure the ability to infer pragmatic meaning was the Happé Strange Stories Test (SST, Happé 1994); others used the Test of Pragmatic Language (TOPL, Phelps-Terasaki and Phelps-Gunn, 1992) and the Strong Narrative Assessment Procedure (SNAP; Strong 1998); others were all non-standardized procedures. In many tests, there were also control questions to understand if wrong answers could be related to general inferential abilities or to strictly pragmatic abilities. Studies of the Loukusa and Moilanen's (2009) sample obtained contrasting results, which revealed weaknesses, but not inabilities, in making pragmatic inferences. Studies of the sample analysed their results in one of these following perspectives: Weak Central Coherence, ToM, Relevance Theory or executive functions deficits. None of these gave a satisfactory response of all results of the review, so Loukusa and Moilanen concluded that reasons of differences individuated between subjects with ASD and control subjects (always subjects typically developing, TD) are not attributable to one specific cause because reasons vary between individuals: "some individuals may have difficulties in all complex processing, whereas in others there may be a specific reason causing difficulties" (*ibid.,* p. 901).

I think that these differences among individuals are linked to different way of conceptualizing the word. In 2005, Bogdashina sustained that subjects with ASD differ from those with TD because they are *perceptual thinkers* rather than *verbal thinkers*. The author sustained that each subject with ASD has a preferential way to perceive the world; "It is important to let the children use the sensory modality they prefer to 'check' their perception" (Bogdashina 2005:84); that different perceptive styles exist; and that

they are different from those used by TD subjects[6]. For our theory, this is important: different ways of perceiving the world correspond to different ways in conceptualizing the world. Actually, some lines of research are focalized on the study of different systems of autistic cognition to perceive and so conceptualize the world (i.e., Grandin 2014). Even if not all subjects with ASD are visual thinkers, most of them are. Some studies seem to indicate that subjects with ASD spontaneously use visuo-spatial rather than verbal representations (inner speech) (Hartley and Allen 2014; Holland & Low 2010; Joseph et al. 2005; Whitehouse et al. 2006; Sahyoun et al. 2009; Sahyoun et al. 2010). A lot of studies seem to show that visuo-spatial representations are, in subjects with ASD, intact and maybe superior to verbal (Kamio and Toichi 2000; Caron et al. 2004; Edgin and Pennington 2005; Grandin 1995; Hurlburt et al. 2004; Kana et al. 2006; Mitchell and Ropar 2004; Silk et al. 2006; Järvinen-Pasley et al. 2008; O'riordan 2003 Joseph et al. 2009).

Now I will discuss some of the latest studies on inferential abilities in subjects with autism. I will try to show that there is not a general deficit in *inferential skills*, but that is more appropriate to consider that subjects with autism simply consider and conceptualize the world differentially. Their "deficit" in inferential processes are in fact linked to the content of inference and not to the formal mental process that we call *inference*.

§3.3.1 Content-based classification of inferences

McKenzie et al. (2011) and McKenzie et al. (2010) showed that adolescents with ASD don't integrate, despite the provision of explicit contextual prompts, background knowledge with the premises to the same degree

[6] For a brief survey of perceptive differences between subjects with ASD and TD see Pennisi 2014

as TD adolescents. Because of this data, experimenters suppose that subjects with ASD are less likely to integrate their previous knowledge with the context than TD subjects. In these studies experimenters used classical explicit tasks that require participants to answer a direct question (posed by a robot on a screen or read in a booklet). All of experiments presented in these works require the use of verbal cognition to be targeted.

Bodner et al. (2015), in a cross-sectional study (37 adolescents and 49 adults with ASD vs 16 adolescents and 49 adults TD), showed that individuals with ASD had lower scores on the PIT than TD subjects at a younger age, but not at an older age. Moreover, individuals with ASD with higher VIQ (Verbal Intelligence Quotient) scores had higher PIT scores than the TD group at a younger, but not at an older, age. The diagnosis[7] was more negatively related to PIT physical causation subscale than VIQ or age. The age x VIQ interaction was more positively related to PIT intentional states rather than diagnosis. The VIQ x diagnosis interaction was more positively related to PIT emotive scale. The emotive scale was not related to age.

To sum up, these results, in our opinion, suggest that:

- Individuals with ASD, with age, become able to recover the gap that separate them from TD subjects in the general ability to make inferences and—especially at a younger age—they use linguistic competences to compensate the deficit; but, in general, they show lower performances than TD subjects.

- It's possible to draft a model of relations between inferential skills in subjects with ASD and individual key factors. We can suppose:

[7] ADOS

- a correlation between the deficit in physical inferences with the severity of diagnosis;
- a correlation between the ability to make intentional inferences with age and linguistic skills;
- a correlation between the deficit to make emotional inferences with severity of diagnosis and linguistic deficit;

Is the ability to make inferences really linked to diagnosis? My idea is that, in subjects with ASD, pragmatic deficits are not linked to a general deficit to make inferences, but that are content-dependent. Åsberg (2010), with a *text based* experiment showed that performances of subjects with ASD and TD are very similar in understanding: explicit main ideas, explicit details, implicit main ideas and implicit details. For both groups, in fact, explicit main ideas were easier than implicit main ideas, that—in turn—were easier than explicit details, which were easier than implicit details. In my opinion, these data support the idea that: pragmatic inferential deficits depend on the context and on the content of the message.

It's also possible to interpret in this sense results from the experiment of Chevallier et al. (2010), in which both participants with ASD and TD showed similar performances (in accuracy and in reaction time) in making scalar inferences from prosody stress of the two connectives "and" and "or".

For these reasons, I decided to analyse inferential abilities of subjects with ASD, assuming as starting point the content of data that needs to be processed; I collected my data categorizing them in:

- Physical causation inferences
- Intentional inferences
- Emotional inferences

I suppose that, for the way in which different tasks of experiments taken into consideration by my study were projected, physical causation inferences are more related to visual cognition; intentional inferences with verbal cognition and emotional inferences (based on face scanning and on verbal knowledge regarding social attitudes) with both visual and verbal cognitions. So, according to my hypothesis, physical causation inferences, for subjects with ASD, should be easier than emotional inferences, which should be in turn easier than intentional ones.

§3.3.1.1 Physical Causation Inferences

Paganini and Gaido (2013), in a cross-sectional study (200 ASD *vs* 1004 TD of various nationality and ages), showed that subjects with ASD performed better in folk physics inferences than TD subjects. They presented stimuli via images, so this data is perfectly in line with my assumption that the ability of making visuo-spatial inferences is intact (if not superior) in subjects with ASD.

Also David et al. (2010) confirmed this assumption, in showing intact abilities to infer visuo-spatial perspective of other people's viewpoints in subjects with ASD.

I have chosen these last two, but studies in this sense are very numerous. Also experiments that give participants stimuli in a verbal way confirm my idea that physical causation inferences are, for subjects with ASD, easier than emotional and intentional ones. Sansosti et al. (2013) and Saldaña and Frith (2007) showed that both TD and ASD subjects are quicker in making bridging inferences when the content item is physical rather than social. Even if the two groups have similar performances, it's plausible that subjects with ASD have more difficulty than TD subjects in bridging inferences

because of, as reported in Sansosti et al. (2013), they made more and longer fixation on stimuli rather than control subjects. In my perspective, longer fixation times could be caused by the difficulty in processing a stimulus with (less spontaneous for subjects with ASD) verbal cognition.

§3.3.1.2 Intentional inferences

Grynszpan and Nadel (2015), in a cross-sectional study (11 ASD vs 11 TD), analysing the ratio of cognition verbs used to describe a social situation, showed that intentional inferences appear to be positively correlated with total fixation times on faces of actors and negatively correlated with CARS (Childhood Autism Rating Scale) scores and with the ADI-R (Autism Diagnostic Interview Revised) sub scores in the Reciprocal Social Interaction domain. The contrasting results about the correlation between ability to make intentional inferences and the severity of diagnosis between this last study and that of Bodner et al. (2015) could depend on the two different kinds of measurement (ADOS[8] and CARS). However, in Bodner et al. (2015) a low correlation between severity of diagnosis and deficit in the ability to make intentional inferences was shown, but that with age and linguistic skills was strongest. In our opinion, even if it is plausible to suppose a relation between severity of diagnosis and ability to make intentional inferences, the relation found by Bodner et al. (2015) is more scientifically founded because their sample is wider and ADOS is a more detailed measure than CARS.

From these observations, we suggest that: the ability to make intentional inferences is positively correlated to visual attention in scanning others' face, age, linguistic skills and to a lesser extent with autistic outcome

[8] Autism Diagnostic Observation Schedule

How to interpret the correlation between total fixation time on faces of actors and ability to make intentional inferences detected by Grynszpan and Nadel (2015)? Practically, if subjects observed the faces of actors for longer time, it was more probable they make a correct intentional inference; but a significant trend of the sample failed to make intentional inferences. It's possible that in this case, the difficulty of subjects with ASD is just integrating visual and verbal information to obtain a linguistic output (the intentional inference).

Marsh et al. (2014), in a cross sectional study, individuated many similarities in visual scanning pattern of a scene in which an agent reaches a goal. They found that both ASD and TD groups looked at the non-goal target of an action for more time when it is made by an intentional agent rather than by anon-intentional agent, and when the action was made with irrational logic rather than rational logic. On the contrary, more predictive saccades were on target when a non-intentional agent rather than an intentional agent performed the action. Moreover, in both groups, there were more eye movements from the non-goal zone to the goal zone of the scene when the action was performed according to non-rational logical rather than rational logic.

To sum up, these observations suggests that for both groups predictive inferences on an action are more precise:

- when they are about a physical causation rather than the behaviour of an intentional agent;
- when the action is performed with rational rather than irrational logic.

Despite these similarities, experimenters also found some discrepancies between scanning behaviour of two groups: TD subjects, in fact, look at the agent and the target zone for more time and made more predictive saccades from the agent zone to the goal zone rather than subjects with ASD. From this, we can infer that even if the pattern of scanning is similar in both groups regarding the intentionality of agent and the rationality of the action, TD subjects appear to be more focused on the more relevant element of the scene: the agent, the target and the path between the two.

These data could be explained by supposing that finding relevance is a consequence of the linguistic thought. To use a concept of agent, subjects must categorize the elements of the scene on the bases of their function in the movement; on the contrary, a perceptually based categorization of the scene makes, in this context, the identification of the agent impossible, since the agent has always-different aesthetic forms.

With an original experimental paradigm, David et al. (2010) showed that individuals with ASD were slower and less accurate than TD subjects to infer the others' preference of an object out of two from facial expressions, gesture and body orientation, even when they were able to infer its visuospatial perspective. In the classical Garndner (2011), the author individuated, besides linguistic and visuospatial intelligences, also musical, logical-mathematical, personal and bodily-kinaesthetic intelligences. It's possible to explain this last data reported by David et al. (2010)—and maybe also all the general literature of the deficit in interpreting the biological motion found in subjects with ASD—supposing their incapability to integrate in a linguistic context (the intention of avatar to take on one object rather than another) with bodily-kinaesthetic data.

§3.3.1.3 Emotion inferences

As we have seen in previous paragraphs, Grynszpan and Nadel (2015) showed a correlation between the deficit to make emotional inferences with the severity of diagnosis and linguistic deficits. Cassidy et al. (2014), with a more ecological setting, showed that subjects with ASD (like TD group, but at a higher degree) have more difficulties in distinguishing between positive emotions and feigned positive emotions from face scanning; have more difficulties rather than TD subjects in inferring emotions from face scanning; but they have the same ability of TD subjects to link the appropriate social response to an emotive response of others. This last information has, for us, great importance. Mey (2001) outlined the importance of social context for pragmatic considerations; often, like for example in the case of pragmemes (Capone 2005), "the rules of language and of society synergize in determining meaning" (*ibid.*, p. 1357). So, if subjects with ASD understand social rules, the problem in their inferential abilities is probably linked to the integration of this linguistic knowledge with the situation. To sum up, these data suggest that the ability to make emotional inferences from face scanning is specifically linked to the diagnosis and, although is related to linguistic abilities, it is not strongly associated with the ability to understand a socially appropriate response to the context. Inferences about different emotions have different levels of difficulty: inferences of positive emotions appear to be easier than others and, for subjects with ASD, inferences of sincere emotions appear to be easier than that of feigned emotions.

According to our hypotheses, it's possible to explain the correlation between severity of diagnosis and ability to make emotional inferences in assuming that subjects with ASD have more difficulty than TD subjects in

linking a visual perception (the visual configuration of a face) with linguistic data about the emotion expressed. How to explain that subjects with ASD showed more difficulties rather than TD in distinguishing feigned emotions from real ones? To acquire the ability of detect a feigned emotion, a subject must observe that a subtle change in the classical configuration of the emotion represented is linked to a behaviour of the subject that is incoherent with the context. For example, a subject shows happiness for a gift, but it never uses it. A link between these two occurrences is a linguistic and not a visuospatial ability. The observation that subjects with ASD can link, if extrapolated from the context, the social appropriate response with the emotive reaction of others let us think that the problem is not the general use of linguistic thought, but just its use in the context.

By TASIT, Mathersul et al. 2013 showed that subjects with ASD had poorer performances in detecting sarcastic rather than sincere interactions and that they have poorer performances rather than TD subjects in distinguishing sarcasm from deception. In this last task, participants performed a control group about feelings, but showed poorer performances about beliefs, meaning and intentions. So, we could draw a sort of hierarchy from the most to the less difficult to interpret for subjects with ASD: sarcasm, deception and sincere interaction. Like as for the previous example, to explain this hierarchy we must consider that the detection of sarcasm and that of deception are linguistic second order representations and, to be understood, need to be integrated in the context.

Paganini and Gaido (2013), that—as we have seen in §3.1—showed intact ability of making physical causation inference by visual presentation of stimuli, also showed that subjects with ASD performed worse in folk

psychology inferences rather than TD subjects. Experimenters use a multicultural adaptation of RMEt that requires the background knowledge to link a visual configuration with more complex concept like *absorbed, attentive, troubled, etc*. Contrary to the folk physics game of the same study, to understand the expression of this test the subject must integrate its previous knowledge about the concept of *absorbed*, with all the occurrences in which it saw the same (or similar) image and integrate it in the context. But probably, the inability to use linguistic background correctly in order to interpret words makes it incredibly difficult for subjects with ASD to create the *absorbed* categorization. On the contrary, to perform the folk physics task, they could visually simulate the physical movement represented in their mind.

§3.4 Prosody

In §3.3 I showed that a general cognitive deficit in inferential abilities of subjects with ASD is improbable, but rather we have to consider alterations in processing of the single content of each scene or sentence perceived. On the contrary, what is seems to be a deficit independent to the semantic content associated with it, is prosody. Now I will propose some general concepts related to prosody, and after I will describe and discuss anomalies in them in subjects with autism.

Literature on prosody is very rich. In 2006, Deirdre Wilson and Tim Wharton individuated three points on which, according to them, study on prosody converge:

1. prosodic signals are interpreted through a range of signals that goes from emotive to strictly linguistic;

2. prosodic signals are strictly linked to precise contingencies of communication: that means the same acoustical conformation of a vocal stimulus could be differently interpreted according to the context;
3. prosody marks the pertinence of the different interpretative possibilities of an utterance (Wilson and Wharton 2006).

The topic is complex. Here I will limit myself just to three component of prosody, those most studied in autism: the emotional, the grammatical and the culminative functions of prosody.

As *emotional prosody* I will intend that to individuate the emotion of the speaker while it is pronouncing the utterance; as *grammatical prosody* I will intend that which permit us to distinguish between questions or affirmations; as *culminative prosody* I will intend that which marks a specific word in a sentence or a specific syllable in word.

The parameter usually considered in the acoustic analysis of a sound is the fundamental frequency F_0, which expresses the speed of vibration of the vocal cords. To indicate the auditory correlate of F_0, we usually use the term *pitch*. The *pitch range* is the segment that represent the distance between the highest and the lowest values of F_0; on the contrary, the *pitch variance* shows far from the mean are the different values of F_0.

We can consider some trends in prosody, but there are a lot of exceptions present in them. Usually the emission of high frequencies (graphically represented in a cartesian system by a spike upwards) is associated to the production of questions and the emission of low frequency to the production of affirmations.

At the emotional level, on the contrary, high value of F_0 are often associated with deference, education, submission, poor security and low value of F_0 are on the contrary associated to assertiveness, authority, aggression, security, menace (Ohala 1994). Theoretically there is an inverse correlation between F_0 and body mass; the reception of low values of F_0 is often associated to a perception of power and dominancy of who emits it (*ibid*).

At the culminative level, the interpretation of F_0 depends on the language for the localization of the accented syllable (i.e., in Italian, F_0 has a longer duration in the vowel of the accented syllable); instead regarding the accentuation of a world in a sentence, it depends on the grammatical and the emotive intonation of the sentence.

Other approaches commonly used to quantify prosody are those based on the analysis of a wave component from evoked potentials after stimulus that are differently relevant to the context. These kinds of measurement are called *mismatch negativity* (MMN) if they are measured by electroencephalography (EEG) and mismatch field if they are measured by magnetoencephalography (MEG).

In subjects with ASD a positive correlation between deficit in the understanding of prosody and the general pragmatic and social functions seems to be present (Wang and Tsao 2015).

Since the first account of the pathology, prosody was configured as an area of weaknesses in subjects with ASD (Kanner 1943). Let's consider together the most recent literature on the topic.

§3.4.2 Prosodic deficits in subjects with autism

Among various clinical populations, not all pragmatic deficits are linked to prosody and not all prosodic deficits imply the presence of other

pragmatic deficits; however, in subjects with ASD, prosodic and pragmatic deficits always are both present.

The two Chinese researchers Jia-En Wang and Feng-Ming Tsao individuated a systematic correlation between pragmatic skills and the ability to recognize emotional prosody during the listening of sentences in children with ASD between 6 and 11 years old (Wand and Tsao 2015). If this correlation was founded in the simplified assessment of a scientific experiment, it's easy to hypothesize that it would be strongest in more ecological contexts.

§3.4.2.1 ASD: production and perception of prosody

It seems, in general, that prosodic deficits are correlated with the general severity of symptoms (Bone et al. 2014) and of social (Paul et al. 2005b) and linguistic symptoms (Shirberg et al. 2010). Subjects with ASD don't produce (Sharda et al. 2010; Paul et al. 2005a, 2009; Filipe et al. 2014; Peppé et al. 2010) and don't correctly perceive (Paul et al. 2005a; Lindner and Rosén 2006; Paul et al. 2009) prosody; they show deficit in the perception of positive emotion through prosody (Wang and Tsao 2014; Grossman and Tager-Flusberg 2012); while data on negative emotional prosody are controversial. Specifically, Wand and Tsao (2015) didn't find anomalies in the perception of sadness and anger; on the contrary Grossman and Tager-Flusberg (2012) and Doi et al. (2013) did. It's possible that these differences are linked to different levels of intensity of experimental stimuli because often subjects with autism seem less responsive to high-intensity stimuli. But not all researchers agree with this data (Doi et al. 2013). Moreover, subjects with ASD seem to be less accurate of TD subjects in linking affective prosody with visual representation of the corresponding emotion (Matsuda and

Yamamoto 2015) and in detecting irony from prosodic indices (Wang et al. 2006; Li et al. 2013). The recognition of emotions through prosody seems moreover highly worse in presence of comorbidity of ADHD (Oerlemans et al. 2013).

