ON THE COMPREHENSION OF PASSIVE SENTENCES AND RELATIVE CLAUSES BY A GROUP OF HEARING IMPAIRED ADOLESCENTS

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INTRODUCTION

When one considers the phenomenon of deafness, it is always surprising how many aspects are associated with this. Deafness is also called the 'invisible disability' due to the fact that this deficit is not immediately visible if you do not enter into relationship with people who are deaf. In fact in interacting with them you can find out for example that your interlocutor is a deaf signer (one who uses sign language) or that under his/her hair he/she wears a hearing aid. Once you enter this world of deafness, an infinite number of aspects are linked to their status.

These issues relate to, for example, the identity of the deaf person as belonging to a community of deaf or hearing people (or both) depending on the method of re-education and communication used by them. Some deaf people indeed do not recognize sign language as their own language but rely exclusively on the oral. Beyond that, the features that contributed to deaf people being a heterogeneous population are due to physiological differences, and cultural and social aspects that contribute to these developments.

Another important aspect to be considered is the acquisition of the oral language by deaf people. The hearing deficit, indeed, involves the partial or total inability to hear and affects the acquisition and development of linguistic abilities. A damage to the auditory canal prevents deaf people from having direct access to linguistic input and consequently from having typical language development.

This study investigates the comprehension of two Italian linguistic structures - passive sentences and relative clauses - by a group of hearing impaired adolescents. The group included eight teenage boys and girls with profound hearing loss, and three with severe hearing loss; which attended the I.S.I.S.S. ‘A. Magarotto’ high school in Padua. They ranged in age from 14;7 to 17;8 and the majority of them did not use any hearing aids or cochlear implants. All of them were Italian except for three that were of a different nationality, but had lived in Italy for many years.

Results show that, despite the age of the partecipants, their performances are comparable to that of younger typically-developing children.
These two particular structures were chosen because they were considered to be more difficult to acquire due to their complexity. In addition, there has been very little research in this field with this population, and so it was felt to be an area where a further positive contribution could possibly be made.

In Chapter 1 I will outline some information related to deafness, starting from a description of the anatomy of the ear, then listing the types of hearing impairment that follow based on the damaged part of the ear. Subsequently I will indicate the different degrees of hearing loss and the various periods of onset of hearing impairment and the final paragraph will indicate the existence of various educational methods.

In Chapter 2 I will indicated the effects of hearing impairment on language acquisition. Initially I explain the stages of language development in children with typical development and then compare it with that of deaf children, identifying the main language difficulties related to hearing impairment. Then I will describe the structure of passive sentences and relative clauses, indicating the processes of their acquisition both in hearing impaired and in typically developing children. For relative clauses I will illustrate some theories that explain the asymmetry between the different structures of restrictive relative clauses.

In Chapter 3 I will introduce the study describing the participants and the tests that were used; the first of these is the TCGB test, a standardized test used to investigate the general linguistic abilities of the hearing impaired adolescent students. This test will be explained together with the results obtained and then the findings discussed.

In Chapter 4 I will focus on the comprehension of passive sentences and relative clauses; the first paragraph dedicated to the former structure, describing the test, the procedure and the results. In the second paragraph I will outline the same as regards the relative clauses test. In the last section I will report some brief conclusions.

In Chapter 5 I offer the central conclusions from the experimental study.
CHAPTER 1
HEARING IMPAIRMENT

1.1 INTRODUCTION

Deafness is a hearing deficit which involves a partial or total inability to hear. In Italy the birth rate of deaf people is around one per thousand of which 5% are born to deaf parents and 95% to hearing parents (Maragna 2000). This percentage of deafness is almost constant over time.

There are several factors as to why the deaf population turns out to be a very heterogeneous group. By this I refer to the physiological, linguistic or educational variability characterizing each deaf subject.

The part of the ear where the damage is collocated, for instance, determines the type of deafness of the subject (conductive, sensorineural, combined, central) and the resulting entity of hearing loss. The various degrees (mild, moderate, severe, profound) are measure values of frequencies perceived and expressed in decibels, and precisely determine the degree of hearing loss.

The period of onset of deafness affects the development of language skills according to the age range in which it occurs, the specialists divide this period into pre-lingual and post-lingual deafness.

In addition, the type of education planned for the deaf child has consequences for the cognitive and linguistic development of the child, the kinds of social interaction, and their awareness of personal and cultural identity.

This chapter will elaborate these aspects starting with a description of the ear anatomy and its functions.
1.2 EAR ANATOMY

Outer, middle, and inner portions comprise the ear. In the outer ear, the pinna is located and is made of ridged cartilage. The middle ear consists of the eardrum and three small bones called hammer (malleus), anvil (incus), and stirrup (stapes). The Eustachian tube serves to connect the middle ear to the throat in order to keep the air pressure well balanced. The last section - the inner ear - is composed of the cochlea, vestibular system, and auditory nerve. The cochlea appears to be a spiral; it contains a liquid and a population of sensory cells (hair cells).

Figure 1. the ear

The sound is carried inside the ear canal, causing the displacement of the tympanic membrane and then the eardrum vibrates with sound. These sound vibrations then pass through the ossicles to the cochlea which cause the internal movement of fluid; this movement stimulates the hair cells. These hair cells then generate neural signals that are conducted by the auditory nerve to the brain. The hair cells in the initial end of the cochlea send information regarding low-frequency sounds, which become more acute along ‘the spiral’ to reach the apex in the inner end of the cochlea, and the auditory nerve then sends signals to the brain, which are then interpreted as sound.

1 The picture has been taken from the following website (December 2014) http://manumissio.wikispaces.com/Deafness
1.3 TYPES OF HEARING IMPAIRMENT

Types of hearing impairment can be categorized according to the area in which the auditory system is damaged.

- **Conductive hearing loss.** This concerns damage of the outer or middle ear and occurs when sound is not conducted efficiently through the outer canal to the middle ear. People with this kind of disturbance hear the sounds softened and also losing the perception of low-pitched tones.

- **Sensorineural hearing loss.** This occurs when there is damage to the inner area, cochlea or the nerve, which is linked to the brain. The subjects hear imprecisely and have difficulties in recognizing sounds, especially high-pitched tones.

- **Combined hearing loss.** This type derives from damage in the inner ear and the outer or middle ear. Thus, sensorineural hearing loss can combine with conductive hearing loss. Namely, in addition to some irreversible hearing loss, there is also a dysfunction of the middle or outer areas that yields the hearing worse than the sensorineural hearing loss alone.

- **Central hearing loss.** This kind can be found in individuals with lesions to the auditory cortex, or to damage to the roots of the auditory nerve. The sounds are not properly interpreted despite reaching the brain area.

1.4 DEGREE OF HEARING LOSS

The degree of hearing impairment varies in relation to the hearing loss measured by audiometric testing. Sound intensity is measured in decibels (dB), a logarithmic unit of frequency or pitch which is measured in units called hertz (Hz). Hearing is usually measured on a scale of frequencies ranging from 125 Hz up to a maximum of 8000 Hz, and on a scale of intensity ranging from -10 dB to 110 dB.

The hearing threshold level (HTL) for each ear is represented in a graph: on the ordinate axis the hearing loss is expressed in decibels. The upper part shows the acoustic perfection (0 dB) and the lower the various losses, usually up to 120 dB. The horizontal axis shows the various frequencies and the sounds are distinguished in
relation to the frequency, namely the number of vibrations per second or cycles per second expressed in Hertz. Audiometric examination tests for the main frequencies audible to the human ear. The degree of hearing impairment is represented as the average of the HTL for the three of these frequencies which are considered to be the most important for the reception of speech (500, 1000 and 2000 Hz) (De Filippis Cippone, 1998).

The following picture shows two examples of audiograms, the one on the left side belongs to a person with normal hearing and the one on the right side belongs to a person with severe hearing loss. The blue line (x) identifies the left ear and the red line (o) identifies the right ear.

![Audiograms](http://omicron.wiserhosting.co.uk/~schoolt/deaf_studies/audiology2/levels.htm)

Figure 2. Examples of audiograms

According to the B.I.A.P. (Bureau International d’Audiophonologie) classification, the level of hearing loss is distinguished in the following categories:

- Normal hearing: lower than 20 db
- Mild hearing loss: 21 – 40 db
- Moderate hearing loss: 41 – 70 db
- Severe hearing loss: 71 – 90 db

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2 The picture has been taken from the following website http://omicron.wiserhosting.co.uk/~schoolt/deaf_studies/audiology2/levels.htm (December 2014)
• Profound hearing loss: 91 – 119 db
• Total hearing loss: higher than 120 db

1.5 ONSET OF DEAFNESS

The period of onset of deafness, produces an impact more or less serious on the language skills of deaf individuals in relation to the age: these periods are distinguished between pre-lingual and post-lingual.

Pre-lingual deafness can be divided into two classifications:

• deafness arose before the age of one, period in which the process of language acquisition has not yet started. In this case deafness is defined as congenital.

• deafness arose between the age of one and three, before that time oral language is not entirely acquired and the consequence for language development appears to be consistent. In this case deafness is defined as acquired.

Post-lingual deafness can be divided in:

• deafness arose in the first childhood, it refers to a span of age between three and seven, within which language ability is not yet consolidated. The onset of a profound or severe hearing impairment in this period involves a regression of the linguistic abilities.

• deafness arose in the second childhood, after the age of seven, a period in which damage is not so serious because the language is already acquired.

Deafness may occur before birth as well, when it is referred to as congenital causes and it can be genetically inherited or acquired during pregnancy (De Filippis Cippone, 1998).
1.6 EDUCATIONAL METHODS

As mentioned earlier, the deaf population cannot be defined as a homogeneous group, in fact every deaf person has different characteristics due to various factors. An interesting aspect relates to the approach of the method of education or rehabilitation intended for them which often depends on the background of the parents or the rehabilitation philosophy of doctors and speech therapists on whom the parents rely following the birth of a deaf child. This variety of approaches has consequences for the deaf person in terms of identity, development of language abilities both in the oral and sign language, and considering these factors, regardless of the approach adopted, each individual seems to be unique in terms of their level of linguistic competence (Bertone, Volpato 2009). Based on the orientation chosen, the deaf person can be exposed to the input language in various ways consisting of the use of signs or speech language.

The oralist method employs exclusively written and spoken language without any use of signs. This approach is usually chosen for deaf children born to hearing parents, and is based on the exploitation of the ear canal through hearing aids or cochlear implant in conjunction with lip-reading. Hearing aids are external devices and perform better in amplifying sound and coding low sound frequencies. Cochlear implants are instead devices that are surgically implanted in the inner ear (actually in the cochlea) in order to stimulate the auditory nerve, and are activated by an external device, which is worn outside the ear. These implants are designed to code mid and high sound frequencies in which speech information is contained. (Hammer 2010). Generally the oralist method excludes individuals from the teaching of sign language because it is thought that it would have a negative effect on oral speech.

Sign language is a visual gestural language, which is considered a full-fledged natural language (Newport & Supalla 1999, Bertone, Volpato 2009). Children born to deaf parents are usually exposed to this type of language, as they can learn it naturally from their parents (and probably also from the deaf community to which they may belong). There are, in addition, a small percentage of “hearing families” who choose the use of sign language for their deaf children.

The bimodal approach combines the oral and the visual-gestural modalities, but it fundamentally follows the grammar rules of the oral language (in the case in point,
Italian) (Beronesi et al. 1991). In this approach, signs accompany the words, thus maintaining the linear order of the oral language. However, for functional categories that do not have an equivalent sign, a manual alphabet or signs of fantasy can be substituted.

Bilingual education involves exposure of the deaf child to both sign language and oral language. The child is exposed to two languages in parallel in two separate contexts (for example, school and family) or from two different sources (for example, deaf/hearing parents). In this context, bilingualism concerns the learning ability of deaf children of two different linguistic systems, one oral and one signed. These two languages are used in different situations and with different interlocutors, and also to avoid linguistic interference phenomena. This approach offers deaf people the opportunity to communicate spontaneously regardless of the environment in which they are located (deaf or hearing) and consequently to have access to both cultures, in developing language, cognitive and cultural skills, and personal identity (Cavalleri & Chiricò 2005).
CHAPTER 2

THE EFFECT OF HEARING IMPAIRMENT ON LANGUAGE ACQUISITION

2.1 LANGUAGE ACQUISITION

2.1.1 Language development in typically developing children

Language acquisition takes place at the same time and identical manner for all children regardless of the language to which they are exposed and the method of expression of the language (oral or sign language) (Guasti 2007). For example, children who are born into an environment where people speak Italian, will learn the Italian language; others born into an environment where German is spoken, they will learn German. Furthermore, children exposed to Italian by one parent and German by the other will learn both languages (Taeschner 2003). The same phenomenon occurs where a deaf child is exposed to sign language. This process called ‘faculty of language’ affects the attitude of every child to learn a language to which they are exposed from birth or early in life.

Deafness is defined as an invisible disability, so the development of language in deaf child undergoes an arrest or a delay due to a deficit in the auditory canal. Many studies have shown that from the first year of life, there is a perceptive capacity and production of the sounds according to the language to which they are exposed (Kuhl 1991). Others argue that linguistic signals have already been learned from the last trimester of pregnancy (Caselli et al., 2006). Because of this deficit, the deaf child is excluded from these early processes. As stated previously, the faculty of language is present in every individual, but it requires a suitable environment in which to make it possible for language to develop. Many researchers suggest, furthermore, that a specific period of time exists within which this may occur. Lenneberg (1967) named this span of time a ‘critical period’ and affirmed that exposure to language within a certain time period is critical to stimulate the child’s language, and he fixed puberty
as the end point of this period. Guasti (2007), in contrast, spoke of a ‘sensitive period’ considered optimal for the acquisition of such ability (not fixed by time period) which is acquirable even after this, although not optimally. In addition, Guasti pointed out the existence of multiple sensitive periods depending on the linguistic component considered; the resulting sequence of these periods results being phonology, morphosyntax and syntax, and morphology.

2.1.2 Language development in hearing impaired children

For deaf people, the acquisition of oral language is not natural and spontaneous as in hearing people because they do not have direct access to the linguistic input. Language development of the deaf child differs therefore quantitatively and qualitatively compared to that of the hearing child, but nevertheless there is an analogy in the early stages of language production.