It seems that subjects with ASD show more difficulties in perceiving the contrasting stress of insignificant syllables than TD subjects (Paul et al. 2007); more difficulties in perceptually distinguishing words for which disambiguation depends exclusively from the accent (Diehl and Paul 2012); more difficulties in using prosody to disambiguate syntax (Diehl et al. 2008; Filipe et al. 2014); and more difficulties in imitating a prosodic pattern, because they tend to dilate prosodic times of utterances (Diehl and Paul 2011; Van Santen et al. 2010). However, we must consider that–in contrast with Diehl and Paul (2012)–Järvinen-Pasley et al. (2008b) found normal performances of subjects with ASD when stimulus were words and anomalous when stimulus were phrases.

Järvinen-Pasley and collaborators (2008a) hypothesized a tendency of subjects with ASD to elaborate stimuli toward perception and contrasted it with the tendency of TD subjects to elaborate stimuli mainly toward semantic conceptualization. Effectively, Ference and Curtin (2015) showed that brothers of subjects affected by ASD (that according to Oerlemans et al. 2013 seemed to show mean performances between TD subjects and subjects with ASD in the recognition of emotion from prosodic stimuli) that at twelve months of age perceive lexical the lexical stress of words, have more probability to correctly develop expressive language at 24 months of age. Moreover, the prosodic awareness seems to be positively correlated with a major accuracy in lecture (Nash and Arciuli 2015). However, Lim (2010)

showed that linguistic or musical training have the same positive effect on prosodic alterations.

Let's analyse now more in detail these prosodic alterations.

Following data need still to be confirmed with major sample, but it's interesting at the moment evaluate the state of the art. It seems that prosodic alteration in subjects with ASD can already be found between 0 and 6 months of age, because the modulation of production is less complex (Brisson et al. 2014).

Lyons et al. (2014) confronted the performances of perception and production of prosody in subjects with ASD in the range of age that goes from 9 to 12 years old; in TD subjects in same age range; in subjects with ASD in the range of age that goes from 13 to 17 years old; and in TD subjects in the same age range. From this comparison emerged that adolescence could be a fundamental phase for prosodic skills in subjects with ASD. In fact, prosodic skills don't change in TD subjects from 9 to 17 years of age; on the contrary, in subjects with ASD they improve. In general, it seems that in the pre-adolescent clinical group, linguistic skills (CELF-4) (Semel et al. 2003) are associated with the ability to correctly produce and perceive prosody. In the clinical group of adolescent, on the contrary, this correlation was found exclusively with production and not with perception. This last data could induce us to think that, if the correct production and perception of prosody can benefit from a treatment of linguistic skills in the pre-adolescent age, in adolescence can improve exclusively the production.

Also studies conducted with the MMN confirm perceptive differences at prosodic level between 8 and 12 years of age in subjects with ASD. Specifically, Kujala et al. (2010) individuated a difference in the elaboration of

frequency and intensity of syllables in subjects with ASD. In subjects with AS, the MMN is larger in intensity and smaller for frequency changes than TD subjects. Moreover, the generation of MMN seems to have a different localizations in subjects with AS and in TD subjects (Kujala et al. 2005).

Coherent with this line of research is the study of Su et al. (2014), in which experimenters showed differences in performances of Mandarin-speaking children and adolescents with ASD. In this study adolescents with ASD, as their TD peers, were able to interpret the meaning of *wh-words* in ambiguous contexts both through prosodic analysis both through semantic analysis; while children with ASD showed more difficulties to understand the intended meaning of these words during affirmations, but not during questions.

However, Nakai et al. (2014) found a positive correlation between deficits in production of correct prosody in children with ASD (that were monotonic) and social deficits (but not communicative deficits). This last data is coherent with my idea that, if we consider an empiric perspective, as that of clinical pragmatics, the distinction between these two categories become fallacious.

Stewart et al. (2013) showed that if prosody and linguistic sense are reciprocally coherent, there are no differences between ASD and TD performances; if, on the contrary, they are incoherent, subjects with ASD show more difficulties than TD subjects.

Also at a neural level there seem to be differences between the two groups. I will report some data, but in chap. 4 I will also show the strong limitations of brain imaging data.

In general, it seems that subjects with ASD the elaboration of prosodic information produce a more intense and diffuse activity than in TD subjects (Eigisti et al. 2012). Specifically, for example, in TD listeners the activity of frontotempoparietal networks decreases if, through prosody, the speaker emphasizes word's borders; this phenomenon, on the contrary, is absent in listeners with ASD (Scott-Van Zeeland et al. 2010). Or even, during tasks irony recognition, subjects with ASD show a major activation of the frontal inferior girus and of temporal regions (Wang et al. 2006). Eigisti et al. (2012) attribute this major cerebral activity to a minor development of automatisms of the elaboration of language.

Helsing et al. (2010) found a link between perceptive and performative deficits in some prosodic components: the rytm, the fatic component and the emotive one. They found, in subjects with ASD, an anomalus activation of the supramarginal lift girus than the TD group and an absence of inactivation of the default mode network.

However, it seems that subjects with ASD show a deficit at the encefalic level in tracking the pitch of the listener. This suggests anomalies in the activation of subcortical areas during the elaboration of prosody (Russo et al. 2008).

A very accurate study conducted on cortical answers to irony in TD and ASD listeners showed that the latter have a major activation of medial prefrontal cortex and of the left temporal pole than TD subjects, while they process ironic inputs (Colich et al. 2012). On the contrary, Ting Wang et al. (2007) found reduced activity in the medial prefrontal cortex and in the right superior temporal girus in subjects with ASD compared to in TD subjects during prosodic perception of irony. The activity of medial prefrontal cortex

was inversely proportional to the severity of social symptoms. However, explicit instructions of the experimenter that ask to specifically monitorate facial expressions and tone of voice of stimuli, produced an increment of cortical activity in the prefrontal medial cortex, but just in subjects with ASD.

MMN studies seem to show the absence, in subjects with ASD, of the differentiation of cerebral elaboration of happy prosody to angry prosody that is, on the contrary, present in TD subjects (Fan and Cheng 2014).

Studies on acoustic frequencies show that the deficit in prosodic production, although it seems to effectively join all subjects with ASD, can assume different characteristics on the basis of linguistic skills of subjects considered. In particular, De Pape et al. (2012) found that subjects with ASD with good linguistic skills (PPVT) (Dunn and Dunn 1997) tend to have a wider pitch range than TD subjects, but that doesn't correctly mark the salience of the information; on the contrary, in subjects with ASD with modest linguistic skills, usually have a less wide pitch range than TD subjects, but they correctly mark the salience of information. This distinction in two clusters is coherent also with another study conducted by Russo et al. (2008). In it, experimenters measured F_0 during the production of the sound /a/ in subjects with ASD and in TD subjects. A feedback followed the sound after 200 ms. The group with ASD gave answer with much wider or much less wide magnitude than TD subjects. Diehl and Pul (2011) and Nadig and Shaw (2012), that didn't divided their sample with ASD in clusters (CELF-4), had previously detected a tendency in subjects with ASD to adopt wider pitch range and pitch variance than TD subjects. Moreover, Green and To-

bin (2009) had previously found a wider F_0 and Filipe et al. (2014) had previously found a major pitch variance.

§3.4.2.2 Reactions of linguistic partners to prosodic alterations

Bone and collaborators (2014) studied reactions of linguistic partners of subjects with ASD to their prosodic alterations. Their focus was on therapists. They found that more evident were prosodic alterations of patients, higher were prosodic alterations in therapists.

In this direction, others interesting studies were conducted on parents of patients. In 2012, Venuti and collaborators studied the reaction of parents of children with autism in some specific situations. They collected a series of daily videos (i.e. birthdays video) of children before the diagnosis and a series of daily videos of other TD children in the same age range. At this point, they asked the parents of all children to listen the recording of cries of their son. They found that, during the listening, parents of children with autism showed increased cerebral activity in:

- the primary and secondary auditory cortex (including the area of Wernicke);
- the frontal inferior bilateral gyrus (including the Broca's area);
- the left supramarginal gyrus.

These areas, according to research in scientific literature proposed by the authors of the study, are those considered as primary in the linguistic understanding and in the prosodic interpretation (Venuti et al. 2012). In §5.9.1 we will critically discuss the value of neuroimaging data. Questionnaires of auto-evaluation showed major frustration in reacting to cry in parents of the clinical group than in parents of the TD group.

Brisson et al. (2014) used a similar experimental procedure, but analysed just vocalization. Specifically they compared daily videos of interactions between mothers and children of two groups. The first group of children was not still diagnosed with ASD, but received the diagnosis at the time in which the study was conducted. The second group was a TD control group of children. Researchers found that mothers of the clinical group used shorter vocalization than mothers of the TD group.

Another study conducted with a similar experimental procedure but with a more heterogeneous sample of caregivers found that emotional prosody of TD newborns becomes more acute after caregivers' vocalizations. Moreover, parents of newborns that receive a diagnosis of ASD produce more intense and frequent vocalization than those of the non-clinical group (Cohen et al. 2013). It's also possible that social behaviour of children that do not receive the diagnosis induces parents to augment the use of motherese. The study of Cohen et al. (2013), in fact, analyse these data in light of Dean Falk's theory (Falk 2015) on the evolutionistic origins of language. We will come back on this topic in §5.5.

§3.4.2.3 Critics: do subjects with autism show prosodic deficits?

Not all studies agree with the idea that subjects with ASD have prosodic alterations. Le Sourn-Bissaoui et al. (2013), for instance, hypothesized that problems of interpretation of emotions could be linked to inferential deficit and not to prosodic deficits. They, in fact, empirically found that subjects with ASD consider less prosody when it is positive than TD subjects. Coherent with this data are results of Ploog and collaborators (2014). They found that this phenomenon is absent if the input is not in the mother tongue of TD group and that effectively, the deficits in prosodic interpretation, are

absent in subjects with ASD if they are listening language different from their fist language. Brooks and Ploog (2013) confirmed that subjects with ASD correctly perceive prosody and the attribute differences in performances often founded as absence of the preference (present on the contrary in TD subjects) for phrases with positive prosody to prosody that denotes bad mood.

Brennand et al (2011) found deficits in subjects with ASD in identification of happy, painful, angry and sad prosody, but they were not statistically significant. Heikken et al. (2010) found intact ability to interpret emotional prosody in adolescents with AS.

Singh and Harrow (2014) limit just to the emotional function the prosodic deficits in subjects with ASD.

Contrary to the most diffused trend, Ploog et al. (2009) seem to show that TD subjects consider the linguistic content more than the prosodic one of an input, while subjects with ASD, on the contrary, consider both prosodic and linguistic contents at the same level.

The studies of Coralie Chevallier and collaborators are very interesting. In 2009, they found that subjects with AS have analogous performances of TD subjects in the understanding of grammatical prosody (Chevallier et al. 2009). The following year, the same research group showed that subjects with ASD and TD subjects have analogous performances in tasks of pragmatic disambiguation of semantic ambiguity of connectives such as *and* and *or*, when the only clue to distinguish between to competitive alternative is the prosodic accent (Chevallier et al. 2010). In another study they also found that subjects with ASD have the same accuracy in detecting emotions and intentions from prosody, but they show longer reaction times (Chevallier et

al. 2011). According to their interpretation, prosodic alterations are not qualitative; subjects with ASD simply need more simplified stimuli to perform this task. Also if they have prosodic alterations or deficits in the daily life, this is not an ontological constraint of the pathology (*ivi*).

Nadig and Shaw (2014) found that effectively, subjects with ASD correctly use the contrastive stress of prenominal adjectives (in English), but two groups differ in the use of *pitch*.

Mattehw Lieberman spoke about a dance of communication (2000), a process of reciprocal understanding in which phenomenological intuition has a fundamental role for the success of communication At the state of the art, it seems that something goes wrong in prosodic communications with subjects with autism, but we cannot catch it with the numbers of the scientific classification.

§3.5 The fixing of reference

The fixing of reference is really difficult for subjects with ASD. All kinds of references are affected in such a way in autistic language. In the next two paragraphs I will describe anomalies in temporal (§3.5.1) and personal (§3.5.2) references, but what I will discuss about these two in next chapters will be valid also for spatial reference.

§3.5.1 The fixing of personal reference in subjects with autism

Since Kanner's first account of autism (Kanner 1943), something strange in the use of personal pronouns emerged in this clinical population. Kanner dedicated a lot of observations to this topic, and his work showed that some subjects with autism cannot use personal pronouns and others can. This trend is still confirmed. Anthony Lee, Peter Hobson and Shulamuth

Chiat summarized the question well: a lot of anecdotal experiences reported this problem, but experimental data on this alteration are inconsistent with each other (Lee et al. 1994). It is quite interesting that this research group, without referring to EC, hypothesized that this inconsistency of experimental data with experiences of caregivers of patients could be linked to the differences in engagement triggered by reality and that triggered by experimental situations (*ibid.*; Hobson 1990; Hobson 1993). Other similar interpretations in this direction are that of Bosch (1970) and Charney (1981).

However, not every anomaly in the use of personal deixis in subjects with autism reflects this trend: in fact, for example, pronoun reversal between *I* and *you* is reported both in qualitative (Kanner 1943; Fay 1969) and in quantitative studies (Naigles et al. 2016), although with minor samples; but it is never reported for all subjects of the study.

In fact, the different levels of engagement for subjects between experimental situations and ecological ones are not the only possible explanation. For example, Novogrodsky et al. (2013; 2015) showed that when children with ASD repeat a story after listening, they use third-person pronouns just as TD peers; when they create a new story, they show anomalies in the use of the same pronouns. In Novogrodsky et al.'s (2013; 2015) experimental setting, the main difference between these two tasks is the level of performativity (Pennisi and Falzone 2016) required by the activity: telling a new story requires a stronger creative effort than retelling something after hearing it. Also Colle et al. (2008) found that subjects with ASD manifest anomalies in the use of personal deixis when telling a story: for example, despite the analogous number of referential expressions to the two main characters of the story, contrary to the control group, the clinical group uses

more extended nominal expressions than pronominal ones (as we will see, Lee et al. 2004 showed a similar phenomenon with a different experimental setting).

Lee et al. (1994) showed that when subjects with autism (25 children and adolescents), had to answer questions such as "Who can see the X?" they often wrongly use the pronoun *I* rather than *me*, contrary to control group (25 non-autistic children and adolescent matched for verbal mental age, so with a delay in cognitive development). Moreover, the target group showed the tendency to use proper names rather than pronouns (when it is possible to choose without making grammar mistakes) more than the control group (*ibid.*). But, contemporrally, they found no problem in other uses of *you* and *I*.

Hobson et al. (2010) showed that adolescents with autism correctly and spontaneously use *we*, *us*, *ours* and *you* in experimental settings that ask participants to answer questions such as "Whose tower was the tallest?" when the correct answer is "ours". On the contrary, the same group failed when the correct answer to such a question was *he*; moreover, in these cases, subjects with autism didn't look (contrary to the control group of TD subjects) at the person to whom the reference was directed.

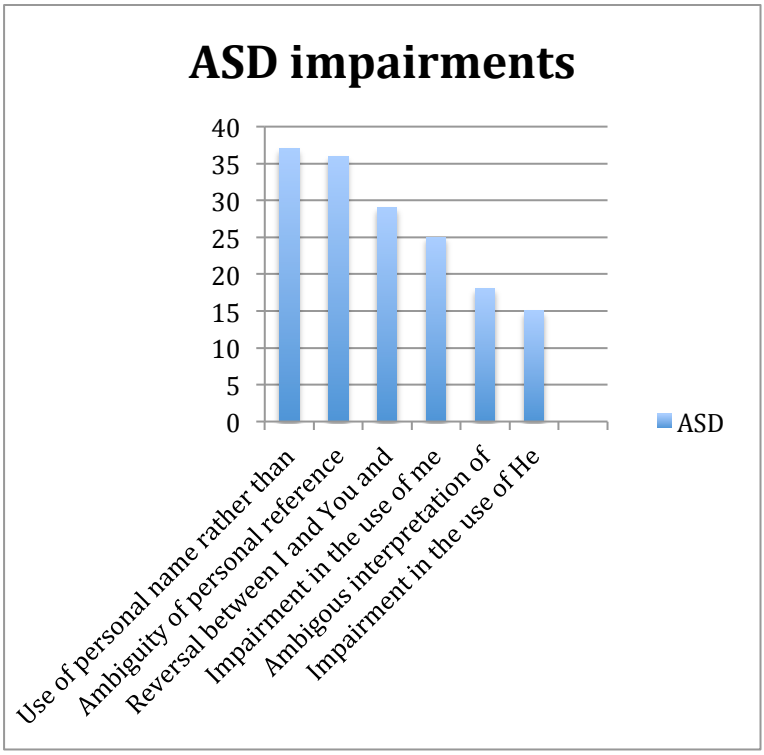
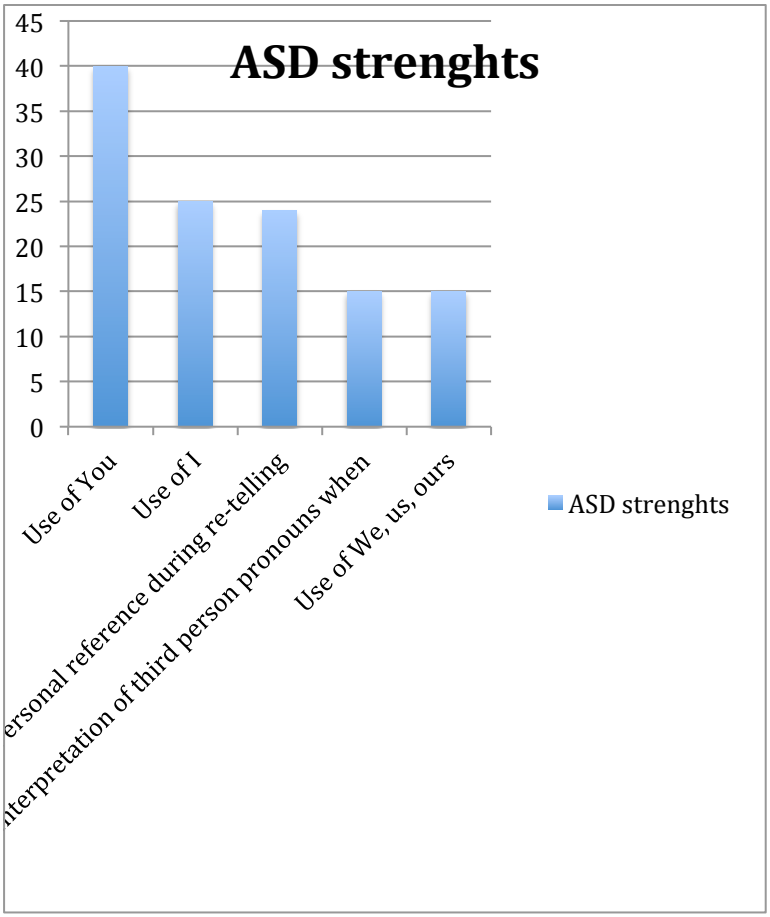

ASD impairments
40
35
30
25
20
15
10
5
0
Use of personal name rather than
Ambiguity of personal reference
Reversal between I and You and
Impairment in the use of me
Ambigous interpretation of
Impairment in the use of He
ASD

Figura 14



Graphs express the number of participant (sum of each study) for each single item. So the taller the bar graph for each item, the numerically stronger the phenomenon described. Data is organized by the author and comes from: Lee et al. 1994; Hobson et al. 2010; Novogrodsky 2012; Naigles et al. 2016. Novogrodsky and Edelson 2015; Fay 1969; Perovic et al. 2013; Colle et al. 2008; Kanner 1943.

Figura 15

We will critically discuss the fixing of reference in next chapters. Now I will describe anomalies in the fixing of temporal reference in subjects with ASD.

§3.5.2 The fixing of temporal reference in subjects with ASD

This is the last paragraph of the thesis dedicated to the description of characteristic linguistic anomalies in subjects with ASD. So, at this point we can make a general observation on the linguistic profile of this clinical population: it is in such a way recognizable by those who know the pathology, but—as we say in the §1.1—it is not predictable or representable through rules or labels.