At birth, the infant’s phonatory apparatus is not equipped to produce speech sounds; in fact, the child produces mostly vegetative sounds associated with shouting and crying. From 3 to 4 months of age, the phonatory apparatus begins to change (including descent of the larynx and oral cavity expansion) and the child is able to control the air pressure and produce sounds with more hues. Around 6 months, the hearing child begins to produce sounds similar to those of language and between 6 and 8 months starts 'babbling'.

Babbling is a form of linguistic production which is characterized by a syllabic organization, a use of a subset of sounds present in languages and in the absence of an associated meaning. (Guasti 2007:94). This phenomenon consists of repetition of the same syllable or different syllables. The former is known as canonical babbling (bababa), (dadada), while the latter as variegated babbling (badabada).

Hearing impaired children begin babbling not earlier than 12-25 months (Oller & Eilers 1998). Although these forms of babbling are initially quite similar, after a few months the sound tends to differ compared to the hearing children and the types of consonants produced, for example, are essentially labial consonants (Bortolini et al. 2002, Marschark 2009).

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3 Pettitto & Marentette (1991) have observed that in sign languages there are babbling manual gestures that have the same characteristics as the oral, and follow the same temporal stages.
As regards the development of vocabulary, some studies have shown a marked delay in deaf children and a slow increase of the lexicon compared to their hearing peers. This development is characterized by an absence of the period of ‘explosion’ of the lexicon, the phenomenon is detectable in typically-developing children (Lederberg & Spencer 2001; Lederberg 2003). Other researchers argue that the development of vocabulary is independent of the degree of hearing loss of the child, but with a more severe hearing loss (70 dB and above) affecting the amplitude of the vocabulary there is a longer delay in the acquisition of new words (Fenson at al. 1994). Despite this delay and in addition to the difficulty of understanding words with more than one meaning, hearing impaired children seem to have pathways of vocabulary development similar to those of hearing children (Volpato 2010).


Overall, although other cognitive skills are not deficient, generally deaf people manifest more language difficulties than their peers with normal hearing: poor vocabulary, use of short sentences, difficulties with complex and subordinated sentences (passive sentences and relative clauses), errors agreement of gender and number, difficulties in the use of verbal morphology (use of the infinitive, omission of copula, auxiliary, and modal verbs) and omission or substitution of functional elements (determiners picture representing the item, clitic pronouns and prepositions) (Caselli et al., 2006; Chesi, 2006; Volpato, 2010).

Some examples are now considered from Chesi’s study (2006) in which he investigated the oral and written production in a heterogeneous group of children and adolescents, ranging in age from 6 to 17 years and having a severe or profound hearing impairment.
First of all, he found a significant correlation in participants between mean length of utterance (MLU)⁴ and in production of atypical forms. Children with low MLU had the highest percentage of non-standard responses in different contexts whereas in those children with high MLU atypical forms were less.

In considering the analysis of different functional areas such as the determiners, the verbal inflection and the complementizers, these have emerged as a common trend in relation to following: the omission of the determiners, the use of the infinite optional, the incorrect usage of inflected forms incorrectly, the absence of complementizers, and the use of conjunctions replacing the complementizer.

In particular as concerns articles the omission of these elements seems to be quite common in hearing impaired subjects; the highest percentage of omissions was in the post-verbal position (95%) (il gatto prende ø toast ‘the cat takes ø toast’ Target: Il gatto prende il/dei toast ‘the cat takes the/some toast’). Furthermore, definite forms were more frequently produced than indefinite or partitive ones. The most problematic article forms were respectively masculine plural (41%) (Tom scivola e rompe ø piatti ‘Tom slips and breaks ø dishes’) masculine singular (35%) (scende con ø latte ‘he goes down with ø milk’), feminine singular (18%) ((Questa è la tua scuola?) Si mia ø scuola ‘(is this your school?) Yes my ø school’), and feminine plural (6%) (È mio ø carte ‘(it) is my ø cards’).

Accusative, dative and reflexive clitics were systematically omitted by them, repeating the object DP or leaving a gap in both positions. Enclitic pronouns were omitted more than proclitic ones. Interestingly, in some cases the clitic pronoun was produced and often the correct agreement between the clitic and its antecedent/referent and correct case assignment was attested.

The verbal inflection is characterized by errors regarding the lack of agreement between subject and object, and errors of number (tutta la compagne ‘all the(FEM.SING.) partners(FEM.PL.’)) or person features (tu ha vinto! ‘you has win!’). In addition, compound verbs were only attested in a small number of productions and generally auxiliary verbs were correctly used, although some substitutions of the verb essere ‘to be’ with avere ‘to have’ were attested (Tom ha scivolato ‘tom has slips’). In place of optional infinitives the finite form was used, and temporal and agreement

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⁴ The MLU is a measure that is determined by counting the words in a sentence and then averaging them (Guasti 2007:132)
verbal morphology were sometimes expressed by other elements, such as lexical subjects, pronominal subjects, adverbs (quando professore parlare si capito ‘when professor to speak yes understand’, dopo fare i compiti io ‘then to do homework I’). The use of the complementizer to produce more complex sentences is often omitted, or is replaced by a conjunction. The main complementation problems seem to be in relative clauses where they were replaced with the complement of coordinating.

2.2 Passive sentences

2.2.1 Structure

Passive sentences are complex structures characterized by a long-distance dependencies between syntactic constituents. Turning an active sentence into a passive sentence involves the reorganization of the constituents, and the movement of the object (theme) of the verb to the position of the subject of the sentence (determining the agreement with the verb), introduced by the preposition by. Furthermore, this movement forms an A(rgumental)-chain between the underlying object and subject positions.

Phrases in (1a) and (1b) are respectively examples of a sentence moving from an active to a passive voice.5

(1)  
a. Marco pushes Sara

b. Sara is pushed (by Marco)

A particular aspect of the Italian language is to allow the construction of passive sentences using two auxiliaries: both essere (to be) or venire (to come) being correct.

However, the following reading results in ambiguity when the auxiliary is essere (to be) rather than venire (to come). Indeed in a sentence such as la porta è aperta (the door is open), the word aperta ‘open’ is either an adjective or a verb and consequently the sentence can produce a stative, a resultative, or an eventive reading.

5 The examples has been drawn from the test of Verin (2010)
In sentences such as *la porta viene aperta* (the door is being open), the word *aperta* ‘open’ may only be analysed as a verb, and therefore only an eventive reading of the sentence is possible (Volpato et al. 2013).

### 2.2.2 Acquisition in hearing impaired and typically developing children

Studies have been conducted on the acquisition of passive sentences by typically-developing children in contrast to the volume of research on hearing impaired people. Some studies on adolescents conducted in America date back to the 1970’s and 1980’s. Schmitt (1968) reported difficulties in the comprehension and in the production of passive sentences in subjects up to 14 years, arguing also that at the age of 17 years these constructions are not yet fully acquired. Power & Quigley (1973) showed how these problems are related to the absence of the by-phrase. Gormley & McGill-Franzen (1980) argued that the context in which passives are used can facilitate the children’s understanding. Instead of a sentence in isolation that lacks a context to disambiguate the grammatical relations between words.

Recently, Franceschini (2013) conducted the first longitudinal study on passive sentences in Italian; she investigated the comprehension and production by two twins with mild-to-moderate hearing loss. Franceschini observed that passives with actional verbs are comprehended better that those without, and the presence or absence of the by-phrase did not influence their performance. In addiction, sentences built with the auxiliary ‘venire’ show better results compared to those with the auxiliary ‘essere’, although these also had high scores. She found an improvement of the twins performance between the first and the second test administration.

The main research concerning passive sentences has analysed different aspects of these structures by focusing on certain variables such as the type of verb used (actional versus non-actional), the presence or absence of the by-phrase (long passives versus short passives) or the interaction between them.

Studies on the acquisition of passive sentences have been reported in several languages, such as: English (Bever, 1970, Maratsos et al. 1985, Borer & Wexler 1987, Gordon & Chafetz 1990, Fox & Grodzinsky 1998, Stromswold et al. 2002, Wexler 2004, Hirsh & Wexler 2006), Spanish (Pierce 1992), Japanese (Sugisaki 1998, Sano...
Bever (1970) attributed this problem to general difficulties with non-canonical word orders. Maratos et al. (1985) observed that in the English language, acquisition of the passive does not occur before the age of five. These authors found that passives with actional verbs are better comprehended than passives with non-actional verbs, while such difficulty was found with actional verbs in the active form.

Borer & Wexler (1987) argued that young children’s experience difficulty is due to their inability to form an A-chain between the underlying object and subject position, and cannot correctly assign the thematic role to the displaced object, therefore interpreting these sentences incorrectly; the authors called this phenomenon the A-chain Deficit Hypothesis (ACDH). According to Borer & Wexler, this inability is genetically determined and is manifest itself up to the age of five. Within this period they would be able to interpret only adjectival passive sentences (without A-chain movement) which are constructed generally with actional verbs and without the by phrase. Hirsh and Wexler (2006) reformulate Borer & Wexler (1987)’s proposal claiming that children’s passives do not contain adjective allowing a stative reading, but contain verbs expressing a state as the result of an event giving a resultative expression.

Gordon & Chafetz (1990) attribute the problem with passives to their direct input scarcity as child develops.

Fox & Grodzinsky (1998) have noted that in a subgroup of children aged 3;6 and 5;5, the performance was problematic only with non-actional long passives unlike actional passives both with and without the by phrase, and non-actional short passives. They argued that children do less well with non-actional verbs because of their computational abilities: this structure involves, indeed, theta-role transmission in addition to the A-chain. In non-actional short passives, theta role transmission is not involved.

Driva & Terzi (2008) analysed data from studies of Greek children, and observed that the presence or absence of the by phrase is irrelevant in the comprehension of passives.
Chilosi & Cipriani (2006) have shown in a study of Italian children that passive sentences with irreversible verbs (e.g. *la macchina è lavata dal bambino* ‘the car is washed by the child’) are acquired almost entirely by the age of five. Passive sentences with reversible verbs (e.g. *la bambina è pettinata dalla mamma* ‘the child is combed by the mother’) and with verbs that express an improbable event (e.g. *il cane è morso dal bambino* ‘the dog is bitten by the child’) are instead acquired at the age of 5;6.

Volpato et al. (2013) investigated data on Italian-speaking children and adults, confirming the results of Driva & Terzi (2008) for which there is not a difference between long or short passives. However, they noted an asymmetry between actional and non-actional passives, where the former are better comprehended than the latter. They have shown that young children are able to comprehend correctly passive structures containing the auxiliary *venire* (to come) which emphasize the conduct of an event expressed by verb. As explained above the auxiliary *venire* can only have an eventive reading. According to the authors, the result shows that children have mastered these structures as well as the A-chain very early.

### 2.3 Relative clauses

#### 2.3.1 Structure

Relative clauses are complex subordinate structures characterized by long-distance dependencies between syntactic constituents, and these kinds of clauses modify a nominal element (antecedent) which is the head of the relative clause, and can be either the subject or the object in the main clause, as the examples (2) and (3) show:

(2)  
*la pecora che colpisce i gatti*

‘the shep that hits the cats’

(3)  
*I gatti che la pecora colpisce*

‘the cats that the sheep hits’

---

*The examples have been drawn from the test of Volpato (2012).*
The relative clause is introduced by either a relative pronoun (e.g. *al quale* ‘to whom’) or a complementizer (e.g. *che* ‘that’) (Renzi, Salvi, Cardinaletti, 2001).

In relative clauses, the movement of the constituents involves the creation of an A' chain (not argumental) that connects two positions, the one from which the movement originates, occupied by an unpronounced copy of the constituent moved, and the final position in which the relative constituent is pronounced.

Relative clauses are divided into appositive and restrictive. The former add information already known and it is not necessary to understand the phrase, whereas the latter modify the antecedent restricting the number of possible referents for it.

In my own research, detailed later, the type of relative clauses analysed are the restrictive ones. The head of these clauses can have the role of both the subject (SR) and object (OR) of the embedded phrase and this also delimits the range of possible referent for it. Restrictive relative clauses belong to the syntactic category labelled as CP and are embedded in a complex nominal expression named DP (Cinque 1982, Vergnaud 1985, Rizzi 1997, Bianchi 1999, Zwart 2000). Subject and object relative clauses are different depending on the constituent that is moved: in SR, it is the subject moving from the embedded position, while in the OR, it is the object. While in SR the canonical order of the constituents is preserved (subject, verb, object), in the OR the object precedes the embedded subject producing a non-canonical word order (object, subject, verb). Both are introduced by the complementizer *che* (‘that’) and contain a gap which marks the initial position of the element which has been moved by the subordinate clause to the relative/principal clause.

The following phrases in (4) and (5) are examples of SR and OR, respectively:

(4)  *il pesce* che <*il pesce*> segue le tartarughe
    ‘the fish that <the fish> chases the turtles’

(5)  *il bambino* che la nonna pettina <*il bambino>*
    ‘the child that the grandmother combs <the child>’
With regard to the syntactic derivation of relative clauses, early research suggests that these phrases are derived by \textit{wh}-movement of a relative operator (Cinque 1978, 1982). This operator moves from the embedded position, in which it is originated, to a higher position in the sentence, namely Spec/CP. In this position the operator is coindexed with the relative head and then they create a chain with each other. According to these accounts, a SR is derived as in (6) and an OR as in (7):

\begin{align*}
\text{(6)} & \quad [\text{DP II} [\text{NP} \text{pesce}, [\text{CP OP, che [IP ti segue le tartarughe]}]]] \\
\text{(7)} & \quad [\text{DP II} [\text{NP} \text{bambino}, [\text{CP OP, che [IP la nonna pettina t]}]]]\
\end{align*}

According to recent studies, it is the relative head itself and not the operator which moves in subject and object relative clauses (Vergnaud 1985, Kayne 1994, Guasti & Shlonsky 1995, Bianchi 1999, Cinque 2009). The syntactic derivation that results for the two types of sentence is the following:

\begin{align*}
\text{(8)} & \quad [\text{DP II} [\text{CP [NP pesce]} \text{che [IP [NP t] segue le tartarughe]}]]]\
\end{align*}
Additionally, my research has analysed, as well as the subject relative clauses, two types of object relative clauses. One of the two (OR) has already been considered and is characterized in a preverbal embedded subject as in (8); the other is constructed with a post verbal embedded subject (ORp) as in (10); the phrase therefore has the following order of constituents (object, verb, subject).