Coherently with this rule of absence of rules, but presence of trends is also the general fixing of temporal and spatial aspectuality. Here we will describe just temporal aspectuality.

First observations regarding anomalies in the temporal aspectuality in subjects with autism were made in 1974 by Giampiero Bartolucci and Robert Albers. They noted (but in a very small sample) that subjects with autism had the tendency to under-use the past in favour of the present even when the past was required by the context. And this observation was valid both in relation with TD subjects and with subjects with mental retardation.

Recently, Zhou et al. (2014) found that high-functioning Chinese children with autism that are 4–5 years old use the morpheme *–le* of Mandarin Chinese that signs the perfective flexion less than their TD peers (matched for chronological and verbal age). The same phenomenon was found in 2004 by Roberts and collaborators for the morpheme *–ed* that is needed to form the past tense.

Is this a simple grammatical problem or is a conceptual problem?

Studies in this direction are few in number. In 2006, Michael Perkins and collaborators quantitatively and qualitatively analysed the records of some dialogues between an experimenter and seven adults with autism.

Their study, which unfortunately is without a control group, show a very high frequency of errors in the spontaneous use of aspectual relative expressions, for example, regarding the contraposition between habitual and non habitual; continuative and non-continuative or even perfective and non-perfective; sometimes they are associated with alterations in the declination of perfective forms. Let's consider, for example, the following exchange between the experimenter and the participant George:

> **GEO: yeah I've been out cycling when I've been here.*
> **RES: xx where do you go?*
> **GEO: ehm if it's morning then I'll be going track < across> [///] on the railway track.*
> **RES: wow do you go on your own?*
> **GEO: no I shall go with a member of staff.*
> **RES: (who) who goes with you?*
> **GEO: ehm well Gary Manning is going with me (Perkins 2006:800–801).*

In this case, George seems cannot fix a specific temporal perspective: he uses before the present perfect, then the future continuous, then the future simple, and finally the present continuous. Moreover he does it despite the prompts of the researcher in using the present simple.

The difficulties in the expression of the sense of habits is expressed also in the wrong use of non-verbal temporal expressions. For example, Phoebe, another participant in Perkins et al.'s study (2006), to the researcher's question "How often do you go swimming?" (Perkins et al. 2006:801) answered "lots of days" (*ivi*). Or even, the participant Penelope seemed to have missed the sense of the word *usually*, as we infer from the following affirmations:

> **PEN: I usually buy CDs every Friday.*
> **PEN: yeah I usually get paid every Friday as well.*
> **PEN: I usually get upset sometimes because of Keith Chegwin not being on all week.*

**PEN: I usually live at Poplar House as well. ['live' = a state, not an habitual event] (ivi).*

To sum up, from the few studies that we have on the topic, more questions emerge than answers. It seems that children with autism have difficulties in the acquisition of expression of temporal concepts linked to habits. This difficulty is expressed by alteration in the use of verbal forms that express them and difficulties in the acquisition of temporal adverbs.

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Chapter 4

Ontogenetic development of language in subjects with autism

§4.0 Introduction to the chapter

In this chapter, I will propose a hypothesis regarding the ontogenetic development of language in subjects with ASD. In §4.1 I will discuss the incidence of linguistic disorders in the clinical population; in §4.2 I will discuss studies regarding language in this clinical population before the diagnosis; in §4.3 I will show some studies regarding anomalies in lip reading during the acquisition of language; in §4.4 I will describe the development of language after the diagnosis; finally, in §4.5, I will analyse the correlations between pre-linguistic anomalies, language and pragmatic deficits.

§4.1 Incidence of linguistic disorders in subjects with ASD

As we saw in §1.1, the linguistic profile of autism is very heterogeneous.

In 2005, Sigman and McGovern showed that in a sample of 48 adolescents with ASD (19 years old):

- 49% had a linguistic age inferior to 30 months; so didn't have the lexical explosion and didn't acquire syntax;
- 15% had a linguistic age comprised between 30 and 47 months, so it moderately understood and used language;

- the remaining 36% had a linguistic age superior or equivalent to 48 months, showing a fluent or semi-fluent language.

A more recent study, with a wider (164 subjects with ASD) and younger sample, suggests better results: children 28 months old showed a linguistic age of about 13–16 months (Luyster et al. 2008).

Sigman's and McGovern's study evaluates subjects that were not treated or about which we have little knowledge of their treatments, so it's probable that they are too pessimistic for today. However this data suggests something important: non-treated subjects with ASD have high probability to develop serious linguistic deficits. Sigman and McGovern, in fact, after having done a follow-up of a previous study that analysed linguistic improvements of the same group of subjects from the ages of 4 to 12 years old (Sigman and Ruskin 1999), showed that from 12 years of age to 19 years of age language almost doesn't improve (Sigman and McGovern 2005). The difference between this study and that of Luyster et al. (2008), is probably linked to the major precision of tool for measurement adopted by this last.

Language is a complex and multiform phenomenon. The difficulty in defining the incidence of linguistic deficits in subjects with autism is linked to the different conception of language behind each test used by experimenters. But we can consider that usually articulatory skills and quantity of words used are positively correlated to joint attention, use of prelinguistic gestures and pointing (Luyster et al. 2008).

This correlation found the agreement of the scientific community, in fact, a delay in the pre-linguistic communication before 18 months of age is usually considered a index of risk for a future diagnosis of autism according to the M-CHAT-R/F, validated on 16,071 subjects (Robins et al. 2014).

§4.2 Language before the diagnosis

When a child receives a diagnosis of autism, all his manifestations of life are measured, controlled, recorded, etc… Thanks to the scientific obsession for numbers, today we have more data on autism than what is possible to interpret. On the contrary, what we lack is data regarding behaviours of children before the diagnosis. It's easy to understand why.

How to study language before the diagnosis?

More used methods until now are:

- analysis of familiar video made before the diagnosis;
- retrospective interviews and questionnaires administered to parents of children regarding the pre-diagnosis period;
- intensive monitoring of children considered at risk (such as brothers or sisters of children with autism; children considered at high risk of ASD after M-CHAT-R/F, etc…).

At six months of age it seems that there are no difference between children later diagnosed as autistic (LDA) and TD children, at least regarding visual reception of communicative gestures, understanding of simple phrases; production of vocalizations and fine and global motor control (Landa and GarrettMayer 2006; Ozonoff et al. 2014).

Mitchell et al. (2006) confronted the linguistic behaviour of LDA children with that of a group of TD peers. At 12 months of age, LDA children—according to declarations of parents through the *MacArthur Communicative Development Inventory Infant Form Word and Gestures* (MCDI-WG)—didn't appropriately respond to simple phrases of social interaction such as "don't touch". At 12 months of

age they don't show communicative gestures such as *pointing* or enlargement of arms while waiting a hug and they don't react to play interactions such as peek-a-boo. But they are able as TD peers to use objects in appropriate ways, so for example, they correctly bring the phone to their ear and the spoon to their mouth. At 12 months, LDA children seem to use and understand the same quantity of words of their TD peers, but at 18 months old the latter show significantly higher performances. Great part of this data are confirmed by Zwaingebaum et al. (2005); Hurdy et al. (2014), Ozonoff et al. (2014); Lazenby et al. (2015).

From this brief survey, it seems to emerge that at 12 months of age children with ASD show a linguistic phenotype different from children without ASD. Specifically, the problem seems not be the acquisition of single words, but the combination of more words in a phrase; or of words and gestures to produce meaning or of prelinguistic meaningful gestures.

So, once again, the problem seems to be pragmatic and not semantic.

§4.3 Alterations in lip reading

Infants under 2 months of age tend to look at the edges of another's face (Maurer e Salapatek 1976; Haith et al. 1977); later they will prefer the internal features of the face (Yarbus 1967; Hunnius e Geuze 2004). Differences in these habits may reflect differences in language acquisition (Lewkowcz e Hansen-Tift 2012).

Recent studies focused their attention on face scanning of autistic subjects. Pelphrey et al. (2002) showed that ASD subjects, compared to typically developed (TD) subjects, look for a longer time at non-salient areas of faces and for a shorter time at salient areas of faces. However, van der Geest et al. (2002) found results contrasting with these last studies and showed that there are no differences in gaze behaviour of scanning faces between TD and ASD subjects when faces are presented in isolation and without sound.

Let's analyse together the question of time spent looking at the mouth rather than the eyes during dyadic interactions.

In 2002, a prestigious psychiatric magazine published an experiment that, despite the small number of participants involved, gave rise to a widespread debate on the relationship between perception styles and social skills. Klin et al. (2002) showed that, while watching a video (30-60 s) representing naturalistic social situations, ASD subjects (n = 15; m.a. = 15.4), rather than TD subjects (n = 15; m.a. = 17.9), looked twice as long at the mouth region, half as much at the region of the eyes, twice as much at the body region and twice as much at the object region. Experimenters also found a positive correlation between time looking at the mouth and social competence measured by VABS-E[9] and ADOS social scores; and conversely, there was a positive correlation between time focusing on the object region and severity of autistic symptoms. Thus, the authors inferred that:

- increased focus on mouths predicted improved social skills and less autistic social impairment;

[9] Vineland Adaptative Behavior Scales Expanded Edition

- increased focus on objects predicted decreased social skills and more autistic social impairment.

The hope of finding a biomarker for autism in perceptual biases led several research groups to replicate the experiment. Dalton et al. (2005) carried out two different experiments in which experimenters presented photographs of other human beings to participants while they underwent fMRI scanning and found that ASD subjects (Exp.1 n = 14 ASD, m.a. = 15.9 vs n = 12 TD, m.a. = 17.1; Exp. 2 n = 16 ASD, m. a. = 14.5 vs n = 16 TD, m. a. = 14.5) spent less time watching eyes than did TD subjects and the same amount of time as TD subjects in watching mouths while observing static black and white images of faces.

How can we explain these discrepancies? Bar-Haim et al. (2006) hypothesizes that these contrasts in results could derive from the loss of interest that occurs in longer observation. In fact, experimenters showed with a presentation of static photos of emotionally neutral faces that, like TD subjects, subjects with ASD make an initial attention shift from the eye region and do not disengage within 400 ms from stimulus presentation. De Wit et al. (2008) proposed another interpretation. With a sample of 13 subjects with ASD (m.a. = 5.16) and 14 TD subjects (m.a. = 4,93) it was shown that there was no difference between groups in their time looking at the eye region and that children with ASD look for a shorter time than TD children at the mouth; also, the opposite trend revealed by Klin et al. (2002), poorer social and communicative skills (Autism Diagnostic Interview-Revised[10]) were correlated with a shorter time looking at the mouth region by a presentation of static, representative emotional photos (10 s). Experimenters at-

[10] Autism Diagnostic Interview-Revised (ADI-R) (Lord et al. 1994)

tributed these differences to the difference in abilities of the two samples. Klin et al. (2002) included more verbal individuals than de Wit et al. (2008), so de Wit et al. concluded "predominantly verbal individuals will be expected to look preferentially at the mouth". Effectively, a more specific analysis of Klin et al.'s (2002) study reveals that indices of fixing on the mouth and eyes had a very high standard deviation; thus, if experimenters also found a statistically significant tendency to fix on the eyes in TD participants and the mouth in ASD participants, in each group it is possible that some subjects did not show a marked tendency like other members of their group. Due to the small number of subjects in their experiment, Klin et al. did not have the possibility of identifying clusters in a post-experiment analysis.

As described in the previous paragraph, some researchers suggested a correlation between high eye-mouth index (EMI[11]) and the severity of autistic symptoms (Klin et al. 2002). Due to the high occurrence of discrepant results, De Wit et al. (2008) proposed a different interpretation of the percentage of time spent looking at the mouth region, and hypothesized a correlation between time spent in looking at the mouth and linguistic abilities. Effectively, Young et al. (2009) and Elsabbagh et al. (2014) showed that the EMI in children considered at-risk for developing the pathology did not relate to a future diagnosis, but they found some correlation with the development of expressive language.

Young et al. (2009) confronted thirty-three 24-month-old infants who at 6 months of age were declared at-risk for receiving a future diagnosis of

[11] We use an index elaborated in Elsabbagh et al. 2014 which was calculated as follows: (looking time towards the eyes – looking time towards the mouth)/ total looking time to any area of the scene. The higher the value of this index, the greater is the difference between the time spent by infant in watching eyes and mouth. A positive value indicates that the child looked longer at the eyes, a negative value indicates that the child spent more time looking at the mouth.

autism (15 high risk, 19 low risk) with 25 TD infants in ecological 3-minute interactions with the mother (the second minute in the still-face condition[12]). Only three of the 33 children at risk received an autism diagnosis. None of the 6-month-old infants' gaze behaviours predicted severity scores in ADOS or in M-CHAT. However, EMI was negatively related to expressive language at 24 months of age and to expressive language growth according to the Expressive Language subscale[13] of MSEL and Vineland. These results are perfectly in line with the study of Lewkowicz and Hansen-Fit (2012) that showed that TD infants (179 in their sample) shifted their attention from the eyes to the mouth between 4 and 8 months of age, and that afterwards they shifted back to eyes in response to native, but not non-native, language.

In a longitudinal study, in which four conditions were confronted (only eyes are moving; only mouth is moving; only hands are moving; eyes, mouth and hands are moving), Elsabbagh et al. (2014) showed that in a scene in which hands, eyes and mouth are simultaneously moving, negative EMI at 7 months predicts superior expressive language at 36 months. In contrast, EMI at 14 months or in a simplified scene in which only eyes, mouth or hands are moving did not correlate with either diagnosis, EL or receptive language.[14] Moreover, more time spent watching the mouth when it alone is moving, is associated with poor expressive language in all groups and with greater impairment in social ability (measured by ADOS) in the at-risk group. Thus, the tendency to look longer at the mouth rather than the eyes may be context-dependent and if it is present at 7 months, it is a predic-

[12] The caregiver ignores the baby and is expressionless.

[13] Ability to put thoughts into words and sentences, in a way that makes sense and is grammatically accurate (subscale of Mullen Scales of Early Learning, MSEL)

[14] Ability to understand what is heard or read (subscale of MSEL)

tor of better expressive language development, but not a predictor of a future ASD diagnosis.

Falck-Ytter et al. (2010), studying a sample of 15 children with ASD (m. a. = 5.16 years) and 15 TD children (m. a. = 4.91 years) and also with another sample of 12 children with ASD (m. a. = 6.58 years), suggest that "there is a tighter link between language and non-verbal communication skill than between language and socio-emotional skills". Experimenters showed 15 children with ASD (m.a.= 5.2) and 15 TD children (m.a. 4.11) 36 short videos (4s) showing expressions of different emotions. Some of these were inverted. Experimenters used the Social Impairments[15] and the non-verbal part of the Communication Impairment[16] of the ADI-R to test differences in non-verbal communication skills and socio-emotional skills and found two different cognitive profiles in ASD subjects:

- Children better at non-verbal communication look more at the mouth that at the eyes
- Children with better social skills look less at the mouth region

There was a significant positive correlation between Social Impairment-Communication Impairment and mouth-looking time (suggesting that longer looking time at the mouth is related to the balance between Social Impairment and Communication Impairment rather than to one of their individual values).

In the same study, experimenters replicated these results with a new sample of 12 children with ASD (m.a.=6.7). None of the other subscales or

[15] Inability to develop relationship with peers appropriate to their level of development

[16] Marked impairment in the use of various nonverbal behaviors, such as direct gaze, facial expression, body postures and gestures to regulate social interaction

other measures of intelligence correlated with data, so IQ or other adaptive skills cannot explain this result.

The relative independence of social and communicative abilities was also extrapolated in general to the population with ASD (Happé et al. 2006; Ronald et al. 2005, 2006b). Happé et al. (2006) sustained that—among the symptoms of the autism triad of the DSM IV[17]—there is always prevalence and that there is no correlation between the severity of social impairment and the severity of communicative impairment. Their assumptions were based on Ronald et al. (2006a), a study conducted on 3,419 twins in which it was shown that the three autistic traits described in DSM IV appear to be genetically determined but interdependent.

Thus, the theory of Flack-Ytter et al. (2010) may be useful for identifying a cognitive profile of autistic subjects: a child more focused on the mouth in face scanning would probably have poorer social skills (so could have more difficulty in developing affective relationships); on the contrary, a child more focused on the eyes during face scanning could have more problems in silent communication (and thus show more problems in the use and interpretation of eye gaze, proxemics, facial expressions, etc.).[18]

The first observation appears to be more easily explained than the second: children who focus on eye gaze for a long time are probably concentrating on the more salient stimulus, but fail to attribute a social meaning to it; thus they do not respond to it in the typical way of looking away from the eyes. On the contrary, the first question is more controversial: if looking

[17] She referred to the DSM IV because the last edition (DSM V) was published in 2013 for the first time.

[18] From results shown in §3, another question arises that we have not discussed in this paper: if social attitudes are positively correlated with language skills and silent communication is uncorrelated with social attitudes, can we infer that language is uncorrelated with silent communication, as is most frequently sustained (cfr. i. e., Bara 1999)? We attempted to answer this question in Pennisi 2016.

longer at the mouth predicts poorer social abilities—how can we explain this trend?

In TD subjects, audio-visual input facilitates the processing of spoken syllables rather than an audio input (Stekelenburg and Vroomen 2007; Van Wassenhove et al. 2005).

In 1976, Harry McGurk and John MacDonald showed that if the listener could see the speaker, his visual perception of the verbal communication will influence his auditory perception, creating a confusion or a combination between them. In fact, if we show the listener a film in which the video shows lips that say "ga-ga" and the audio plays the sound "ba-ba", probably it will perceive "da-da" (McGurk e Mac Donald 1976). This phenomenon, known as McGurk effect, is universal.

In 2004, Williams et al. showed that ASD subjects (n = 15, m.a. = 8,81; vs TD n = 15, m. a. = 9.5) did not suffer the McGurk effect, but experimenters link these differences not to an absence of integration, but to their poor visual accuracy, measured in the experiment by a speech-reading task, whose participants' accuracy in its performance correlated with participants' performance in the British Picture Vocabulary Scale.[19]

Bebko et al. (2006) compared the reactions of three groups of children (ASD n = 16, m. a. = 5.49; DD[20] n = 15, m. a. = 4.88; TD n = 16, m. a. = 2.36) in contemporary exposure to two screens, one with correct audio-video synchrony and the other with a 3-s delay between audio and visual stimuli during three situations: non-linguistic event; simple linguistic event and complex linguistic event. While the TD group showed greater preference for synchronized inputs, the ASD group showed this preference only in

[19] Dunn et al. 1997. A linguistic measure of autistic symptoms
[20] Developmental disorders

the non-linguistic conditions. The DD group manifested a preference for synchronized input in non-linguistic and simple linguistic input, and borderline preference for complex linguistic input. Experimenters proposed two possible interpretations of the ASD group's results: either ASD subjects do not perceive synchrony in linguistic stimulus, or they are slow to detect these kinds of violations and the trial is too short.

Smith & Benedetto (2007) replicated these results with a more ecological procedure in which participants (18 ASD, m.a=15.84 years *vs* 19 TD m.a.= 16.08 years) report captured words in the three conditions (visual, auditory and audio-visual). Results confirmed autistic audio-visual impairment, autistic deficit in lip reading and the exclusiveness of TD in improved comprehension of speech in noise with the addition of visual information.

Iarocci et al. (2010) replicated the experiment with a sample of 12 children with ASD and 12 TD children (ASD m. a. = 10.58; TD m. a.= 10.31) using photorealistic images of the mouth and nose region of a male face, and found—in line with Smith and Bennetto (2007) and Williams et al. (2004)—that the ASD group performed worse in visual-only conditions.