(10)  I conigli che pro tira la gallina <I conigli>

‘the rabbits that pro pulls the hen <the rabbits>’

The term ‘pro’ before the verb indicates a null pronoun. Italian is a pro-drop language in which the subject of finite sentences can be omitted and can be deduced from the context. This parameter provides the possibility for the subject to be in either a
preverbal or post-verbal position, unlike the non pro-drop languages such as English. The following examples demonstrate this:

(11) a. Gianni ha vinto
    ‘John has won’

    b. Ha vinto Gianni
    * has won John
    ‘John has won’

When a relative clause contains semantically reversible verbs there may be ambiguity between a subject and an object reading. In fact, when both DPs have the same feature number the phrase does not have a clear subject or object interpretation, since both DPs can be the subject of the embedded sentence:

(12) L’orso che saluta la tartaruga
    ‘The bear that greets the tortoise’

In the previous sentence, a subject reading implies that ‘the bear is greeting the tortoise’, and the gap is therefore in the preverbal embedded subject position. In the object reading, ‘the tortoise is greeting the bear’ and the gap is in the post-verbal embedded object position.

However, the phrase may be unambiguous if the DPs have different number features. Since in Italian the verb agrees with the subject morphologically, the agreement allows the interpretation of SR as in (13) or OR as in (14).

(13) le scimmie che <le scimmie> fermano il pinguino
    ‘the monkeys that <the monkeys> stop the penguin

(14) le scimmie che l’elefante insegue <le scimmie>
    ‘the monkeys that the elephant chases <the monkeys>’
Through a syntactic strategy, even in a condition of equality of the features number of DPs, it is possible to make the sentence not ambiguous by placing the subject of the embedded sentence in a preverbal position.

(15) l’orso che la tartaruga saluta <l’orso>
    ‘the bear that the tortoise greets <the bear>’

2.3.2 Acquisition in hearing impaired and typically developing children

The structural complexity of relative clauses tends to delay their acquisition. Although their production begins at the age of 2 or 3 (Guasti 2007), comprehension occurs relatively later, even after the age of 6 years (Hakansson & Hansson, 2000; Sheldon, 1974).

Numerous studies have investigated the acquisition of relative clauses in different languages, and in various populations such as typically-developing people, children with specific language impairment (SLI), aphasic people and the hearing impaired population. The results seem to follow a common line in demonstrating that the ORs are more problematic than the SRs, both in comprehension and in production.

This asymmetry was observed in the Italian language for typically developing children (Arosio et al. 2005, Adani, 2008; Adani et al. 2010; Guasti & Cardinaletti, 2003; Utzeri, 2007; Volpato, 2010), for adults (De Vincenzi, 1991; Volpato, 2010); for SLI (Adani, 2008) for aphasic patients (Garraffa & Grillo, 2008), and for hearing impaired children (Volpato & Adani 2009; Volpato, 2012; Volpato & Vernice, 2014).

Other studies in different languages have been published on typically-developing children: for those speaking Hebrew (Friedmann & Novogrodzsky 2004, Arnon 2005), for children affected by SLI (Stavrakaki 2001 for Greek; Friedmann & Novogrodzsky 2004, for Hebrew; Adani et al. 2007 for English).

Some research undertaken on hearing impaired subjects in different countries includes the following: for English speaking children (Quigley et al. 1974, and Engen & Engen 1983) and for Hebrew speakers (Friedmann & Szterman 2006; Friedmann et al. 2008, Friedmann, Stzermann and Haddad, 2010).
On typical populations Arosio (2005) and Adani (2008) tested the comprehension of restrictive relative clauses in 5 to 11 year old and 3 to 7 year old children, respectively, using the same picture selection tasks but with different methodology. They investigated three conditions: subject relatives (SR), object relatives with a preverbal embedded subject (OR) and object relatives with a post-verbal embedded subject (ORp). Their results indicate that SRs are comprehended better than ORs, and ORps being more problematic than ORs. At the age of 3, children are able to comprehend subject relatives and then from the age of 4 object relatives with preverbal embedded subjects. Only by the age of 11 are object relatives with post-verbal embedded subjects comparable to adult performance. Friedmann and Novogrodsky (2004) tested a group of children (mean age 4;7) in the comprehension of subject and object relative clauses, using a picture selection task similar to previous tests. The results confirmed the findings of previous studies in which performance was poor on object relatives in contrast to subject relatives, which were correctly interpreted.

With the hearing impaired population, Friedmann et al. (2010) tested a group of Hebrew-speaking deaf children (age range 9;1-12;3) and a group of Palestinian Arabic deaf people (age range 9;0 – 21;0). This research focused on the comprehension of sentences derived by wh- movement, among which relative clauses. The comprehension of object relative clauses was problematic in both groups, and object interrogatives were less accurate than subject ones. As argued previously by Friedmann and Stzermann (2006) these results showed that the deficit could be ascribed to those particular structures derived form the movement of the constituents.

Volpato and Adani (2009) tested a group of 8 hearing impaired children with cochlear implants (CI) and three groups of children with typical language development. The results showed that the performance of children with CI was less accurate than that of the control groups. However even in this study all groups performed better in a gradient of difficulties such as SRs>ORs> ORps, and claimed that the deficit with ORs in hearing impaired children depends on subject-verb agreement.

Volpato (2010) found the same results as Volpato and Adani (2009) studying a group
of hearing impaired children with cochlear implants (CI) and a group of normal hearing children. Furthermore, the author verified the comprehension of relative clauses in ‘Match and Mismatch’ conditions; namely when DPs have the same Number features or both the embedded DP and the relative head have different Number features. The results showed that Number features support the comprehension of ORs in hearing children unlike hearing impaired children, who are not sensitive to Number features.

Adani et al. (2010), tested three groups of hearing children ranging in age from 5;7 to 9 years on the comprehension of centre-embedded object relatives, arguing that the internal features of the DP (Number or Gender) regulate the difficulty with ORs. The results revealed that Mismatch conditions are more accurate than Match ones, and Number features are more accurate than gender ones. The researchers conclude that Number features of DPs modulate the comprehension of ORs as Volpato (2010) found in her research on hearing children comparable with hearing impaired children.

2.4 Discussion

2.4.1 The Minimal Chain Principle

The asymmetry of the comprehension between subject relatives and object relatives with preverbal embedded subjects can be explained with the Minimal Chain Principle (De Vincenzi, 1991), where short dependencies are observed to be less difficult to process than longer ones. The element moved and its trace in fact form a short chain in the case of SR, a longer chain in OR and exactly two chains in the case of ORp, one between the name and its origin position, and another between the pro and the post-verbal element which are coindexed.

(16) Il coniglio che <e> colpisce i topi

\[
\text{short chain } \text{<head DP, e>}
\]

‘the rabbit that <e> hits the mice’
2.4.2 The Relativized Minimality

A more recent theory, related to a linguistic analysis, is determined by the Relativized Minimality Principle (RM) (Rizzi 1994, 2000), which suggests that a relationship between two constituents X and Y, respectively the target position of the element and its origin position, cannot be constituted if a third element Z intervenes.

RM is exemplified in the following scheme:

(19) x…..z…..y

Each syntactic node is associated with a structural class which is characterized by a
set of morphosyntactic features (Rizzi 2004):

- Argumental (A), as a person, gender, number, case;
- Quantificational (Q), as the negatives, the wh-, the topic and relative.

The element Z represents a disturbance because of its 'identity traits' with the other two elements. In fact, in relative clauses, the head of the DP and its trace belong to the Quantificational class in contrast to the embedded DP that belongs to the Argumental class:

\[(20) \quad [+R, +A, +R]\]

indica il cavallo che i leoni stanno inseguendo <il cavallo>

‘point the horse that the lions are chasing <the horse>’

A mature and uncompromised system can properly assign these set of traits, whereas in an immature system the distinction between Q/R and A classes is not available, consequently children fail to process object relative clauses (Grillo 2008, Friedmann et al. 2009, Volpato & Adani 2009).

More recently, Friedman et al. (2009) investigated the difficulties with object relatives in comparison to subject relatives by Hebrew-speaking children, and proposed a theory slightly different compared to the previous one. They argued that in ORs, the intervention of a lexical NP generates 'lexical restrictions' blocking the relation between head DP and its copy.

\[(21) \quad [+R, +NP] \quad [+NP] \quad [+R,+NP]\]

indica il cavallo che i leoni stanno inseguendo <il cavallo>

The intervening element (+NP) is present both in the head DP and in the embedded DP, and includes a subgroup of features in common with the moved DP. Consequently, in a child grammar if the intervening element (I leoni) shares a set of traits that also belong to the element moved (il cavallo) they cannot process this structure because of the high cost of computation of their memory system; it is
necessary that the traits are completely disjointed. They affirmed, however, that
manipulating the properties of the embedded DP improves accuracy when using, for
example, an arbitrary pro subject.

2.4.3. The theory of Agreement

However, RM is not able to account for the asymmetry between OR and ORp; in order
to interpret this phenomenon, based on the proposals by Guasti and Rizzi (2002) and
Franck et al. (2006), Adani & Volpato (2009) adopted the minimalist theory of

According to this theory, syntactic constructions are created in three operations
called Merge, AGREE and Move: in the first process (Merge), the verb merges with its
arguments within the VP, and subsequently activates the functional projection of IP
where the relationship of agreement between subject and verb is established. The
subject imports the features of number and person from VP to I thus establishing a
relationship, defined as AGREE. Subsequently, the verb moves to I to check the
morphology of number and person in an operation called MOVE; and finally, the
subject which is inside the VP moves to SPEC I entering into an agreement
relationship with the SPEC-Head's verb.

In summary, the agreement is composed of a dual process: AGREE and SPEC-Head
checking.

In ORs, the agreement is established through both AGREE and SPEC-Head (22); the
agreement being robust because it is double-checked. On the contrary, in ORps the
relationship is established only through AGREE (23), and this agreement is fragile.
2.4.4 Attraction and agreement phenomena

With regard to the Number features of the DPs, Chesi 2006 and Chinellato 2004 argued that in atypical populations, Number features might be inaccessible or underspecified in verbal plural forms.

In Italian, the verbal plural form of the 6th person is constructed by adding the morpheme -no at the (unmarked) 3rd person (Thornton 1999), as shown in the following sentence (24):

(24) La giraffa che le zebre tira-no <la giraffa>

‘the giraffe that the zebras pull <the giraffes>’

In analysing performance on deaf subjects, Volpato (2010) argued that the morpheme marked -no seemed to fail in entering into the system of computation, thus leaving the basic form (tira) that no longer agrees with the embedded DP (le zebre). Consequently there is a phenomenon of attraction (Kayne 1989) for the singular (unmarked) features of the Head DP (la giraffa) and the verb (tira-), which contribute to a misinterpretation of the phrase.

In English\(^7\), on the contrary, the marked form is the 3rd person (-s) and the other persons are unmarked. Therefore, the attraction phenomenon is possible in the situation in which the embedded DP is singular (marked) and the verb is plural.

\(^7\) In particular in same varieties of America English
(unmarked), and these two elements can co-occur when the head of the relatives is in the plural form (unmarked), as shown in (25)

(25)  the people who Carl see are in the garden
       PL       SG     PL

Attraction does not manifest itself, when the head of the relatives is singular (marked) and the embedded DP is plural (unmarked) (Keyne, 1998), as shown in (26)

(26)  *the man who the girls likes
       SG       PL     SG

Returning to the study of Volpato (2010), a sentence like (21) demonstrates a construct of a singular Head DP (marked) and a plural embedded DP (unmarked) where there is an attraction:

(27)   la giraffa che le zebre tira-no <la giraffa>
       DPO[-pl]   DPS[+pl]   V [-pl]

Hearing impaired children established an incorrect agreement between the head DP and the verb, thus committing a reversible mistake due to the interpretation of the embedded DP as a topicalized object.
In the RO where both the DPs are singular, the attraction phenomenon can occur as well, because both DPs can establish an agreement with the verb, and also give a reversible reading of the object, as shown in:

(28)   la giraffa che la zebra tira <la giraffa>
       DPO [-pl]   DPS [-pl] V [-pl]
In contrast with the previous unmarked DP examples, marked futures cannot perform as attractors for the verb, as in the case in which the head DP is plural and thus the attraction phenomena does not occur, as shown in the following sentences (29) and (30)

(29) le giraffe che le zebre tira-no <le giraffe>
    DPO [+pl]  DPS [+pl] V [+pl]
    \__________/\__________/\__________/\__________/^\

(30) le giraffe che la zebra tira <le giraffe>
    DPO [+pl]  DPS [-pl] V [-pl]
    \__________/\__________/\__________/\__________/^\

Without the attraction phenomenon, hearing impaired children are not able to establish a relation between the relative head and the verb, and so they select an agent character.
CHAPTER 3

THE STUDY

3.1 Introduction

The comprehension of passive sentences was investigated by using a picture matching task (Verin 2010) test, and the comprehension of the relative clauses by utilizing an agent selection task (Volpato 2010). The administration of both these tests, which are illustrated in chapter 4, were preceded by the administration of the Test of Grammatical Comprehension for Children (TCGB, Chilosi & Cipriani 2006). This test is useful to measure morphosyntactic and general linguistic abilities of the participants; the test will be explained in the section 3.3 introduced by a brief presentation of the participants in the experiment.

3.2 Participants

In this study, eleven teenage boys and girls participated, who were attending the I.S.I.S.S. ‘A. Magarotto’ in Padua. This is a public high school for deaf boys and girls which is equipped with innovative technologies. Indeed, in each classroom an integrated system is installed consisting of a multimedia interactive whiteboard (L.I.M.), a projector, and a computer. All classes, the secretary offices, the presidency, the auditorium and common areas are furnished with multi-functional visual communication, which allows, through fixed monitors, the diffusion through LIS movies of any message both in real and deferred time. The experimental group included eight boys and girls with profound hearing loss, and three with severe hearing loss; they ranged in age from 14;7 to 17;8, and all of them used the Italian Sign Language (LIS); the majority of them did not use any hearing
aids or cochlear implants. All of them were Italian except for three that were of a different nationality, but had lived in Italy for many years.

The data was collected during the month of May 2014; at that time, the students were attending the first and the second class which was distributed in two sections for each degree. The experiment was proposed during the school week in lesson times; all students were assessed individually in different days in a quiet laboratory room inside the school.

Table n. 1 shows the characteristic of each of the participants.