Megnin et al. (2012) presented monosyllabic spoken words in five conditions (auditory only with face; visual only with face; audio-visual with face; visual only with scrambled face; audio-visual with scrambled face) to 14 TD and 14 ASD (both mean 16.9 years of age) and ask them to detect a target while experimenters registered their ERP (they focused on three consecutive stages: word detection, so N1; transition from phonetic to lexical-semantic analysis, so P2 and semantic integration, so N4). Based on their data, experimenters inferred that neural networks that in elaborating spoken words are normally facilitated by visual features, are altered in ASD sub-

jects. In particular, amplitude of N1 and N4 were attenuated in ASD samples during audio-visual effects[21] and the amplitude of P2 negatively correlated with scores on the Social Communication Questionnaire (Rutter et al. 2003).

Thus differences in cognitive processing of the phase of translation from phonetic to a lexical-semantic analysis are related to autistic symptoms.

I will come back to lip reading in the next chapter, when I will discuss this data in light of data on autistic perception of salience.

At the moment, I just ask the reader to consider that, during language acquisition and in adult age, subjects with autism show anomalies in perceiving lip reading; these anomalies are unbiased, so we cannot build a model of development of lip reading in subjects with ASD. I choose to put this paragraph between the two that discuss language before and after the diagnosis because I would like to encourage the reader to consider that these anomalies, despite not being studied in children LDA, are probably present before the diagnosis.

§4.4 Language after the diagnosis

Usually the age of five years old is considered determinant to predict the prognosis of linguistic alterations in subjects with ASD (Rapin and Dunn 1997).

In principle, almost all children with ASD, also those that finally reach a good development of language, show delay in the acquisition of language.

[21] Effect of seeing lip movements accompanying speech

Clara Claiborne Park says that Elly, at 34 months of age was suddenly able to incorporate in her reduced vocabulary the word "scissors": "but we started to become aware that she forgot those previously learned" (Claiborne Park 1967:29). However "for her fifth birthday, Elly started to develop a communicative speech" (*ibid.*, p. 169).

Tony Charman et al. (2003) analysed the linguistic profile (MCDI-WG) of 134 children with ASD of 3 years of age and with an NV-IQ of about 83.2 (*Leiter International Perfomance Scale*, 1952), and after they confronted this data with those previously existent in literature on TD subjects. They found that all children with ASD showed delay in language: 50% of the sample doesn't show primary signs of linguistic comprehension (i.e. answer to own name or imitate some words), usually present in 1-year-old TD children. These signs started to be manifest at 2 years and half of mental (but not necessary verbal) age. Also the production of words was affected: half of the sample produced non-recognized words. But the delay was not relative to the proportion of names, verbs and predicates (that was analogous to TD children) (this last data is confirmed also by Swensen et al. 2007), the delay affected some specific semantic categories: sound effects, animals and toys. The production of phrases presented a delay greater than the production of words.

Also the acquisition of pre-linguistic gestures was altered: gestures usually more difficult to be learnt such as the correct use of object, were easily acquired; on the contrary, communicative gestures of daily life were delayed (Charman et al. 2003).

Phonological development of subjects with ASD is analogous to that of TD subjects (McCleery et al. 2006).

Sigman and McGovern (2005) did a longitudinal study on the increment of language in subjects with ASD in following ages:

- 3-11 years (Reynell Scales of Language Ability (RSLA) (Reynell and Curwell 1977; Sigman and Ruskin 1999)
- 12-18 years (RSLA and CELF-R) (Semel et al. 187)
- 19 years (CELF-R: RSLA and MSEL).

In this way, they found that at about 4 years of age language increases as for 24 months; during the adolescence as for 12 months. On the contrary, non-linguistic communication doesn't increase after 4 years of age; in such cases it decreases.

From these data, experimenters infer that the school age is critical for the acquisition of language in subjects with ASD.

§4.5 Relationship between pre-linguistic correlates, language and pragmatic deficits

In 2008, Luyster et al. studied the relationship between the initiative to require join attention (IJA), the tendency to accept to receive join attention (RJA) and the development of language. They found that between IJA and language there were no correlations; on the contrary, high level of RJA was predictive of a good level of linguistic comprehension and use of communicative gestures such as pointing. Unfortunately the ontology of this link is a mystery for science: the ability to joint attention with others is necessary to the acquisition of language or, on the contrary, our linguistic nature predisposes us to joint attention with other? Can we hypothesize the existence of other elements that link language and joint attention? I will support this last idea in this paragraph.

As we have just seen, joint attention doesn't improve after 12-13 years of age in subjects not intensively treated; on the contrary, language weakly improves (Sigman and McGovern 2005).

Effectively, the relationship between joint attention and language seems to depend on age. A recent study shows that in 12 months LDA children there is no correlation between language and joint attention; however in the same subjects, at 18 months of age there seems to be a partial association between RJA and language (Gillespie-Lynch et al. 2013).

While not all subjects with ASD show linguistic deficit in strict sense, all of them show pragmatic deficits (Luyster et al. 2008). But it seems that there is no correlation between deficit in joint attention and pragmatic anomalies (Gillespie-Lynch et al. 2015).

So, to sum up, subjects with autism:

- show different levels of linguistic impairments;
- linguistic impairments, in relation to age, seem to be related to RJA;
- all of them show pragmatic deficits.

Also this trend will be discussed in next chapter, in relation to the question of perception of environmental saliences.

Let's consider now, how to interpret all anomalies analysed until now.

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Chatper 5

Relationship between pragmatic deficits and perceptual salience of stimuli in subjects with autism

§5.0 Introduction to the chapter

Until now I described and analysed some of the linguistic anomalies showed by subjects with ASD. Sometimes I did some reference to micro-theories to explain small phenomena such as difficulties in interpretation of emotional prosody (§4.4.2), but I have avoided speaking about general theories of autism.

The focus of this thesis is not to explain autism. My focus is on language; I investigated linguistic alterations of subjects with ASD in order to understand what is mainly affected in a non-social cognition such as that autistic. This study led me to reflect on how much the human brain is social in nature.

The first and most disconcerting assumption that I caught, and the last one that I will discuss in the rest of the thesis, is that perception is a social cognitive processes. Perception is more social than we usually think. Human understanding is born from certain kinds of perception. I'm not referring to high cognitive levels of perception, but very basic levels of perception. I think that, from an ontogenetic point of view, the alteration of communicative attitudes in subjects with autism, starts with alterations in the catching of perceptive salience. In this chapter I will analytically develop this thesis.

In §5.1 I will present some of the most important theories developed to explain linguistic or cognitive anomalies in subjects with autism. In §5.1.1 I will describe the hypothesis of a semantic deficit; in §5.1.2 that of pragmatic deficit; in §5.1.2 I will describe the relationships between deficits in pragmatics and semantics and deficits in central coherence; in §5.1.4 I will discuss the classical ToM and in §5.1.5 the Extreme Male Brain Theory. Starting from §5.2 I will present my thesis. In §5.2 I will support that inferential processes are fully part of perception; I will do it through the comparison between the Direct Social Perception Model (§5.2.1) and the Predictive Model (§5.2.2). In §5.3 I will present the hypothesis of alteration in interoceptive inferential processes, specifically I will analyse the concept of "interoceptive inference" (§5.3.1) and after I will describe its alterations in subjects with autism (§5.3.2). In §5.4 I will briefly describe the starting of perception in TD subjects and in §5.5 and §5.6 I will highlight the role of emotional prosody in this process. In §5.7 I will analyse the development of prosody before the diagnosis of autism. In §5.8 I will hypothesise that, if my hypothesis is plausible, prosody, in the first days of life, would be lateralized in the right hemisphere. At this point, I will briefly stop to expose my thesis on autism to describe the scientific approach to the question of development of linguistic cerebral networks that I consider more reliable among those existent at the state of the art (§5.9). I will not examine the others because this is not the gist of the thesis and the question is complex, but I will discuss the question of limitations of the use of brain imaging data (§5.9.1); I will briefly describe the two-ways hypothesis regarding linguistic cerebral networks in adults (§5.9.2) and—after due caution—I will describe a little part (the part that is interesting for my thesis) of the neurological develop-

ment of language (§5.9.3). In doing so, I found data coherent, although not probative, with my thesis. In §5.10 I will better explain what I mean with deficit in detecting perceptual salience; in §5.11 I will describe some important studies on the alterations of salience network in adolescents with autism. In §5.12 I will link the concept of interoceptive inference to problems in the acquisition of language. Finally in §5.14 I will discuss the alteration in interoceptive inference with that in perception.

§5.1 Hypothesis on the origin of linguistic deficits in subjects with autism

As I have shown, linguistic data are often inconsistent. So it's very difficult to find a theory able to catch all of them. In this paragraph I will show some of theories that had a greater impact on medical and philosophical debate on the pathology.

§5.1.1 The semantic-deficit hypothesis

One of first theories regarding the linguistic alterations of autism was that of the semantic deficit. At the beginning, Tager-Flusberg considered plausible that the inability to use semantic information to learn syntax rules could be at the origin of the autistic delay in language (Tager-Flusberg 1986b).

The theoretical presupposition of this theory was that grammar develops after that the child start to understand the systematic relationship between words and syntactic forms. This theory was opposed to the chomskian idea of the innate acquisition of grammar. According to Tager-Flusberg, in fact, this theory doesn't explain why also subjects with ASD without

mental retardation have cognitive delay (*ivi*). So, according to this model, the ontogenetic development of language can be represented as follow:

Figure 16

This theory was mainly based on three kinds of data:

- the recently discovered importance of prosody for word segmentation (Gleitman and Wanner 1982);
- Prizant's idea that the autistic approach to language is not analytic, subjects with autism lack—according this old theory—a gestalt in considering language (Prizant 1982)
- The acquisition of *past tense* and of *present*, for which TD children use semantic cues, is difficult for subjects with ASD (Howlin 1984; Pierce and Streiner 1980).

After considering this hypothesis, it was the same Helen Tager Flusberg who refused this thesis. In fact, as we saw in the first chapter, it is evident that subjects with ASD are able to link words with content. The problem is that this linking is inflexible. However, in this case, it is more appro-

priate to consider the linguistic anomalies in subjects with ASD as directly derived from pragmatics.

§5.1.2 The hypothesis of pragmatic deficit

Tager-Flusberg contemporarily considered both semantic and pragmatic deficits. In the eighties, the theory with major impact to a general explanation of autism was that of Simon Baron Cohen regarding a deficit in ToM. In this context, the theory of a deficit in pragmatics was perfectly in line with the general ideas on autism.

Let's consider the classical distinction between protoimperative gestures and protodeclarative ones. Protoimperative gestures are those through which children ask for help; on the contrary, protodeclarive gestures are those through which children ask to share attention on something, just for the pleasure of sharing. The presence of protoimperative gestures and the absence of protodeclarative gestures were considered from Tager-Flusberg the first sign of pragmatic deficit in subjects with ASD (Tager-Flusberg 1996).

Tager-Flusberg still contrasted Chomsky's idea of an innate acquisition of grammar and she tried to explain the autistic delay in the acquisition of language considering as primary the deficit in ToM. Specifically she supposed that the difference between the autistic cognition and the normal one was linked to the aetiology of acquisition of words: if TD subjects acquire words through social sharing of meanings, subjects with ASD learn words after physical exposition to objects of reference (*ibid*).

Unfortunately, although ToM catch a strong trend of the autistic population, it cannot be considered a diagnostic marker of the pathology; in fact:

- Some children with ASD have performance analogous to TD children in the false belief task (Charman 2000);
- Also congenitally blind children (Hobson and Bishop 2003) or late deaf signers without ASD show deficits in ToM;
- Early signs of autism are detectable even at 18 months of age, but the development of ToM is usually supposed at 4 years of age.

Also at a linguistic level, the limits of ToM are evident. Let's consider, for example, the dialogue between George and the experimenter that we spoke of in §3.5.2. If the problem of autistic cognition is simply related to George's inability to understand the experimenters' prompt in the use of present, we would expect that George might not use the present, but he will use a temporal perspective; but George didn't fix a temporal perspective. He used a lot of different temporal perspectives. So the deficit in ToM explains why the prompts of the researcher were useless, but doesn't explain why George didn't adopt a single temporal perspective.

So, linguistic alterations of subjects with autism are pragmatic in nature, but we still need to explain why pragmatics is lacking in the autistic cognition. Probably, the deficits in ToM are a consequence and not a cause of these anomalies.

§5.1.3 Pragmatics, semantics and central coherence

The study of Tager Flusberg and Joseph (2003) was used against the explanatory totalitarianism of ToM (Siegal and Blades 2003; Noens and van Berckelaer-Onnes 2005). Effectively, also regarding the explanation of linguistic deficits in subjects with ASD, the theory of a deficit in ToM explain

pragmatic anomalies, but it doesn't explain semantic anomalies or syntactic and phonological delay (Noens and van Berckelaer-Onnes 2005).

One of the most important essays to separate linguistic deficits from social ones was made by Utha Frith (2002) with her Central Coherence Theory (CCT). At a general level, this theory poses that normal cognition used to organize according to a gestalt of the mental flow of stimuli; the autistic cognition, on the contrary tends to concentrate the attention exclusively on some details, lacking—in this way—the general coherence of the scene (Frith 2008). At a linguistic level, this theory posed that subjects with ASD tend to be focused on single words than on the general sense of the communicative interaction (*ibid.*, p. 90).

This theory is often based on Bates's (1979) theory of the ontological acquisition of language, according to which there are two phases of the development of language: the development of communicative intention; and the emerging of symbols.

According to this hypothesis, at 9 months of age, the baby cries in response to an interoceptive stimuli; after protoimperative and protodeclarative signals start. So the intentional communication is a "signaling behavior in which the sender is aware a priori of the effect that a signal will have on his listener, and he persists in that behavior until the effect is obtained or failure is clearly indicated". (Bates 1979:36)

The second phase is the symbolic one and it starts from 13 months; in the meantime the child discovers the names of words (*ibid*).

For example, Lisa Travis and Marian Sigman, in 2001 noted that in children with ASD the ability to follow an object (except for others' eyes) with their eyes develops before than TD children. So it seems that this skill

is acquired without a link to communicative needs. So, according to CCT, it is not the ability to follow an object with one's eyes which is impaired in autism, but that of following an object (also others' eyes) in a dynamic, interactive, communicative general context.

If interpreted in this direction, previous studies could be considered coherent with this perspective (Bryson and McCormick 1990; Joliffe and Baron Cohen 1999; Frith and Snowling 1983; Noens and Barcklaer-Onnes 2005).

For instance, Joliffe and Baron Cohen published two experiments based on the ability to correctly read homographs and found it difficult for subjects with ASD and with AS to integrate words in the context.

The CCT explains a trend of the autistic population, but it doesn't explain why the autistic cognition shows this trend. Moreover, it is true that often for subjects with autism details are very salient; other times they perceive the entire scene in a way that is impossible for TD people, as shown, e.g., by Stephen Wiltshire's drawings.

So, maybe, it's more appropriate to consider general alterations of gestaltic biases than higher perception of details. It's on the alterations of perceptual biases that we will work for explaining linguistic alterations.

§5.2 Is inferential processing part of perception?

Now I will start to show my idea regarding the linking between pragmatic and linguistic deficits in subjects with autism. I think that abnomalies in prelinguistic communication and in language shared a problem that starts from perception. To develop my thesis, I need to describe the difference between the Predictive Model of Perception and the Direct Social Perception

Model. As we will see, the main difference between the two is that the first excludes and second includes inferential processes in perception. Actually none of the two have been finally validated or invalidated, but the second is perfectly in line with my thesis: perception is integral part of pragmatic studies.

§5.2.1 Direct Social Perception Model

According to Gallagher (2008), perception is "direct and smart". The meaning of *direct perception* is that it doesn't need an added inference or interpretation:

> *If I directly see my car I do not ordinarily have to make an inference on the basis of what I see that it is my car. Of course, there may be a case in which I would have to make such an inference. For example, if my car was terribly totaled in an accident, I may not recognize it at first and I may have to use certain clues about its appearance to infer that it is my car. (Gallagher 2008:537).*

Something similar happens—according to Gallagher—in social perception; most part of our social interactions are mediated by embodied mechanisms, we don't make inferences about all others' hidden mental states: "for the most part, in most of our encounters in everyday life, direct perception delivers sufficient information for understanding others" (*ibid.,* p. 540).

To understand Gallagher's meaning of *smart perception*, we will cite his example of distinction about *non-smart* and *smart perception*:

> *I open my eyes and I see a certain unrecognized red mass with a specific shape just in front of me. My eyes are working fine, thank you. My visual cortex is processing all of the preliminary visual information, and what vision delivers is the mean-*

> *ingless red mass, which I then have to interpret in some non-visual, non-perceptual cognitive steps that go beyond perception itself. Let us call this a not-so-smart perception. In contrast, in the very same situation, when I open my eyes I see my car. It is true that it has a specific shape and is red, and I do see the shape and the color, but I see the shape and color as being aspects of something that is amazingly recognizable as my car. Actually, if you ask me what I see, I would likely not say that I see a red and shapely mass. Somehow I see through those aspects and I see my car. I do not see red mass, shape, and color, and then try to piece all of that together to make it add up to my car. I simply and directly see my car. So let us call this a perception with some degree of smarts* (*ibid.*).

The concept of *car* is what differentiates between its *non-smart* and its *smart perception*. But the philosopher underlines that, even if concepts become integrative part of perceptual processing, they are not strictly necessary: in fact, new-borns have the capability of distinguishing between their mother's voice and another; to distinguish faces from others stimuli; etc…

Also the integration of previous experiences and emotions are part of the perception processes.

So, in Gallagher's model, inferential processing is the line beyond which we can no longer speak about perception.

§5.2.2 Predictive Model

In predictive model (Palmer et al. 2015) we can discern between lower-level perception and higher-level perception. Regarding that, Gallagher recognized, obviously, different levels and pathways for the elaboration of inputs; however, according to him, "that is a problem for the neuroscientist; not for the perceiver" (Gallagher 2008:537). The predictive model provides the existence of a prediction system that, in gathering information from both levels of perception, predicts a draft of the output and gradually integrates all data in it. The difference between the two levels of perception is in amplitude of space-temporal scales:

> *Predictive processing thus provides a different picture of inference than that which Gallagher discerns in theory-theory and simulation theory. Specifically, the extra-neural causes of sensory activity are represented in a hierarchical manner, with higher levels more divorced from the present sensory input, reflecting their association with causes operating over larger spatiotemporal scales. The relationship between mental states and observed behaviour is thus comparable to the relationship between local and global perceptual features, or causes that modulate input over shorter and longer timescales. Moreover, this relationship is bidirectional. The inference of a particular mental state entails predictions about lower level representations, potentially shaping lower level perception; conversely, prediction errors update mental state representations to better account for lower-level features. Thus, lower-level perceptual features are not merely the evidence that inference is conditioned on, in order to produce a mental state representation, but rather, mental state representations and lower-level representations are each adjusted in interaction with one another to minimise prediction error over time (Palmer et al. 2015:5).*

Both models provide a role of perceptual features in inferences about others' mental states. But, the strongest advantage of the predictive model is about the influence that higher-level perception could have on lower-level perception. The prediction system, that tends to progressively minimize estimation errors, is bidirectional: in Gallagher's model the output is given by the physical characteristic of the input and from the set of data added by working memory, experience and emotions; in the predictive model the output derives from physical features of the input, the general knowledge of the world (a space-temporal scale wider than that of the lower-level perception) and from the effect that the latter could have on lower-level perception processing.

The predictive model was variously formulated in the history of neuroscience; a recent version was proposed by Quattrocki and Friston (2014) and supposed a role of the oxytocin system in the prediction error system. According to authors, a deficit in this system could cause an incapability to attenuate interoceptive signals, with a consequent incapability to distinguish

them from exteroceptive signals and then a deficit in the correct attribution of salience in socially relevant stimuli. Because it has been showed some deficit in the oxytocin system in subjects with ASD, this theoretical model could explain the autistic incapability to infer others' mental states.

Elisabeth Pellicano and David Burr (2012; Pellicano 2013) posed that the greater part of autistic symptoms could be linked to alteration in the predictive system. According to these researchers, TD subjects build some *priors* that are cognitive models of perception on probabilistic base. In Pellicano and Burr's hypothesis *priors* in autism are weaker. I will come back to this idea in §6.1.

§5.2.3 Practical differences between the two models

We have no reason to think that one of two models is more functional than the other; we can just try to evaluate if one is more realistic than the other. If both accept the *smartness* of perception, just the predictive model provides the possibility that the integration with the context could influence the lower level of perception and that this new lower level perception could, in turn, influence the general output. In other words, the strongest difference between the two models is the integration of inferential reasoning in perception. In the last years some studies are investigating the hypothesis of a damage in perceptual inferences to explain some characteristics of autistic perception (Pellicano and Burr 2012; Skewes et al. 2014).

§5.3 The hypothesis of interoceptive inference

Now I will try to show how my thesis could work at a cognitive level. My idea is that pragmatic and linguistic anomalies in subjects with autism could be explained supposing an inability to synchronize environmental sa-

liency with those of others. Now I will show that this problem is not a deficit in the general inferential abilities, but that its collocation is at the level of acquisition of stimuli that comes from own body. I will suppose that interoceptive feelings are integrated with anomalies in the perceptual inference in subjects with autism. This phenomenon, in turn, generates an alteration also in exteroceptive biases.

In §5.3.1 I will describe the concept of interoceptive inference and in §5.3.2 I will describe anomalies on the interoceptive system in subjects with autism.

§5.3.1 The concept of interoceptive inference

The sensory world is very uncertain, but the perceptions that we have about it are generally certain from a psychological point of view. This *gap* induced some theorists of perception to suppose that the brain, when working, must use perceptive inferences. For example, according to the *Bayesian coding hypothesis*, when for instance the subject is in front of a table and is trying to perceive its depth, his brain calculates all possible depths of the table and all relative probabilities for each value calculated by the sensory data available. In a more general perception of a whole scene, the subject will unconsciously calculate all possibilities of perception for each salient object (i.e., in the case of a table it will calculate all possible depths, all possible colors, all possible lengths) and all relative probabilities for each value of each characteristic of the objects in the scene. All these data will create a predictive model of perception (Knill e Pouget 2004).

In 2015, Ondobaka et al. highlighted that the recent views that use the predictive models of perception to explain Theory of Mind (ToM) left the role of interoception unclear. For this reason they speak about *interoceptive*

inference and attribute to it an important role in ToM. According to these authors "interoception or interoceptive inference can be viewed as a generalisation of active inference to the processing of interoceptive signals carrying information about visceral states (e.g, heart rate, blood pressure, temperature)" (Ondobaka et al. 2015:2). An inference is *active* when the agent actively stimulates its sensors in order to generate the sensorial consequences that the brain expects relative to the situation (Clark 2013). To better understand the concept of *interoceptive inference* it is necessary to consider the supposed tendency of the brain (by homeostasis and allostasis) to maintain internal states relatively constant over time (Ondobaka et al. 2015). Thus, we can consider an *interoceptive inference* like a predictive model of visceral states previously oriented to the balance of internal bodily states, which biases perception toward satisfying an organism's biological needs.

According to recent studies on ToM, interoceptive inference should work like exteroceptive and proprioceptive inference: e.g., to understand others' intentions from their movements, we virtually simulate the same movement. The problem posed by Ondobaka et al. (2015) is that, if exteroceptive and proprioceptive inferences can clearly use sensory input that are unavailable in relation to interoception (we cannot know our pupil dilatation or internal temperature), what data are used during the interoceptive inference? The answer proposed is that "the emotional and intentional theory of mind has to be learned through interpersonal interactions, probably at an early stage of development, in which attachments are made" (Ondobaka et al. 2015:4).

If the problem is well-posed, the solution—in our opinion—shows the failure of computational models. If Ondobaka et al. integrate the fundamen-

tal element of visceral states in models of perception, they are unable to explain how the interoceptive inference should work in a computational model of mind. It is not the aim of this work to determine what is missing in their model; but here I am interested in underlining that the interoceptive inference—in contrast to the proprioceptive and esteroceptive—is not a computation. As admitted by Ondobaka et al. "there may be something special about how we are particularly adept at inferring the drives and affiliative imperatives that contextualise interoception" (Ondobaka et AL. 2015:4).

§5.3.2 Interoceptive inference and autism

Since interpersonal relationships are the most critical area in autistic disorders, we may suppose that a predictive model of autistic cognition will show a deficit in interoceptive inference. Results from social robotics partially confirm this supposition. In fact, interaction with social robots does not require a ToM, so does not involve the interoceptive inference.

It is plausible to suppose that a deficit in interoceptive inference, due to its fundamental role during ontogenesis, will cause a deficit in esteroceptive and proprioceptive inferential abilities. In fact, without interoceptive inferential abilities, interpersonal relationships will become mere computations of perceptions, insensitive to the organism's biological needs. And this will change the gestaltic rules of perception, at least for the interactions with other living beings.

Let’s come back to consider the case of lip reading: the delay in language development typical of subjects with ASD could be partly linked to their difficulties in interpreting the biological motions of the mouth. Herrington et al. (2012) showed that attention to human goals activates biological motion areas. Thus, if in order to carry out ToM inferences one needs in-

tact interoceptive inferential abilities and if the activation of cerebral areas involved in the interpretation of the biological motion is linked to ToM inferences, we can infer that in order to interpret a movement as biological motion one needs an intact ability to carry out interoceptive inferences. Our hypothesis is that linguistic deficits related to ASD are a consequence of these deficits in processes that mediate silent intersubjective communication[22].

In light of this hypothesis, how do we explain the apparent improvement in linguistic behaviours in the presence of social robots?

None or very few interoceptive inferences are involved in interaction with social robots since we do not attribute a ToM to them. On the contrary, in order to be integrated in the scene, lip reading is required to be seen as biological motion. If the very fine movements of lips are not integrated in a meaningful context, they risk becoming merely a distractor; all of us have experienced, at least once in our life, that feeling of discomfort and distraction watching a movie where the voice was not well-integrated and synchronized with the video. In our opinion, this sensation is in part responsible for autistic inattention during verbal interaction.

Maybe in ecological interactions, lip reading could be a distractor for subjects with ASD.

Magne et al. (2011) showed in an ERP study that subjects with autism are able to perform multisensory integration, but only during easy selective attention; on the contrary, TD subjects can also easily maintain multisensory integration during tasks that require divided attention. Similarly, Grossman et al. (2009) showed that adolescents with ASD can perform multisensory

[22] For other related works see Pennisi, P. 2014; Carrozza et al. 2015; Pennisi 2016

integration in tasks constructed with meaningful stimuli and performed in non-distracting environments.

Both these studies show that distraction is an enemy of the audio-visual integration for subjects with ASD. Thus, a subject with autism who does not integrate lip reading in the understanding of the language message is not focused on the latter. At this point the question is: what is an autistic subject doing when looking at a mouth during a verbal interaction? Maybe it is simply not focusing on the interaction. The absence of an interoception by which to build a perceptive gestalt that makes salient biological stimuli push him to perceive a stimulus (the mouth) that is not the most salient for ToM, but is so for the classic rules of perception: the mouth is the stimulus that moves the most.

I hypothesized in Pennisi (2015) that interoceptive inferences aid in integrating various external stimuli towards a joint interpretation of reality with other conspecifics. In light of this theory, I have attempted to explain the lip reading deficit, fixation on the mouth during linguistic interactions, and the negative correlation between fixation on mouths and social abilities

To summarize, I supposed the presence of a deficit in interoceptive inferences in subjects with ASD, which causees their social problems from which are derived their linguistic problems. Cerebral correlates of the deficit in interoceptive inferences are localized in the reward system (deficient toward social motivation in subjects with ASD; Chevallier et al. 2012) and—as we will see—in the salience network (Uddin and Menon 2009; Carrozza et al. 105; Pennisi 2016).

I think that autistic anomalies in lip reading are linked to the inability of subjects with ASD in considering the lips' movement as a biological motion, as do TD subjects.

§5.4 When the world becomes perceived

Long before our birth, we start to respond to some differences in environmental inputs. Specifically, for example, between the 21st and the 33rd week of gestation the heartbeat of the foetus increases in response to mother's voice and decreases in response to other women's voices (Kisilevsky et al. 2003). In the same period, the foetus moves with greater vehemence to the touch of the belly (Marx and Nagy 2015).

Between the 33rd and the 41st week of gestation, the heartbeat of the foetus is peculiar in response to the mother's voice, but not to other women's voices or to father's voice (Kisilevsky et al. 2009).

At the 36th week of gestation the foetus is able to distinguish between a voice coming from a loudspeaker placed on the belly and a real voice (Hepper et al. 1993).

When a baby born, it is immediately able to recognize the mother's smell (Porter and Winberg 1999); some minutes after, it prefers stimuli similar to human faces than others (Goren et al. 1975; Maurer and Young 1983; Johnson et al. 1991; Simion et al. 1998; Valenza et al. 1996). It is immediately more responsive to linguistic sounds than to non-linguistic sounds (Cheng et al. 2012; Ecklund-Flores and Turkewitz 1996; Hutt et al. 1968). Moreover, it is sensible to emotional prosody regardless his sex (Cheng et al. 2012).

From 12 to 72 hours of life it answers to highly salient vocalizations in his mother tongue (and not other languages) by opening his eyes more (Mastropieri and Turkewitz 1999). Moreover, it will perceive sounds in his mother tongue more quickly than in others (Moon et al. 2010).

From 1 to 3 days of life it learns to distinguish his own cry from that of other babies (Dondi et al. 1999; Martin and Clarck 1982). From 2 to 4 days of life it starts to react differently to normal voices or the motherese of his mother (Hepper et al. 1993). From 2 to 5 days of life it starts to segment sound distinguishing between high and low sounds (Winker et al. 2003). At 45 hours it can distinguish his mother's face (Field et al. 1984).

At 2 months of age it starts to phonemically discriminate sounds (Friedrich et al. 2004). At 4 months of age he is more attracted by his name than by other names (Mandel et al. 1995). Starting from 6 months, it starts to use simple words such as *mum* or *dad* to learn the segmentation of other words (Bortfeld et al. 2005). At 7 months and a half it starts to segment monosyllables during fluent speech of adults (Jusczyk and Aslin 1995); but, until 9 months this skill is linked to the regularity of the stimulus; that is the coherence of the stimulus with the mother tongue of the baby (Mattys and Jusczyk 2001). At 10 months and a half the baby is able to phonologically segment two-syllables words both if they have a regular phonological scheme and if they have an irregular phonological scheme (Jusczyk et al. 1999). At 12–14 months the baby starts his first semantic discriminations (Friederici 2005; Dahene-Lambertz et al. 2002).

So, the foetus starts to perceive two essentials inputs: the mother's heartbeat and her voice. Starting from these two, it starts to build segmentations in the flow of inputs. As inputs are more familiar, segmentation of

stimuli will be easier. But a stimulus, to become familiar, it needs to be accompanied by other familiar ones for the starting of segmentation.

§5.5 The role of emotional prosody in newborns

In this perspective, the emotional component of prosody probably can have an important role as primary tool for the decoding of linguistic messages.

At the end of the eighties, a lot of studies on *baby talk* started to be published. According to the anthropologist Dean Falk, *baby talk* or *motherese*, that is "the special singsong way adults talk to infants […] [that] encompasses facial expressions, body language, touching, patting, caressing, and even laughter and tickling" (Falk 2009: 72–73), would help children in the acquisition of language.

According to Falk, at the beginning *baby talk* "initially conveys meaning that is emotional rather than linguistic" (*ibid.,* p. 73). The emotional role of motherese seems to be confirmed from classical experimental studies (Fernald 1991; Papousek 1992; Singh et al. 2002; Trainor et al. 2000; for a synthesis cfr. Santesso et al. 2007). However, a mother—without being aware of this—would emphasize some components of words and of the speech and "because of motherese, newborns discover more easily how to divide speech into words and clauses long before they learn their meanings" (Falk 2009:76).

In a certain sense, the mother connotes with a different salience some elements of the flow of sounds. This will be a starting point for the phonic segmentation of the flow. As the child grows, the mother and the other

members will adjust the motherese to new requirements until the moment arrives to stop using it.

Effectively, motherese often tends to exaggerate some sequential structures of the phrase (Fernald and Mazzie 1991; Nelson et al. 1989) and the way in which children classify linguistic sounds is, at the beginning, linked to rhythmic information (Nazzi et al. 1998). Not just theoretical approaches, but also experimental ones seem to show that prosodic signals of *baby talk* can increase cerebral answers to meaningful words (Zangl and Mills 2007).

In Falk's argumentation, there are three of what are probably the most interesting scientific argumentations.

The first is the adult behaviour: transculturally, adults tend to use motherese with children from 0 to 3 years old, with a specific emphasis between 3 and 5 months of life (Stern et al. 1983). This use of the motherese is often directed also to pets. Recently, moreover, a correlation was found between levels of oxytocin in plasma of parents after the birth of a baby and their tendency in the use of *baby talk* (Gordon et al. 2010). Also signer mothers use motherese (Masataka 1996).

Secondly, mothers tend to always emphasize the same components of speech with motherese: e.g., English, Japanese, American, Russian and Swedish mothers emphasize vowels during motherese if they speak with babies, but not if they speak with pets (Burnham et al. 2002; Andruski et al. 1999; Kuhl et al. 1997). Other studies show cultural differences in the objects of references of markings (Cheng 2014). Gogate et al. (2015), for example, showed a lot of differences between American and Indian mothers in what and when baby talk was used. More recent studies are focused on lin-

guistic adaptations of adults in relation to linguistic skills of children (Zellou and Scarborough 2015).

Children that at 7 months are more able to discriminate linguistic sounds will have better performance in tasks of semantic discrimination for the rest of their life (Tsao et al. 2004).

Baby talk was found in a lot of cultures (Papusek et al. 1991; Werker et al. 1994, for a synthesis cfr. Falk 2009). However, the thesis of Diane Falk was criticized by Elonor Ochs, according to which Western Samona, Kaluli New Guinea and black working class American children are not exposed to motherese (Ochs 1992). But Falk contested this observations showing that in reality also these children are exposed to forms of *baby talk*, although different from other, more evident forms.

Regardless of transcultural differences, the existence of acoustic parameters specific to motherese was the object of numerous studies started in the sixties. A systematic review of baby talk that consider studies published between 1966 and 2011 identifies, as common acoustic features of motherese, the presence of long pauses, a major dilatation of rhythmical times, a higher number of prosodic repetitions and higher values of $F_{(0)}$. At level of contents, on the contrary, the same study revealed a simplified language, the use of redundant utterances, an increased use of words and sentences out of context, proper names and questions (Saint-Georges et al. 2013). These features seem to make the *baby talk* clearer than normal language (Burnham et al. 2013).

Although specific characteristics of *baby talk* are still in the course of definition, recent data seems to indicate the theoretical possibility to conceive an acoustical base common to all cultures in the expression and rec-

ognizing of emotions (Bryant and Barrett 2008; Sauter et al. 2010) and to intentions (Bryant and Barrett 2007).

However, Falk's idea seems to extend the concept of motherese to something more vague and multimodal: it can be considered a pragmatic form easier to interpret that adapts it to the culture of reference: "If it is considered impolite to make direct eye contact, then that taboo likely will be incorporated into motherese" (Falk 2009:93).

§5.6 Normal children and the motherese

Motherese has, for human beings, an attractive power stronger than normal speech (Saint-Georges et al. 2013; Santesso et al. 2007; Kaplan et al. 1995; Werker and McLeod 1989) or other sounds (Chang and Thompson 2011). This phenomenon is more accentuated in smaller children (Werker and McLeod 1989). Infants of 40–70 days of age answer to *baby talk* vocalizations of their mothers; moreover, their vocalizations are correlated in fundamental frequency to those of mothers (Shimura and Yamanoucho 1992). Experimenters think that motherese increases the arousal for the associative learning (Saint-Georges et al. 2013).

Baby talk changes as the baby grows (Saint-Georges et al. 2013). Naturally, in last months of the first year of life, children start to prefer shorter vocalic sounds more in line with the speech of adults (Kitamura and Notley 2009). Matsuda et al. (2014) tried to show a correlation between the activation of a specific area (the right caudate nucleus) and the flexibility of mothers in adapting their motherese to needs of their baby (Matsuda et al. 2014). In §5.9.1 I will show the methodological limits of this kind of studies.

Behavioural studies show that infants of 4 months of age observe for a longer time a stimulus to which is associated a linguistic stimulus produced by the *baby talk* than a stimulus produced by normal speech (Kaplan et al. 1995). Infants of 5 months of age seem to more easily answer to emotions expressed by the *baby talk* than with normal linguistic stimuli (Fernald 1993). Also while sleeping, children are more responsive to motherese than to normal speech (Saito et al. 2007).

Signer mothers slow their speech while using motherese as TD mothers and children both with typical development and deaf react increasing their attention while mothers slow their signs (Masataka 1998).

Children of 9 months of age slow their heartbeat while perceiving motherese (this is considered a signal of increased attention) (Santessio et al. 2007).

But is the motherese helpful for the learning of language or is it just a sort of emotional prosthesis?

A digital model of learning showed that motherese makes the learning of vowels rather than normal speech clearer (De Boer and Kuhl 2003).

A more recent study shows that newborns (33 hours of life) with older siblings (the difference of age were in all cases inferior or equal to 4 years, so that the first child was exposed to the motherese of mothers during the pregnancy of the second child) are more responsive to their language than to foreign languages more than children without siblings (Zhao et al. 2011).

To sum up, studies on motherese seem to show that:

> *results support the idea that prosodic and linguistic aspects of IDS play an important role in language acquisition. One possibility is that prosodic components play a major part in the very early stages of language acquisition and linguistic aspects play an increasingly important part later in development*

when children gain some verbal abilities (Saint-Georges et al. 2013:10).

§5.7 Prosody before autism

My idea is that pragmatics is what usually allows semantics and syntax to become well-developed. In cases of pragmatic alterations, semantics and syntax will be delayed, although not totally lost.

Subjects with ASD seem to have different reactions to emotional prosody (as we saw in §4.4.2). As showed by Janet Bang and Aparna Nadig, it seems that children with autism are exposed to the same quantity and quality of linguistic stimuli (Bang and Nadig 2015). So the problem is probably the reception of these stimuli.

Studies on LDA children are few in number. The few present were discussed in §4.4.2 and, in my opinion, are perfectly in line with my idea: prosody seems to be altered because the graphic of $F_{(0)}$ is less complex in LDA children than in TD children. Moreover, mothers seem to react to this behaviour through the shortening of motherese vocalizations: this could be index of unaware understanding of the level of the development of the baby.

In fact experimenters supposed that the low level of responsiveness of children would induce parents in diminishing communicative behaviours such as the repetition of children's name or peek-a-boo (Brisson et al. 2014).

Unfortunately, these studies are not just few in number, but also with very low numbers of participants, e.g., Brisson et al. (2014) had a sample of 13 LDA children and 13 TD children.

We need more data for our thesis.

§5.8 Neurobiology of prosody

After an analytical study of the scientific literature on the neurobiology of prosody, Silke Paulmann concludes that cerebral neurocorrelates of emotional prosody depends on: conditions external to the experimental task, the task, the quality of stimulus and the experimental design of the procedure. Or, in other words, studies on the neurobiology of prosody are inconclusive (Paulmann 2015). However, it seems that there is high agreement on the idea that prosody is probably lateralized in the right hemisphere (*ibid*).