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>AGE (Y;M)</th>
<th>HEARING IMPAIRMENT</th>
<th>PARENTS’ STATUS</th>
<th>HEARING AIDS</th>
<th>CLASS</th>
<th>COUNTRY OF ORIGIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>16;9</td>
<td>Profound</td>
<td>Hearing</td>
<td>No</td>
<td>IA</td>
<td>Romania</td>
</tr>
<tr>
<td>S2</td>
<td>16;2</td>
<td>Profound</td>
<td>Hearing</td>
<td>CI</td>
<td>IA</td>
<td>Romania</td>
</tr>
<tr>
<td>S3</td>
<td>16;7</td>
<td>Profound</td>
<td>Deaf</td>
<td>No</td>
<td>IA</td>
<td>Italy</td>
</tr>
<tr>
<td>S4</td>
<td>15;6</td>
<td>Profound</td>
<td>Hearing</td>
<td>YES</td>
<td>IB</td>
<td>Italy</td>
</tr>
<tr>
<td>S5</td>
<td>17;8</td>
<td>Profound</td>
<td>Hearing</td>
<td>No</td>
<td>IIA</td>
<td>Italy</td>
</tr>
<tr>
<td>S6</td>
<td>16;8</td>
<td>Profound</td>
<td>Deaf</td>
<td>No</td>
<td>IIA</td>
<td>Italy</td>
</tr>
<tr>
<td>S7</td>
<td>14;7</td>
<td>Profound</td>
<td>Hearing</td>
<td>YES</td>
<td>IIA</td>
<td>Italy</td>
</tr>
<tr>
<td>S8</td>
<td>16;5</td>
<td>Profound</td>
<td>Deaf</td>
<td>No</td>
<td>IIB</td>
<td>Italy</td>
</tr>
<tr>
<td>S9</td>
<td>15;0</td>
<td>Severe</td>
<td>Deaf</td>
<td>YES</td>
<td>IB</td>
<td>Italy</td>
</tr>
<tr>
<td>S10</td>
<td>15;4</td>
<td>Severe</td>
<td>Hearing</td>
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<td>IB</td>
<td>Albania</td>
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<tr>
<td>S11</td>
<td>15;5</td>
<td>Severe</td>
<td>Deaf</td>
<td>No</td>
<td>IIB</td>
<td>Italy</td>
</tr>
</tbody>
</table>

Table 1. The participants

3.3 Material

3.3.1 The TCGB Test

TCGB (Test of Grammatical Comprehension for Children) is a standardized test which is used to evaluate the development of children’s comprehension abilities. The test was designed by Chilosi & Cipriani (2006) for hearing children ranging in age from 3;6 to 8 years; the absence of linguistic tools for hearing impaired people, at least in Italy, has led to the necessity to use the TCGB test for hearing impaired children as
well. The resulting score is useful to give a general idea of the children's linguistic development and to attribute a linguistic age to them.

The test is composed of 76 items and 76 tables collected in a folder: each table contains 4 pictures, one of them represents the stimulus phrase and the others act as distractors. Indeed, their content is similar to that of the stimulus sentences, but not entirely analogous.

The items are presented in a random order which is maintained in spite of a certain progression of difficulty, and are divided into the eight categories of Italian sentence construction, which are exemplified below:

- Locative sentences (L): include topological (top) or prepositional (prep) locative elements. At the age of 3;6, children with typical development, are already able to understand 65 % of these elements whereas by the age of 4;6 most of the locative elements are accessible to all these children.

(31)  il cane è davanti alla cuccia (L pr.)

‘the dog is in front of the kennel

---

8 The sentences have been taken from this test.
• Inflectional clauses: these sentences are used to test nominal and verbal inflections, and possessive elements. These structures are acquired almost entirely by the age of 5;6 years.

(32) vola su (L. top)
    ‘it flies up’

(33) cane (F nom.sing.)
    ‘dog’
Affirmative active clauses: these sentences contain two types of construction built in the active form: some of them have an SV (subject-verb) order, the others an SVO (subject-verb-object). The latter have different degrees of difficulty due to the reversible factor. In fact, they are categorised in either probable, neutral and improbable reversible sentences or with inanimate subject and animate object sentences. The comprehension of these clauses is considered fully completed at the age of 7 years.
(36)  la macchina tira il camion (AA rev. impr)
    ‘the car pulls the truck’

(37)  la carta brucia il bambino (AA ia)
    ‘the paper burns the child’

• Negative active clauses: these are in similar sentences to active clauses but they contain negative elements: in some clauses these elements refer to an incomplete action and in other clauses they refer to changes of referents and involve a deductive logic. The comprehension of these clauses is considered almost entirely completed when children are 6;6 years old.

(38)  il babbo non bacia la mamma (AN rev.)
‘the father doesn’t kiss the mother’

• Affirmative passive clauses: this category contains irreversible passives, which are formed with both actional and non-actional verbs, and reversible sentences. These are divided into three typologies which are tested according to the probability of the event: probable, neutral and improbable sentences. These sentences are problematic in children with both typical and atypical language development. The acquisition is almost entirely completed by the age of 5;6 years.

(39) il cane è morso dal bambino (PA rev.impr.)
‘the dog is bitten by the child’

• Negative passive clauses: as in negative active clauses, negative elements
are introduced in these sentences. This category contains both SV sentences, irreversible and reversible, and SVA (subject-verb-agent) sentences. These clauses seem to be comprehended by the age of 8 years.

(40) Il cane non è rincorso dal gatto (PN rev)
'The dog is not cashed by the cat'

• Relative clauses: these kind of clauses are divided according to the position of the subordinate sentence with respect to the main clause and to the grammatical function of the relative pronoun. These clauses are divided into subject and object relatives: there are right-branching object relatives, right-branching subject relatives, center-embedded object relatives, and center-embedded subject relatives. This kind of clauses are very difficult for children to understand compared with other structure.

(41) il babbo tiene il palloncino che il bambino rompe (R. fin OO)
'the father holds the balloon that the child breaks'
• Dative clauses: these sentences are composed of a SVO word order with complement expressing the person or thing to which the action is referred. These sentences seem to be entirely acquired when children are 6;6 years old.

(42) il bambino porta il gatto al topo (D aaa impr.)

‘the child brings the cat to the mouse’

(43) la rondine porta il verme all’uccellino (D aaa prob.)

‘the swallow brings the worm to the bird’
3.3.2 Procedure

The test was conducted in individual sessions lasting approximately 30 minutes each. After having explained to the participants how the test would be administered, the folder containing the pictures was shown to them. Usually, in the case of hearing children the phrase is read out to them, but in this circumstance the item was issued on a paper strips. For each trial, participants read the sentence and subsequently pointed out the corresponding picture; in the event of an incorrect response, hesitation or misgivings on the part of the subjects, the sentence was given a second time. A score relating to the performance was attributed for each response and was registered by the experimenter on a scorecard. The total scores were obtained by totalling all the partial scores; the higher the scores, the lower the worse the performance. The TCGB manual provides normative data collected from typically-developing children for each structure investigated; on the basis of this data, therefore, it is possible to attribute a linguistic age to the participant.

The final score of the test is based on the child’s responses and scores are calculated as follows:

- 0 points if the answer is correct;
- 0.5 if the answer is incorrect after the first sentence administration;
- 1.5 if the response is still incorrect after the second administration.

All the items are shown in the appendix A.
3.3.3 Results

The total score of each participant is shown in table 2. The comparison of the results with the data reported in the TCGB manual show that the performance of each participant is comparable to that of younger typically-developing children.