§5.9 Ontogenetic development of linguistic networks

Do models of ontogenetic development of linguistic networks support my hypothesis?

I will show that through brain imaging data, it is impossible to demonstrate my thesis (§5.9.1) because of methodological reasons. But, in some of these studies is possible to find data that are coherent with my idea.

In adopting the Hickok's and Poeppel's model of linguistic networks (§5.9.2) (Hickok and Poeppel 2007; Hickok 2015), I will highlight that children at 3–7 months of age elaborate non-familiar linguistic stimuli with the right hemisphere and with the left hemisphere the voice of their mother. This is coherent with the idea that at the beginning, children start to analyse non-familiar stimuli by the emotive filter, and later they will start to systematize them through the left hemisphere.

§5.9.1 How to consider brain imaging data

Until now I analysed behavioural data in favour of my thesis. Now I will consider brain imaging data.

Brain imaging data are in fact subject to some biases that make them invalid for neuropsychological research. To use the words of William Uttal: "the ease and precision of defining a spatial location of a region in the brain contrasts starkly with the difficulty of defining even the simplest of psychological constructs" (Uttal 2001:16).

In a previous study, I and Francesco Parisi discussed an analogy between the function of brain imaging for cognitive psychology and that of the composite photograph for the physiognomic (Parisi and Pennisi 2015). Although the fascination of brain imaging is absolutely irresistible for those who dream of naturalising mental functions, we need to be careful with the interpretation of these data. However our attention must not lead us to abandon these precious data.

Most effective critics to brain imaging data can be summarized in the four points enucleated by Van Orden and Paap in 1997, and discussed by Uttal in 2001:

1. "one must begin with a 'true' theory of cognition's components" (Van Orden and Paap 1997:86);
2. one must "assume that corresponding functional and anatomical modules exist in the brain" (*ibid*);
3. "the brain must be composed of feed-forward modules to insure that the component of interest makes no qualitative changes 'upstream' on the shared components of experimental and control tasks" (*ibid*);
4. "each contrasted task must invoke the minimum set of components for successful task performance" (*ibid*).

What means to start from the correct cognitive theory?

Let's consider the fMRI. The fMRI highlights cerebral areas that show a decreased haematic activity: in this way, it is normally assumed that it produces morphologic and functional information on cerebral processes. One of main problems linked to the use of this technique is the subtractive paradigm. Let's suppose to investigate attention. We ask the participant to push a button each time that a stimulus appears. How can we know what the cerebral areas that are activated in this condition are linked to? We use the subtractive paradigm: we compare brain activation while the subject is performing the task and while it is doing the same actions without the presence of stimulus. We will consider as salient, the brain areas activated in the second condition that were not activated by the first condition. In this case, we are making an inverse inference (Poldrack 2006).

This method seems theoretically be effective. Let's consider an example. Paul Wright and collaborators, in 2004, looked for the cerebral area of disgust by brain imaging. While located in the fMRI, TD participants had to saw bloody images and neutral images. From results it emerged that the anterior right insula increased their activity during the vision of images representing contamination or mutilation, but not attacks. Experimenters inferred that insula selectively answer to disgust. This interpretation is not entirely misleading, but it is not well posed.

The problem is that if you have no cognizance of what you are looking for and the environment in which you are looking for, you will probably find the wrong thing. If we were Martians scientists and we would like to use methods similar to our fMRI to discover which is the organ for running; probably we will be tempted to assume that the heart is the organ for running, because after having compared its activity during running, sleeping,

resting on the sofa, studying and meditating, we found that it is more active when humans run. Does an organ for running exist? The study by Paul Wright and collaborators moves from this assumption: an organ for disgust exists .

An exemplar case of this bias is the study of Bud Craig published in *Trends in Cognitive Sciences*, according to which: "progression of activity to rAI [right anterior insula] and orbitofrontal cortex is essential for discriminative subjective judgments of interceptive feelings" (Craig 2004:240). This assumption was denial from studies conducted on patients with untreated *herpes simplex encephalitis*, which caused the bilateral destruction of insula, without causing alterations in interoceptive feelings (Philippi et al. 2012; Khalsa et al. 2009).

Moreover, I would like to add another observation. Are we sure that a major haematic activation always means a major functional role? An area could be stimulated but functionally not activated. Let's come back to the Martian for a moment. Could he consider the movement of the hair of the runner functional for the runner?

So, how can we use neuroimaging data? In order to make our scientific data stronger, we can compare fMRI studies with studies on patients with selective cerebral deficits. But also in these cases, we cannot be sure of our assumptions: in fact, the same studies of linguistic networks, despite the high number of studies on patients with aphasia, are still limping and contrasting.

However, the linguistic divergent results are not always a negative phenomenon. Sometimes, just the contrast of results, help experimenters to understand biases in their studies. The two-ways model of languages of

Hickok and Poeppel partially born from contrasting results regarding residual perceptual skills in patients with lesions in the left hemisphere (Hickok 2015).

The major difficulty linked to the subtractive paradigm is that the more specific the task is, the less ecologic it is. It's possible that, to solve a problem, human cognition instinctively change strategy according to the complexity of the task, also when the task appears to be the same. One more time, the case of linguistic networks is paradigmatic. Hickok and Poeppel built the two-way model starting from the observation that no meaningful syllables were elaborated, at cerebral level, by different networks than those inserted in a meaningful context (Hickok and Poeppel 2007; Hickok 2015).

Another kind of possible inference with *neuroimaging* was the forward inference, illustrated by Richard Henson:

> *...forward inference refers to the use of qualitatively different patterns of activity over the brain to distinguish between competing cognitive theories. More precisely, if one can design experimental conditions that differ in the presence of a cognitive process according to one theory, but not according to another, then the observation of distinct patterns of brain activity associated with those conditions constitutes evidence in favour of the first theory.* (Henson 2006:64).

In this case, in front of two contrasting theories, the brain imaging could be used to support a theory or the other. Unfortunately, also in this case, the inference is not decisive because it is always theory-dependent; that means that it will always be possible to use data obtained in this way to support a third theory.

The strict dependence of brain imaging data from the theoretical assumption has been considered from such researchers a risk of bias: in fact experimenters could be accidentally induced to ignore or considered not im-

portant data that contrasts with their theory (Van Orden and Paap 1997; Uttal 2001).

Unfortunately, all the scientific literature is subjectto this bias. Moreover, Francis Galton abandoned his theory after just four years because it was neither supported by empirical data, nor minimally encouraged by circumstantial evidences (Galton 1919; Parisi and Pennisi 2015). Deep down, also Craig, Wright and our Martian that thinks that the heart is the organ of running can have some reasons. It would be a great mistake to ignore the biases of brain imaging data; but it would be a greater mistake to ignore what *brain imaging* data could, being careful, suggest to us about our brain.

§5.9.2 Linguistic networks in adults: the dual stream model

It's still unclear how the cerebral processing of linguistic inputs works. The classic model Wernicke-Geschwind is almost over; but with it the attempts to individuate cerebral *loci* specialized in the linguistic elaboration of stimuli have not stopped. Language is a holistic phenomena, as shown from the limits of all neural linguistic models.

One of the models more considered as state-of-the-art is that of the two-ways proposed by Bickok and Poeppel (2007), that criticises the idea that linguistic understanding is totally localized in the left hemisphere.

Two were the key-observations for the experimenters:

i. Damage in the Wernicke's area or in any other area of the left temporal lobe doesn't cause the inability to understand language; on the contrary, this deficit is present in patients with bilateral destruction of temporal lobes;

ii. The discrimination of non-meaningful words is a cognitively different phenomenon that the discrimination of syllables in words.

If (i) induced experimenters to hypothesize that linguistic comprehension was bilateral; (ii) induced that to hypothesize that conceptual understanding and phonological discrimination were two cognitive processes different in nature (Hickok 2015).

So, they hypothesized a model that provides two ways: the ventral stream that involves the superior and the middle portions of temporal lobe and the dorsal stream that involves the posterior frontal lobe and the posterior dorsal-most part of the temporal lobe and parietal operculum (Hickok and Poeppel 2007). The ventral stream is bilateral, but the two hemispheres have different functions; it is involved in lexical recognition. The dorsal stream is highly left lateralized and is involved in the translation of acoustic signals in articulatory representations and it's mainly involved in the comprehension (*ibid*). During ecological interactions, both streams are involved; the model simply means that it is possible through laboratory experiments to selectively induce one of them to act. They probably have complementary functions in daily interactions (Saur et al. 2008).

§5.9.3 Neurological development of language

Both in adults (Hickok and Poeppel 2007) and in newborns of three days of age (Perani et al. 2011), linguistic inputs seem to be prevalently elaborated in the right temporal cortex and in frontal inferior cortex. Studying the conformation of linguistic networks at 2–3 days of life, a group of researchers observed the lateralization with three kinds of stimuli:

- Human language with emotional and segmental prosody;

- Human language with segmental prosody and without emotional prosody;
- Human language with no prosodic information.

In the second and, above all, the first condition, the auditory processing of language showed a higher activation in the right hemisphere than in the left. According to researchers, this means a more emotional processing rather than linguistic. Starting from this assumption they posed that children unable to perceive prosody will take the risk to be lacking in their language (*ibid*).

The same study also shows that the ventral pathways (necessary for the audio-motor elaboration of language in adults according to Saur et al. 2010; Rauschecker and Scott 2009; Catani and Jones 2005) is present at birth; on the contrary, the dorsal pathways (involved in the elaboration of syntax according to Brauer et al. 2011; Friederici et al. 2006) seems not yet developed.

From Perani et al. (2011) study we can infer that the left hemisphere, in the first days of life, has a primary role in the elaboration processing of linguistic stimuli. Moreover, the more the stimulus is ecological and emotional, the higher the right activation of the brain. This is perfectly in line with my idea.

The same year, Beauchemin et al. (2011), with the MMN showed that at 8–27 hours of life babies have a specific pattern of linguistic elaboration: they process their mother's voice with a preferential activation of the left temporal lobe and after the activation of central regions of the right hemisphere; on the contrary, unfamiliar voices were processed mainly in the

right hemisphere. Effectively, in Perani's experiment, stimuli were female voices, but not the voices of babies' mothers.

To sum up, we could hypothesize that the more familiar a voice becomes, the more "linguistic" will be the processing. We can hypothesize that an unfamiliar stimulus is processed mainly through the right hemisphere, and when it becomes familiar it will be analysed linguistically. The higher the baby is, the higher his linguistic analysis of stimuli will be.

§5.10 From interoceptive signals to the acquisition of language

The mothers' voice is probably a special stimulus for babies, strictly linked to the reward network. Each new form of learning will be born from new associations between familiar and non familiar inputs. The motherese, in the flow of news that the baby receives, emphasizes a salient element, different in each phase of the development (vowels, words, objects, people), depending on contingent needs of communication. By exploiting the differences that the baby perceives in his body instinctively, his ability to systemize the world becomes progressively more automatic.

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Chapter 6

Conclusions

§6.0 Introduction to the chapter

In §6.1 I will explain why the fixing of reference is difficult for subjects with autism. I will posit that in order to understand this *anomaly* of the autistic cognition, we have to consider the social nature of our cognition: when we dream we don't need to fix references, but when we wake up and become again social creatures, our owns dreams become unintelligible for us.

In §6.2 I will make a brief description of the modern application of *embodied cognition*, and I will suggest a possible analogy between the relation that links embodied cognition to cognitive sciences and the one that links pragmatics to philosophy of language.

In §6.3 I will analyse the literature that explains autistic deficits by using the concept of *embodied cognition*.

In §6.4 I will synthesize the literature on how personal pronouns could trigger some embodied attitude in the subjects who perceive them.

In §6.5 I will look at the alteration in the use of personal deixis described in the previous chapter through the theoretical lens of the embodied cognition theory.

In §6.6 I will expose my conclusions.

§6.1 Why is fixing references difficult for subjects with autism?

Let's consider one more time the case of George (§3.5.2). Why doesn't George fix a temporal reference?

Perceptual priors will fix in the human brain some perceptual and cognitive biases. Linguistic forms oblige us to consider temporality in a specific way. They build for us some temporal biases. Instinctively we are induced to think that these biases must have some regularity. We are induced to think that George is thinking according what we can call *a non-shared logic.*

It's impossible to count how much discipline exists. Why? Because the consideration of a same object from different points of view will bring us to very different conclusions, often in contrast with each other, not always wrong. Sometimes two realities in contrast with each other are both true. Obviously, this is an old question. A mother scolds her six-year-old son because he is playing with a ball in the living room. The reader will probably agree with her, but the son won't: deep down the crystal table was perfect as a goal post!

At the end, this is also why cognitive science was born (Garner 1987).

We have the implicit idea that the act of individually thinking needs necessary to be according shared logics. But this is not always the case. For example, we don't consider dreams as thoughts because they don't follow rational rules, such as physical laws. Before Binswanger, also psychotic deliria were considered lost of thought, not different ways of thinking.

The systematic alteration of perceptive biases associated with autism is for us an existential lesson regarding how deeply social we are.

I. e., contrary to what is commonly believed, logic is never universal, but always linked to conventions that we choose to adopt. Because functional for the social understanding, languages develop references systems; but they are intrinsically social. When we dream we don't need to fix references because, alone, we always know to what we are referring to. When we wake up, we come back to the shared logic and we forgot our references: at that point dreams become unintelligible for us.

But subjects with autism have priors toward shared rationality that are weaker. This doesn't cause problems for them in interpreting the physical laws, but the social laws. In fact, as we seen in the third chapter; is the semantic content of an inference to determine if it is difficult or not for subjects with ASD.

The fixing of reference is a social phenomenon. If a subject has weaker shared logic priors, the fixing of reference will be different in his cognition, as in those that are not synchronized toward the sharing of perceptive saliences.

Let's discuss now, how this linguistic trend is translated in the body.

§6.2 Embodied cognition : cognitive sciences = pragmatics : philosophy of language

In 1991, Francisco J. Varela, Evan Thompson and Eleanor Roch published *The Embodied Mind: Cognitive Science and Human Experience*. In it, authors criticized the classical Cartesian dualism that deeply permeated computational approaches (inspired by the metaphor "mind as computer") of the first generation of cognitive sciences and traces of which survived in the second generation of cognitive sciences (that authors indicated as Connec-

tionism). With this, authors triggered the beginning of what can be considered *a posteriori* the third phase of cognitive sciences. The fundamental philosophical idea from which they are mainly inspired is the Merleau-Ponty's one that we have to consider the body both as a structure that we live in and as the context of our cognitive processes (Varela et al. 1991). As we will see, EC will acquire a lot of nuances; what links these nuances is the awareness that a cognitive system with only an algorithmic nature will never produce meaning. The meaning doesn't derive solely from calculations, but also from the interaction—each time different—of the organism with the environment.

So, starting from this critique to the classic Cartesian dualism, cognition becomes "situated". The philosophical precursor of Situated Cognition is undoubtedly James Gibson that, with his concept of *affordance,* integrated the environment as an active agent in cognitive processes. But the theoretical underpinnings of this approach are evolutionistic in nature: "minds make motions, and they must make them fast, before the predator catches you, or before your prey gets away from you. Minds are *not* disembodied logical reasonings" (Clark 1998:1). In this perspective, minds are "organs exquisitely geared to the production of actions" (*ibid.*, p. 8). And actions are usually made in the environment. So, cognitive studies have to focus on all components of action: the body, the brain and the possibilities offered by the environment. The Situated Cognition doesn't refuse the existence of an external, objective world; it simply presupposes that mental representations are not neutral toward action; on the contrary, biological minds are strictly oriented to specific sensory-motor activities and to specific needs (Clark 1998). The Situated Cognition accepts the existence of mental elaborations,

what it puts into discussion is the real nature of inner contents of minds (*ibid*): problem solving is not localized in the brain, but diffused throughout the whole body and strictly depends on environmental affordances.

From this starting point, four different approaches to the problem were born. Mark Rowlands (2010), referring to an oral expression of Shaun Gallagher, organized these approaches speaking of the 4E. Mental processes are:

- *embodied*
- *embedded*
- *enacted*
- *extended*

As pointed out recently (Guidi 2016; Pennisi A. 2016), the difference in these four approaches is mainly related to the main focus point of each of them. The *embodied* approach is mainly focused on the importance of bodily structures for cognition, the *embedded* approach on the environmental context, the *enacted* on the importance of sensory-motor activities and, finally, the *extended* mind mainly studies the reciprocal interaction between body, mind and environment; a causal relationship results in that a change in one of them produces change in the others. The main difference between the more classical *embodied* mind and the *extended* mind is that the first one considers the body as the main element for the development of cognition, the second one—on the other hand—considers the body just as one of the three elements that, together with the brain and the environment, acts in the development of cognition (Clark 2008).

Finally, another weaker declination of EC Theory is the Grounded Cognition. Theorists of Grounded Cognition consider Epicurus, Kant or

Reid as their philosophical precursors (Barsalou 2008). But the general acceptance for the theoretical presupposes of Grounded Cognition is a recent milestone and it follows the general awareness regarding the need to consider not only the presence of amodal symbols in the mind, but also that of modal symbols due to the emergence of the limits of computationalism, which occurred during the second stage of the cognitive revolution. There are a lot of shapes of the Grounded Cognition theory; what they have in common is the idea that to understand cognition, we need to consider both modal and amodal symbols. In the version proposed by Barsalou (2008), when, for example, we live the experience sitting in a chair, our mind will memorize our visual experience, our proprioceptive experience, our emotional experience. But, the act of memorizing is selective; only some of the input presented will be stored in our memory. When we need to use that memory, we partially recreate in our mind that experience toward a simulation. Simulation is a core form of computation. The higher level of mental simulation is the mental imagery. The core of Grounded Cognition doesn't necessarily require bodily states, but it limits itself to provide the presence of perceptions, motor experiences, and interoceptive experiences in the classical idea of computation.

Now I will conclude this thesis simply reflecting on some empirical data created in EC backgrounds.

In a certain sense, we could pose that EC is for cognitive sciences what pragmatics was for philosophy of language. When Paul Grice introduced the concept of implicature (Grice 1989), he demonstrated the majority of meaning is conveyed pragmatically and not semantically. As, according to the EC approaches, the body has to be considered as a structure that

we live in, according to pragmatics, an utterance had to be studied in the way in which is acted by speakers. As Grice posed the need to consider the meaning as an integration of semantic knowledge and lived dimension of language (substantially founding pragmatics), in the same way, Varela, Thompson and Roch posed the need to integrate the study of mind in science and that of mind in experience (founding EC Theory).

§6.3 Embodied cognition and autism

Some studies propose to interpret autistic behaviours in relation to the hypothesis of impairment in the embodied system. In this section, we will analyse some of these studies, in order to better understand how to use EC theories for explaining linguistic and pragmatic deficits of this clinical population and if this hypothesis could be considered promising.

Observations linked to motor problems and use of communicative gestures in autism are as old as first considerations on the disorder: it was in fact Kanner himself who noted alterations in the use of communicative gestures regarding two of his eleven patients: the first case, Donald, "He never looked at the person while talking and did not use communicative gesture" (Kanner 1943:222) and the eleventh case, Elaine, "Her expression was blank, though not unintelligent, and there were no communicative gesture" (*ibid.*, p. 240).

Today, studies on motor alterations in autism are uncountable. Eigisti et al. (2013), that review data considered specifically useful for interpreting these impairments in light of EC Theory, poses that it's plausible to hypothesize that the impossibility to integrate motor movements with ideas, emo-

tions and cognitions will probably cause in patients a different influence of embodiment.

To support their thesis, authors posed a lot of data that shows motor impairments in subjects with ASD, above all regarding two specific forms: (1) the absence of synchrony between environment and subjects' response, probably related to a deficit in the integration of multi-modal stimuli (see i.e. Pennisi 2015 for the deficit in integration between auditory and visual stimuli) and (2) the absence or impairments in the use of communicative gestures. If both of these phenomena are massively present in the pathology (the second is also taken into high consideration as risk-index by the M-CHAT-R/F, Robins et al. 2014, probably the most-used scale for detecting infants at risk of ASD), none of these are necessary for the final diagnosis. Regarding motor impairments, the DSM-V refers only to "stereotyped and repetitive motor movements" (APA 2013:50).

An interesting data referred from Eigisti et al. (2013) in favour of the adoption of EC theories to explain ASD is the reference to Sutera et al. (2007). According to Eigisti et al. (2013), the longitudinal observation of 95 toddlers considered at-risk for autism made by Sutera et al. in 2007 tells us "motor abilities are important predictors of outcomes in ASD" (Eigisti et al. 2013:4). But Eigisti et al.'s (2013) inference is maybe too optimistic; in fact Sutera et al.'s (2007) attitude is safer:

> *"it seems to be the case that children with these skills intact, especially motor skills, are more likely to achieve an optimal outcome. However, there are some children who have intact motor functioning and do not achieve an optimal outcome. In addition, there are a few children who do not have IQ or motor skills in the normal range, yet still reach an optimal outcome. Therefore, adequate cognitive and motor skills are perhaps signs of positive prognosis but appear to be neither necessary nor sufficient for optimal outcome"* (*ibid.*, p. 105).

The exceptions present in their sample and the exiguity of their sample for a claim of such importance oblige us to take prudence: first of all, their initial sample wasn't of 95 children, as reported by Eigisti et al. (2013), but of 90. These 90 babies were recruited because considered at-risk of autism by the M-CHAT-R (Robins et al. 2014); they received a follow-up at, more or less, two years of age, on which occasion, 17 of those was diagnosed as non-autistic. At the age of four, these same children received another follow-up and on this occasion none of the 17 non-ASD were rediagnosed as ASD and other 13 of the 73 originally diagnosed as ASD were considered non-ASD. So, finally, from Sutera et al.'s (2007) study, we have 60 children with ASD and 30 without ASD. As admitted by Sutera et al. (2007) themselves, "with our sample [...] we had .70 probability of detecting a medium effect size" (Sutera et al. 2007:106).

More significant data reviewed in Eigisti et al. (2013) show impairments in the empathic hand of Theory of Mind (ToM) and are relative to mimicry, yawning and emotional contagion, which seem to be highly altered in subjects with ASD. For example, Platek et al. (2003) seem to show that the predisposition to contagious yawing is positively correlated to the empathic hand of ToM. Starting from this observation, Helt et al. (2010) found that 28 children with ASD were less responsive to contagious yawing than both 28 typically developed (TD) children chronological-age-matched and 28 TD children mental-age-matched. These data regarding lack of empathic contagious in children with ASD were not totally new; also Senju et al. (2007) had found analogous evidences with a sample similar in number.

Other authors found some impairments in the empathic hand of ToM in autism: i. e., Minio-Paluello et al. (2009) showed that subjects with Asperger Syndrome (AS), contrary to TD subjects and despite a normal corticospinal reactivity in non-social situations, don't seem to show any neurophysiological modulation of their corticospinal system when observing other people affected by pain. Because the neurophysiological modulation of the corticospinal system during the observation of others' pain is usually considered index of empathic contagion, authors inferred that subjects with AS don't have embodied empathic resonance effects. In matching neurophysiological and psychological measurement, authors also found that, if TD subjects show somato-motor response as strong as the imagined pain of others, subjects with AS show an ego-centric and self-directed perception of others' pain: their perception of others' pain is proportional to their personal arousal during the observation. Maybe this data suggests that a lack of embodied empathy could be linked to a difficulty in clearly distinguishing between themselves and others. Minio-Paluello et al.'s (2009) work is really interesting, but the main problem is that the sample was very small (16 AS and 20 TD). But, fortunately, this is not the only study in this direction (see Minio-Paluello et al. 2009 for other related studies).

§6.4 Embodied cognition and use of pronouns

In this section, we will observe some data about the comprehension of pronouns in TD subjects. Pronouns strongly influence linguistic perception. As pointed out by Alessandro Capone (2010), politicians are maybe the best users of linguistic affordances created by pronouns; to create a theatrical effect, they "ventriloquy" (*ibid.*, p. 2972) the voices of their opponents, subor-

dinating them to themselves through the continuous use of the first-person pronouns to indicate themselves (*ibid.*). Specifically, Capone shows this phenomenon in relation to a speech made by Barack Obama in South Carolina after his election. In essence, Capone reported some of Obama's statements ("when I hear the cynical talk that Black and white and Latinos can't join together and work together", Anonymous 2008) and commented them as follows "this voice [...] too anonymous (though qualified by a negative adjective). To this voice, Obama replies using a particular person's voice" (Capone 2010:2972); in fact, in addition to these lines, other lines will follow in which the use of the first-person pronoun is massive (Capone 2010).

As we will show in this paragraph, personal pronouns strongly trigger some cognitive attitudes. Many studies, in fact, show some patterns between their use in written inputs and the embodiment of readers. As we will see, sometimes language creates affordances for the embodiment during comprehension, but embodiment is not the rule, it is just an exception. In some cases, pronouns are trigger words for the embodiment.

In 2009, Tad Brunyé and his collaborators published a simple, but very interesting, study regarding the modulation of perspective-taking during narrative comprehension. The study provided two experiments, both of them with forty-eight TD native English speaking participants (in both cases, more or less 19 years old). The authors' starting question was: Do personal pronouns trigger the mental simulation of the content of a narrative during comprehension? To answer the question, Brunyé et al. (2009) prepared two experimental settings. In the first experiment, they set some linguistic description of events composed by a personal pronoun, a verb and finally an object. An exemplum follows.

a) I am slicing the tomato

For each sentence, authors prepared four pictures that described the action from different perspectives (see fig. 1). Authors asked participants to say, for each photo, if it was representative of the linguistic sentence. In doing so, authors measured participants' response time.

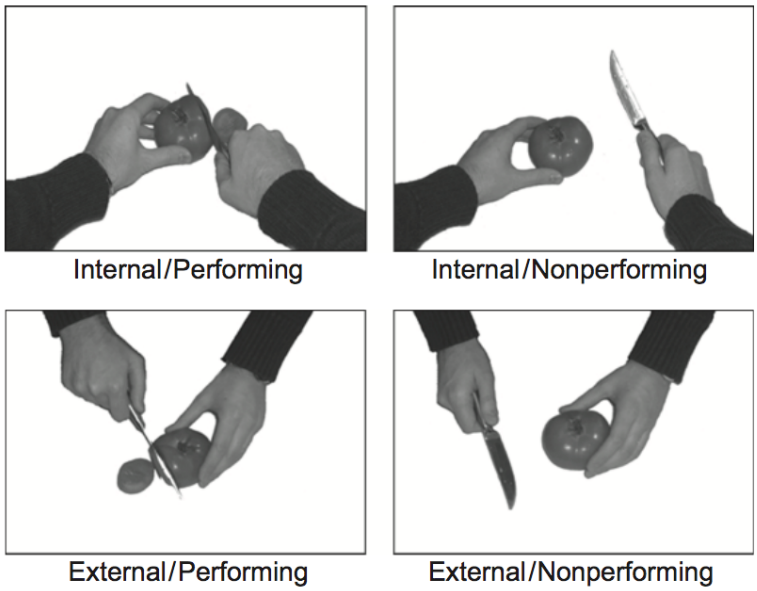

Figura 17

Results showed that the processing of *I* and *You* were analogous and that it was faster in internal perspective than in external; on the contrary, when the linguistic input was the third person pronoun, subjects were faster in the processing of external perspective rather than the internal one. Response time didn't correlate with other parameters.

Because data of the first experiment was at risk of bias, authors performed a second experiment. The problem of the first experiment as the possibility to interpret slower response time in the processing of internal perspective in linguistic sentence with the third person pronoun was due to the ambiguity of the context, uninformative to the actor's identity. To avoid

this risk, experimenters developed a two-sentence discourse context for each sentence of exp. 1 and replicated the task. Results regarding the processing of second and third person pronouns were replicated with greater statistic significance. On the contrary, the trend regarding the first person pronoun was inverted. Because of this, authors posed that,

> *...with single sentences, such as I am slicing the tomato, the ambiguity with regard to the actor seems to lead readers to adopt internal perspectives on described events. [...] However, when character identity is explicitly revealed through an extended discourse we find that readers are more likely to adopt an external perspective following first-person pronouns. It could be the case that reiterating pronouns in extended discourse helps readers disambiguate the actor from the observer and encourages them to play a role as one or the other. (Brunyé et al. 2009:31)*

This observation seems to have been confirmed in 2016, when authors, in a sample of two-hundred and seventeen participants, found that the pronoun *I* can be modulated both by discourse context and by individual differences in emphatic engagement (Brunyé et al. 2016). Moreover, as we will discuss more analytically in this paragraph, in 2013 Stato and Bergen found a lack of embodiment in absence of explicit pronouns. This phenomenon clearly gives scientific substratum to Capone's reflexions on "ventriloquization" of opponents in politicians' speech (Capone 2010).

From data of exp. 1 and exp. 2, the authors infer that participants "use linguistic cues to guide the nature of these simulations. A third-person pronoun cued an external perspective" (Brunyé et al. 2009:30). However, some years later, authors—in reanalysing the same data—were obliged to admit that "only a minority of participants showed evidence for pronoun influences on perspective-taking" (Brunyé et al. 2016). In Brunyé et al. (2011), with a similar experimental setting (but this time with forty-eight partici-

pants), authors confirmed that the internalizing of narration is stronger in a second-person narration rather than in a first-person narration. Moreover, Giannelli et al. (2011), with a different experimental setting based on compatibly effect of movements often used in EC studies, confirmed that also in French, readers embody the action with the trigger pronoun "tu" ("you") (the sample was composed by thirty-two adults, native French speakers) and didn't embody the action when they read the same sentences in which, contrary to *You*, there are names of actors which participants are asked to put themselves in their shoes (this second experiment had a sample of thirty-four French speakers). Stato and Bergen (2013) replicated results regarding the internalization of perspective following *You* and the externalization of perspective following *He* with the same experimental setting of Brunyé et al. (2009), but with a sample of sixty-four native Japanese speakers.

The priority internalization of narration after the second-person pronoun was also indirectly confirmed with a different experimental setting, with a sample of twenty-eight native speakers of Mainland Mandarin Chinese (He et Kaiser 2012). The possibility of also generalizing with the Chinese language is particularly useful because the study was focalized on the pattern of fixation of reference of the Chinese reflexive *ziji* (self). According to authors, if in English the interpretation of reflexive pronouns mainly depends on structural and syntactic cues, in Chinese it is assumed to mainly depends on referents' features (*ibid.*). So, in my opinion, in confirming how, as shown by Brunyé's research group regarding the stronger internalization of perspective following the second-person pronoun rather than the third-person pronoun or the first-person pronoun, Xiao He and Elsi Kaiser indirectly demonstrated a stronger influence of the trigger of embodiment, ra-

ther than of linguistic characteristics of each language, on the fixation of reference. The same discourse is valuable for the Japanese (Stato and Bergen 2013).

Yet the Brunyé's research group replicates the experimental setting to test the effect of the use of personal pronouns on memory (Ditman et al. 2010). This time there were thirty-six participants and they had to read some statements (the same used in Brunyé et al. 2009) and after they had to read other statements and declare, for each of those, if they were previously presented to them or not. The second list of stimuli contained both statements used in Brunyé et al. (2009) (so known by participants), partially old inputs (old-noun+new-verb or new-noun+old-verb) and totally new inputs. The lists of inputs provided both action items and description items. The first kind, according to authors, should trigger a more correct response because of the higher engagement of embodiment processes. The second part of the experiment was replicated also three days later and results were analogous.

Results regarding *You* were coherent with those of Brunyé et al. (2009): when statements represented action rather than description items, participants showed better performances and smaller response times with *You* rather than with other pronouns. This phenomenon didn't manifest with the description statements. Moreover, participants showed better performances with the couple new-verb+old-noun rather than with the couple new-noun+old-verb, but only when statements started with *You*. Authors posed that a first-person simulation of the narrative during the comprehension will probably produce a stronger memory than a classical understanding. If considered together, these studies are coherent and seem to show that the pronoun *You* is a trigger word for embodiment in statements that de-

scribe actions, but not descriptions. In this regard, authors made an observation that will be very useful for our argumentation in §6.3: "internalization of described objects and actions (via the pronoun 'You') occurs in the absence of a task that encourages visualization" (Ditman et al. 2010:176). Independently, Giannelli et al. (2011) better specified that reaction times are shorter when participants embody an action in which *You* is the agent rather than when they embody an action in which *You* is the subject that receives the action. So, embodiment is stronger (or selectively obtained, this is unclear) in "You gave a book to Louis" rather than in "You received a book from Louis".

Moreover Ditman et al. (2010) specified that improvement of memory regarding second-person narration was statistically significant only for spatial and emotional information, but not for time information or contextual causal inferences or something about characters. Finally, they added a new element to our puzzle: the internalization of characters' emotional states and the development of congruent emotional states are improved in a second-person narration rather than in a first-person narration[23]. In light also of this data, when in 2016, they reanalysed data published in Brunyé et al. (2009), the authors hypothesized that trait- and/or state-based factors can influence participants' tendency to embody after trigger-pronouns (Brunyé et al. 2016). Effectively, they found that readers with high empathic engagement with characters use embodied perception and action during the comprehension of narratives more than readers with low empathic engagement (Brunyé et al. 2011; Brunyé et al. 2016).

[23] We will come back to this link between motoric representation, internal perceptual representation and emotional representation when we will come back on autism in §5.

Personal perspectives also influence action perception in mental imagery: specifically, Libby et al. (2009) showed the existence of bidirectional causal relationships between personal perspectives used in representations and abstraction level of the imagined action: the use of third-person perspectives trigger a more abstract visual representation of scenes in respect to the use of first-person perspectives. Moreover, inversely, abstract representations are more easily understood if expressed through third-person perspective rather than through first-person perspective. This behavioural data is confirmed by a fMRI study (Jackson et al. 2006) and a TMS study that showed an increase in motor-evoked potentials for the first-pronouns, but not for the third one, in Italian experimental participants that silently read and decide on the subject of sentence (Papeo et al. 2011).

Another data that confirms our thesis, according to which personal pronouns influence the embodiment of a text, indirectly comes from a Californian research group, which found an interaction between pronouns and the mapping of time onto space (Walker et a. 2013).

Although the influence on pronouns on the level of embodiment of a narrative by reader seems absolutely confirmed from various kinds of replications, the differences that occur in the engagement of embodied processes—despite the comprehension of texts— seem in the same way absolutely to clarify that embodiment is not necessary for understanding. In fact, also when sentences start with third person-pronouns the content of the text is totally understood. To this basic inference, Sato and Bergen (2013) added another interesting element through four experiments: if it is possible to infer the subject of an action from the context, also in absence of an explicit reference to the subject in the sentence, Japanese readers fully understand the

object of reference, but without showing the priming-effect of that personal perspective. Moreover, "even when the referent of a null subject is rapidly and naturally retrieved from the discourse context in conversation, the mental content of the null subject may not be integrated into mental simulation in the same way as it would be id explicitly mentioned" (Sato and Bergen 2013:372). So, putting certain pronouns at the beginning of each sentence will have some irreplaceable consequences on the level of embodiment of the sentences.

If, as we hypothesized in the previous paragraph, subjects with autism are impaired in the embodied system, we could hypothesize that the linguistic areas that engage embodied systems will be altered in subjects with ASD. In the next paragraph we will analyse the use of pronouns in this clinical population.

§6.5 Possible explanations for alterations in the use of personal deixis in subjects with Autism Spectrum Disorders

In the previous paragraph, we analysed some data regarding the use of personal pronouns in subjects with ASD. In this section we will discuss three explanatory hypothesis for these anomalies: the first one posed the echolalic use of pronouns, the second one links these impairments with the deficit in ToM; the third, that I propose as more plausible, integrates the first two in the EC paradigm.

§6.4.1 Echolalia

Many essays explaining these alterations have been written in the past. Different studies exclude a syntactic deficit as the source of difficulty in the

use of personal pronouns in subjects with ASD (Lee et al. 1994; Novogrodsky et al. 2012).

Kanner seemed to prefer the echolalic interpretation: "Personal pronouns are repeated just as heard, with no change to suit the altered situation" (Kanner 1943:244). Moreover, Kanner seemed to link the end of the use of echolalia with the beginning of the correct use of personal pronouns and, in referring to children with autism, wrote "between the age of 5 and 6 years, they gradually abandon the echolalia and learn spontaneously to use personal pronouns with adequate reference" (*ibid.*, p. 249). This idea became a thesis when it was treated by other authors (Bartak et al. 1975; Fay 1969).

In this perspective, children with autism that show impairments in pronoun use seem to not understand the meaning of each pronoun, but just repeat a sentence after hearing it. So, in this perspective, if a clinical subject says, "You want milk" rather than "I want milk", it's because it is repeating something previously heard and it is linking his desire of milk with something just lived, without understanding the difference between "I" and "You".

But this thesis slowly induced researchers to hypothesize something more. For example, Warren Fay (1969) posed pronoun reversal in the same explanatory plane of the classical autistic reversal between *this* and *that*; in both cases, the inability of subjects to find in their previous experiences the correct word, induce them to make mistakes:

> *The problem of pronominal reversals, which the three boys did not share, has become firmly associated with autism and the apparent difficulty these children have in separating "I" from "not-I," that boundary between self and non-self. L.C. was no exception, and there was no evidence from this study that he did not, in fact, have an affect-related problem in self-identity. But such pronoun difficulty also reflects, as does his other echo-*

> *ic performances (immediate or delayed), the utilization of speech available to the child in his listening environment. If, for whatever reason, one has at his disposal only the pronouns spoken by others and cannot edit these pronouns linguistically, the result is non-conversion in both echoic and non-echoic utterances. Therefore, even if the child has successfully passed the hurdle of self-delineation, there remains the linguistic hurdle of converting heard second and third person pronouns into first person pronouns.* (Fay 1969:44)

§6.3.2 Deficit in ToM

Another hypothesis often considered for these alterations is the deficit in ToM. As is well known, subjects with autism show impairment in turn-taking and joint attention; in 1986, Loveland and Landry found a correlation between correct production of *I/You* pronouns and children' spontaneous initiations of join attention. Some authors proposed that ToM mediates the acquisition of personal pronouns (Ricard et al. 1999) and other that its impairment could lack the correct use of reference (Ariel 2001). This hypothesis is coherent with the observation of the major difficulty in the use of pronouns in vis-a-vis interactions rather than in experimental settings (Hobson 1990; Hobson 1993; Lee et al. 1994).

Gabriella Markova and Filip Smolík, in 2013, showed a strong correlation in 181 participants with the use of pronouns in toddlers from eighteen to thirty-six months and their ability to talk about mind and mental states (Markova and Smolík 2014). Because a correlation between pronoun reversal and impairment in social abilities and another between pronouns reversal and linguistic abilities was found, it was hypothesized by Naigles et al. (2016) that impairments in the use of personal pronouns is present when language and social abilities develop asynchronously.

The core idea at the basis of this perspective is well synthesized in the study of Livia Colle et al. (2008) who, referring to cognitive activities of a

narrator who has to use personal pronouns, said: "The speaker not only has to represent the relationship between the pronouns at the local (sentence) level, but also represent what context is already known by the listener, and what new information they need to be provided with" (*ibid.*, p. 31). This perspective allows researchers to predict impairments in each linguistic expression that, to be used, need the consideration of the listener's point of view.

Actually, it was from the observations that came from this hypothesis that opened the road for a new one. I agree with the idea that a change in perspective is the main difficulty for the correct use of pronouns in ASD, but I disagree with the idea that it is a deficit in ToM that causes difficulties in the change of perspective. As found by Novogrodsky et al. (2012; 2015), a different level of performativity (that here is intended as the level of active cognitive effort of doing something; see Pennisi and Falzone 2016 for insights) significantly affects the use of pronouns: the higher the level of performativity of a task, the more, i. e., the substitutions of pronouns with extended references (use of article + noun rather than pronoun for the reference to a character before presented).

§6.4.3 Echolalia, deficit in ToM or executive functions?

The executive functions impairment in subjects with ASD is well known (see, i.e. Wilson et al. 2014). In general, subjects with ASD are described as mentally rigid and less able than TD to adapt their behaviour to different situations; Simon Baron Cohen describes subjects with autism as almost obsessively systematic people (Baron-Cohen 2012).

What I will try to show now is the possibility to interpret autistic anomalies in the use of personal pronouns in light of the idea that deficits

occur when the context requires intact executive functions. Let's start from our graph of ASD strengths:

- use of the pronoun *You* in direct answers (Lee et al. 1994; Hobson et al. 2009)
- use of the pronoun *I* in direct answers (Lee et al. 1994)
- use of personal reference during re-telling tasks (Novogrodsky et al. 2012; 2015)
- use of third personal pronouns when complement in direct answers (Hobson et al. 2009)
- use of *we*, *us*, *ours* in direct answers (Hobson et al. 2009).

All ASD strengths in the use of pronouns were found in experimental settings that provide either direct answers or the repetition of something previously heard. But if we consider these data, from a different point of view, maybe we will find something more interesting in them. The experimental settings of Lee et al. (1994) and Hobson et al. (2009) require the intensive use of the visual perspective: in Lee et al., (1994) the experimenter puts some pictures (e.g. a picture of teddy bear) in front of them and the other in front of the child and then asks the child "Who sees the teddy bear?"; also the experimental setting used by Hobson et al. (2009) is similar and they could be resolved thanks to a visual perspective. The visual thought is a strength, when not an isle of geniality in subjects with autism (Grandin and Panek 2013; Holland and Low 2010; Pennisi 2016d; Pennisi 2016c). If the acquisition of personal pronouns in subjects with autism is partially echolalia (or more echolalia than in TD subjects) and tends to be used more as labels than as deictic words, it will be simple to infer that—to answer questions as those posed by Lee et al. (1994) and Hobson et al.

(2009)—subjects with autism intensively used the visual perspective, interpreting the scene from a more abstract point a view. In this case, I'm posing that, when subjects with ASD use pronouns, they use them semantically (as a label for an entity) and not pragmatically (as deictics). This hypothesis is in line:

- both with Libby et al.'s (2009) results on the bidirectional causal relationship between abstraction level of perspective and personal perspective
- and with the impairment in the use of *me* found by Lee et al. (1994).

If we, in fact, acquire an abstract visual perspective to answer a question such as "Now the puppet's tickling . . . ?" the label for the subject is *I*, although if in an embodied perspective the correct answer is *me*. What I'm suggesting is that embodiment triggers a perspective point of view and that, when we are using it, we are using pronouns pragmatically and so, we are using pronouns as deictics. On the contrary, when we are using an abstract perspective, such a visual perspective or the third person perspective that participants of Libby et al. (2009) used in the task, we are using pronouns semantically.

Let's analyse now ASD impairments in the use of personal pronouns. From the literature that we observed, it emerges that subjects with ASD:

- tend to use the extended reference to subjects more than personal deixis to refer to others (Lee et al. 1994; Colle et al. 2008);
- show more ambiguity of personal references during the telling task rather than TD subjects (Novogrodsky et al. 2012; 2015; Colle et al. 2008);

- show more phenomenon of reversal between *I* and *You* than TD subjects (Naigles et al. 2016; Fay 1969; Kanner 1943);
- show impairment in the use of *me* (Lee et al. 1994);
- show difficulties in the interpretation of reflexives (Perovic et al. 2013);
- show impairments in the use of *he* (Hobson et al. 2009).

The first point (the strongest in relation to quantity of participants of each experiment) is absolutely in line with the thesis: if subjects with autism tend to interact from a more abstract and visual (rather than embodied) perspective, the massive use of extended reference will be the best system of labelling at their disposition. In addition, the second point is perfectly coherent with my idea. If subjects with autism show difficulties in continuously changing from the abstract to the embody perspective or vice-versa, their use of personal references during a narration will be ambiguous when the speaker has to take into consideration what a listener knows or doesn't know when it is different from their own point of view. Also, in order to be used correctly, the phenomenon of reversal between *I* and *You* requires a pragmatic understanding of the meaning of these words, not a semantic one. When a child says "You want milk" instead of "I want milk"; it is using the label connected to the day in which its mother offered it some milk, without embodying that day, but just taking it from an external recording camera. Also impairments in the use of *me* are easy explainable into this perspective: children with autism that show this difficulty tend to think *I* as a label for each occasion; the use of me requires a change in perspective which considers someone acting toward themself ("Now the puppet's tickling . . . ?"), a perspective impossible to reach without embodiment. An analogous reason-

ing could be made for the interpretation of reflexives. In fact, let's reflect of the difference between:

b) "Bart's dad is touching himself" (Perovic et al. 2013:821)

and

c) "Bart's dad is touching him" (*ivi*).

Why do children with autism understand reference in (c) and not in (b)? To understand the reference of (b), the interpreter has to first consider the perspective of Bart (to understand the reference of the genitive) and then it has to change perspective and considering that of the subject of the verb (the dad). While in (b) the reference starts from Bart and arrives to the father, on the contrary, in (c) the reference starts from Bart and comes back to Bart. I'm suggesting that the difficulty for subjects with autism is not to be unable to consider a perspective which is different from their own, but to change perspective as required by a change in reference because of the higher level of cognitive effort that this task requires.

Regarding the final point, impairment in the use of *he*, Hobson et al. (2009) reported that "when participants with autism made reference to a shared point of reference (a third person), their communication failed to include a look towards the third person and then a look back to the tester with whom the communication was being shared (Hobson 2009:662)". We can reason similarly to the previous case. Researchers asked to participants:

d) "Who built the red and blue tower?" (Hobson et al. 2009:657)

and

e) "Who built the green and yellow tower?" (*ivi*)

In (d) the correct answer was "we" and subjects with autism didn't show difficulty; in (e) the correct answer was "he" and subjects with autism

showed difficulty. To solve (d), participants have to say "we" while they are engaged in a first person discussion with the experimenter to which "we" will be referred to. They don't need to change perspective. On the contrary, to solve (e), they have to consider someone external to the perspective they are living in that moment, turn (physically or mentally) toward the third experimenter in the room, consider it and use a perspective that separates the experimenter to whom it is speaking. While in (d) the participant is fully involved in the "we", in (e) the participant has to take himself out of the situation and consider the point of view of the listener to indicate a person external to the linguistic exchange. It's plausible to consider solving (e) more difficult for cognitive effort required than solving (d).

I analysed the way in which some specific kinds of words, the personal pronouns, influence differently the body and the perception of the environment and the way in which the environment and the engagement of the body influence the use or the understanding of personal pronouns in TD subjects and in subjects with ASD.

This study is not conclusive; on the contrary, it opens a door, or maybe a window, towards the world of reflexions on pronouns.

What lies behind the use of a personal pronoun? Why does something change in my body whether I say *I* or I say *You*? In addition, how does this change influence my cognitive processes? Moreover, how does this different cognition influence my body? Before having studied personal pronouns and the different reactions that they trigger on TD subjects and subjects with ASD, I would have never expected how fascinating the dynamics prompted by a simple change in perspective in our cognition are. I never expected to

find the simple use of such small words to have such deep meaning for human beings.

I. e., in Italian the use of the third person personal pronouns (female) is imposed to refer to someone in a formal register. While it's true that—as suggested by Libby et al. 2009—the use of the third person pronouns usually prompt a more abstract representation of the situation described, it's plausible to hypothesize that this convention reflects the conscious choice or the unconscious desire to maintain more rationality during the linguistic exchange, creating a more evident distance between the speakers. As observed by Donna Williams, the famous woman with High Functioning Autism who provided us a very important introspective bibliography on the pathology, apparently the use of personal pronouns is not so important:

> *"The words-pronouns as I, You, he, she, us or they, are not so important. Too many people do a ridiculous "can-can" with them, because they want to root out the "autistic symptoms" or in name of "good manners" or of formalities. Pronouns concern those to whom we are addressing, the place in which you are and where they are in the space, to whom you are saying all these things. There is a big number of connections, many more than have been made, to correctly access, use and interpret the most part of the other words. Pronouns are, in my experience, the words with which it is the most difficult to connect with the perceptible meaning because they always change and are so relative. In my experience, they require much more connections, monitoring and feed-backs than other words.*
>
> *A lot of energy is often wasted on teaching pronouns and people who are trained to use them experiment little success in continuously using them that it's possible to diminish all interest even in learning other words with which are possible to communicate. I spent the most part of my life using general terms such as "a person" or "a", calling people by name or by genre with terms such as "the woman" or "the man", or for age range such as "the boy". It has never been crucial to my ability to be understood that I would explicitly refer to the relationship of people with me or to the relationship of people in the space or that, I did not. The relationship I have with the people I talk to has never made a difference big enough for me to be misunderstood. This can have its time and place, but there are many more important things to learn that are e easier and can build a sense*

of achievement before you build one, too big, for bankruptcy" (Williams 1998:151; translated from Italian edition by me).

In a certain sense, this is not fully incorrect. Pronouns are easier to replace in common linguistic exchanges rather than words such as "mum". It is complicated to teach a child to say "ehi, woman who gave birth to me and that takes care of me, can you give me some milk?". The use of “mum” is almost obvious, we need a word to replace “woman who gave birth to me and that takes care of me”. But finally, on the contrary, it's more difficult to learn the correct use of *I* and *You* than a more abstract use of extended references. Why do we have to use the word “I” rather than our name? As I will try to show, this disadvantage is balanced by an advantage.

Probably, impairments in the correct use of personal deixis showed by subjects with ASD reflect a deeper difficulty in the ability to dynamically change observational perspective, adapting it to the needs of the context. To learn the correct use of personal pronouns, a subject needs to learn to change the video camera with which they observe the scene, basing their choice on the understanding of others, without relying on the algorithmic meaning of language. Clara Claiborne Park clearly explains the difficulties of her child with ASD, Elly:

If You think about it, it's perfectly logical. Elly believes that her name is "You" because all people call her in this way. No one has never called her "I". People call themselves "I" and, with a further refinement she started to call them "I". The reversal of meaning seems almost impossible to teach; now, at eight years old, when Elly says "I like that thing", it doesn't mean that she likes that thing , but her interlocutor likes it. What can I do? I can tell her to say: "kiss me" and reinforce the expression kissing her; I can refuse to push her on the swing until she tells me: "push me". But these rare ways to demonstrate the correct use

> *cannot balance out the hundreds of wrong reinforcements that leads every day . "You were wrong", I say, and Elly replicates: "You were wrong". "No, not me, you were wrong". "You were wrong". The more we talk, the worse it is. Two times, occasionally, within an interval of one year, Elly used the pronoun "me" in the correct way, to denote herself. "Becky gave me a book", she said recently, with the book in her hands. Plummeting me to encourage her, I surprised myself by saying: "Yes, she gave you a book", destroying, in this way, the effect that I would like to reinforce. Finally, I started to ask myself how normal two-year old children can catch something so sharp. Yet they do it. (Park 1967:175; translated from Italian edition by me).*

It's impossible to learn the correct use of deixis exclusively using the digital code of linguistic inputs or modal symbols. If an adult tells a child *You*, the child, to understand that the adult is referring to themself, has to learn to understand to be the *You* of the adult.

The use of pronouns reflects the necessity of the human organism to continuously express the perspective from which it is considering the situation. The use of pronouns reflects the human's irrepressible impulse to continuously change and modify the prospective apparatus of a situation. Maybe the use of pronouns is a reflex of our intrinsic euritopicity (Lorenz 1959). Eurytopicity is a characteristic of some animal behaviour and is the opposite of stenotopicity. Neither of the two is an all-or-nothing phenomenon, but both need to be thought of in a continuum that opposes them to each other. Behaviour is by nature stenotopic when, regardless of the external environment, it is present in the animal each time in the same modality, each time according to the same procedure. An exemplum could be a newborn duckling that pecks the ground even in absence of food (Eibel-Eibesfeldt 1987; Falzone 2012). On the contrary, euritopic behaviour is maximally flexible to the environment's requests (Lorenz 1959).

Man is the most eurytopic animal in the world (*ibid.*).

I think that the use of personal pronouns reflects our most flexible aspect; it is, in a way, linked (such a cause or such an effect) to the possibility of dynamically changing bodily-cognitive attitudes toward the world. When I say *You* instead of Simone, Mario and Luca, I'm not only shortening the signifier, I'm also expressing the relationship of exclusion between me and each subject of the group of referents; through the use of pronouns we express the dynamic and contingent structural relationship that each subject assumes during a conversation. These structural relationships have patterns and these patterns are expressed by pronouns. When lovers call each other, they use invented names and express a relationship of uniqueness. If I call my partner "honey", I know that no one will call him in the same way (or at least I hope so!). On the contrary, when I call my mother "mum" I know that my siblings will call her in the same way. Subjects with autism often use neologisms to refer to object or people that are understandable only to those who live with them (Pennisi 2016). Instead, the use of patterns to directly the change of perspective, as for example the use of personal pronouns, involves an ability to change body attitude towards the world and re-orient the cognition according to this change in perspective.

Analysing the data of this paper, I noted that the more changes of perspective were required by the reference, the more difficulty of subjects with ASD had in understanding or using pronouns.

If the use of pronouns prevailed on that of extended references in all languages of the world, they probably would bring a great advantage. An undoubted advantage was the abbreviation. To say *You* is faster than saying "Mario, Luca and Giovanni". But *You* also engages my relationship with the world, that—in its turn—is faster and easier to understand with a cognitive

use of bodily dispositions (for example toward simulation or toward the activation of the mirror neuron system). Abstraction is not always the better solution to solve problems. In some cases it is more ergonomics to *embody* the action, in others it is more ergonomic, for cognition, the built-in projection. The act of ventriloquists a referent (Capone 2010) is, in fact, a decorporatization of the other; it's a practical way to manipulate perspective and, with it, to manipulate the bodily attitude of the listener toward the referent.

If we would always use extended references for everything, if we would always have our own consideration of who is in front of us or of who is distant from us, probably the metaphor of mind as a calculator will be correct. The impossibility to dynamically change bodily-cognitive perspective is typical of robots. In fact, today robotics can simulate the semantic learning of personal pronouns, but not the pragmatic one; as a recent attempt to simulate the learning of reference in robots shows: "The final definitions learned by the tree can be rendered into English as follows: 'I' is the person that is the speaker. 'You' is a person whom the speaker is looking at. 'He' is a person who is not the speaker, and whom the speaker is not looking at". (Gold et al. 2007).

When reference is fixed exclusively by semantics, it gives origin to inflexible labels, that are not cognitively ergonomic to dynamic changes of perspective. In fact, the robot implemented by Gold et al. (2007) was not able to understand reference when linked to abstract concepts such as "this idea" or when it required the comprehension of spatial paradox such as in "this great country".

In real life, we can speak about *him* even if we are not looking at him. What doesn't work in the use of algorithmic labels that don't take into account the flexibility of the interaction of the organism with the environment is that it focuses on the form and not on the meaning conveyed through the action. A meaning that transcends the form although being strictly dependent on it. The meaning depends on the form but at the same time it transcends it. This paradox answers the question posed by Claiborne Park: the meaning depends on the form because every other signifier will convey different nuances of the referent; but transcends it because not always the same form brings the same meaning. The flesh, the physical presence of the body modifies cognition, arouses it by resonance mechanisms. The body reacts to the movement of the World and moves itself with it. Moreover, while we speak, we move ourselves and we conform our movements and our bodies to understand each other. In understanding you, I feel what you are feeling, but—simultaneously—I feel that sensation isn't mine; in doing so, I discover that I exist and am an *I*. Consequently, I infer that who's feeling that sensation that I'm feeling that isn't mine, it is a *You*.

Bees can refer to something absent, but in an inflexible way. For example, they cannot rely on the referent, they can communicate to the others where special food is, but, in doing so, they use an inflexible genetic algorithm that impedes them from lying (Falzone 2012). So, let's come back to the title's question: why do bees not use pronouns? In presence of algorithmic behaviours, reference needs to be universal. Personal deixis is a performative behaviour for excellence, because—to be used and understood—it requires a continuous, active cognitive effort of interaction with the environment such as to accommodate the perspective fluctuations of the linguis-

tic message. It requires a sort of continuous readjustment of perspective. Just as after a leap, to find the balance, we give ourselves a thousand forces in different directions, inn the same way, the correct use and comprehension of pronouns presupposes that speakers continually suiting the flow of conversation.

The mere existence and linguistic universality of pronouns demonstrates our ability to mix incorporated perspectives and more abstract perspectives; or in general to vary the incidence of bodily perspective while understanding or uttering a sentence. The existence of pronouns demonstrates our ability to experience the world through different levels of integration of bodily perspective.

Naturally, reflections proposed here don't minimally aspire to be conclusive, but I hope they show the theoretical and philosophical potential hidden behind the study of these apparently not-so-useful (Williams 1998), complicated words that we call *pronouns*. Future research in this sense ought to investigate the developmental trajectories of the use of personal deixis in subjects with ASD; looking for eventual milestones in this linguistic acquisition; and to better investigate the acquisition of deixis in robots and confronting it with those showed in TD children.

§6.6 General conclusions

In this thesis, I tried to apply the classical method of cognitive sciences to a problem that can be considered both theoretical and practical: we are still unable to fully understand the ontogenetic development of language.

I think that the study of autism could be useful in order to get a better comprehension of this topic. Subjects with autism show us that our mind is

deeply social: our perception is social; our way of resolving mathematic tasks is social; our system of references is completely social.

This thesis is an attempt to describe ASD starting from the role of the body. By studying linguistic anomalies in subjects with autism I realized that these alterations will never be explicative of the deficit and that they could never be explained without considering pragmatic anomalies. If we want to understand autism and its linguistic anomalies, we had to start from the basic bodily communication.

Autism is the only the pathology that makes us able to observe how the non-linguistic communication and the linguistic communication develop when the subject cannot fully perceive the social cues. By observing this pathology we can deduce what non-linguistic and linguistic communication develop by social interactions.

Moreover, the study of autism can shed light on some ontogenetical issues related to language. Since Plato, we wonder about the origin of the first word. The background of embodied cognition, in combination with the definition of clinical pragmatics that I propose in this thesis, can overturn the classical position of pragmatics in human cognition. The classical view of pragmatics as "the trash of semantics" (Bianchi 2003; Domaneschi 2009) does not stand up after all the recent studies about the ontogenetic development on language in children with autism. Subjects with ASD don't have problem with computation or recursive abilities or with semantic memory; they have problem with eye-contact, emotion recognition, embodiment, pointing, etc… All these deficits will cause problems in ToM, executive functions, fixation of reference, irony, sarcasm, etc…

In other words, pragmatics is linked to our most atavistic part. What appears as a complex and specifically human attitude, such as the understanding and the production of ironic sentences or the categorization of words by flexible criteria, derives–ontogenetically–from pre-linguistic skills like eye-contact and pointing. Without these simple skills, we won't fully develop language.

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