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>CHRONOLOGICAL AGE</th>
<th>TOTAL SCORE</th>
<th>LINGUISTIC AGE</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>16;9</td>
<td>46</td>
<td>&lt;3;6</td>
</tr>
<tr>
<td>2</td>
<td>15;6</td>
<td>16.5</td>
<td>4.6 - 5.0</td>
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<tr>
<td>3</td>
<td>14;7</td>
<td>4.5</td>
<td>6.0 - 6.6</td>
</tr>
<tr>
<td>4</td>
<td>16;5</td>
<td>5</td>
<td>6.0 - 6.6</td>
</tr>
<tr>
<td>5</td>
<td>16;2</td>
<td>36</td>
<td>3.6 - 4.0</td>
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<tr>
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<td>16;7</td>
<td>30.5</td>
<td>3.6 - 4.0</td>
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<td>9.5</td>
<td>5.0 - 5.6</td>
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<td>5</td>
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</table>

Table 2. The total score and linguistic age

For each type of structure the percentage of correct answers for each participant was calculated. The table (3) below illustrates the results.

<table>
<thead>
<tr>
<th></th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
<th>S8</th>
<th>S9</th>
<th>S10</th>
<th>S11</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>57%</td>
<td>93%</td>
<td>100%</td>
<td>100%</td>
<td>71%</td>
<td>71%</td>
<td>86%</td>
<td>79%</td>
<td>93%</td>
<td>93%</td>
<td>100%</td>
<td>86%</td>
</tr>
<tr>
<td>F</td>
<td>56%</td>
<td>75%</td>
<td>94%</td>
<td>94%</td>
<td>81%</td>
<td>88%</td>
<td>44%</td>
<td>50%</td>
<td>100%</td>
<td>81%</td>
<td>94%</td>
<td>78%</td>
</tr>
<tr>
<td>AA</td>
<td>80%</td>
<td>70%</td>
<td>80%</td>
<td>90%</td>
<td>50%</td>
<td>80%</td>
<td>70%</td>
<td>50%</td>
<td>80%</td>
<td>80%</td>
<td>90%</td>
<td>75%</td>
</tr>
<tr>
<td>AN</td>
<td>50%</td>
<td>67%</td>
<td>83%</td>
<td>100%</td>
<td>50%</td>
<td>50%</td>
<td>83%</td>
<td>83%</td>
<td>83%</td>
<td>83%</td>
<td>83%</td>
<td>74%</td>
</tr>
<tr>
<td>PA</td>
<td>50%</td>
<td>80%</td>
<td>80%</td>
<td>90%</td>
<td>40%</td>
<td>40%</td>
<td>70%</td>
<td>50%</td>
<td>100%</td>
<td>100%</td>
<td>90%</td>
<td>72%</td>
</tr>
<tr>
<td>PN</td>
<td>33%</td>
<td>67%</td>
<td>83%</td>
<td>83%</td>
<td>83%</td>
<td>67%</td>
<td>100%</td>
<td>83%</td>
<td>83%</td>
<td>67%</td>
<td>83%</td>
<td>76%</td>
</tr>
<tr>
<td>R</td>
<td>38%</td>
<td>88%</td>
<td>100%</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
<td>100%</td>
<td>88%</td>
<td>88%</td>
<td>88%</td>
<td>88%</td>
<td>80%</td>
</tr>
<tr>
<td>D</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>67%</td>
<td>67%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>91%</td>
</tr>
<tr>
<td>TOT</td>
<td>58%</td>
<td>80%</td>
<td>91%</td>
<td>89%</td>
<td>63%</td>
<td>72%</td>
<td>88%</td>
<td>76%</td>
<td>91%</td>
<td>87%</td>
<td>87%</td>
<td>79%</td>
</tr>
</tbody>
</table>

Table 3. Percentage of correct responses
To analyse the total percentage of responses in each participant, the results demonstrate a marked difference in the performance of individual subjects. However, more than half of the participants had a reasonably high total score, and in some cases close to 100%.

Dative sentences are those that are better understood (91%). Indeed in their performance almost all students were at the ceiling except three that performed lower. Even in locative sentences the average percentage is quite high (86%), and most of the participants answered almost correctly with all the sentences belonging to this type, but on the contrary one participant (S1) answered appropriately in only half of the given sentences. Similarly, relative clauses underlined relevant results (80%), but also in this case the discrepancy of the results between the students was considerable: some of them succeeded with the highest percentage, and others with less than half. Overall, this is a good result in relation to the fact that usually these structures are very problematic to process.

The comprehension of flectional sentences (78%), showed good results.

With regard to the other linguistic structures tested, the percentage of the results is fairly constant between negative passives (76%), affirmative active phrases (75%), negative active sentences (74%), and affirmative passives (72%). It is interesting to note that, albeit minimally, the phrases with the negative element in both the passive form and the active form have higher percentages than those in the affirmative. These results do not appear to follow the data given in the manual of TCGB concerning the acquisition of these linguistic structures.

It is to emphasize the fact that the very high scores in some boys and girls are due to the fact that when they made a mistake and were asked to read the sentence again, their replies were the same and the score assigned was therefore 1.5.

It is also important to note that the participant identified as S1 was of a different nationality than Italian, did not know the meaning of many words in the proposed test and although the meanings of unknown words were provided, his performance was the worst. In the case of S5 they were reported by teachers as a subject having considerable problems in school learning.
3.3.4 Discussion

In the TCGB manual, Chilosi & Cipriani (2006) indicate the age under which the structures proposed in the test are obtained in children with typical language development. Described below are the comparisons between these phases compared to the results of the participants.

According to these researchers the locative acquisition takes place at a rather early stage of language development, by the age of 3;6 children decode correctly 65% of the locative sentences and by 4;6 years the accuracy rises to 80%. Comparing this data with the percentage of accuracy for each subject it emerges that their performance is similar to those children with typical development. In fact S1 has 57% accuracy (age <3;6) and the same phenomenon appears in S5 and S6 which have both an accuracy of 71% (age range 3;6 – 4;0). Considering other participants, the percentages they demonstrate in mastering this kind of structure is according to their linguistic age.

The inflectional structures are generally easy to understand and which around the age of 5; 6 are coded correctly in 80% of the sentences that contain this element. The subjects that performed below this percentage (S1, S2, S7 and S8) have a linguistic age equal or lower that 5;6 years.

Phrases in the active voice offered in the tests are of two types, both affirmative and negative; the former are easier and are understood in 80% by the age of 5;0 years, the latter are more difficult and the same percentage of understanding is by the age of 6;6 years. The results from S2, S5, S7, S8 are consistent with their linguistic age for the affirmative, and it is interesting to note the high performance of S1 (80%). In the negative form S1, S2, S6, and S10 manifest difficulties due to their low linguistic age.

Passive sentences, both affirmative and negative are not comprehended before the age of 5;5 years (80%). Here the mean percentage of the group shows that passives with the negative element are slightly better than those without.

Relative clauses are complex structures and appear slight difficult, indeed participants performance is correct only in half of the items offered in the test, by the age of 5;6 years the accuracy increases to 80%. It is interesting to note that these structures are well controlled by the participants, except for S1 and S5, in which the results are in line with their linguistic age. S4 instead shows an accuracy rate of 50% in spite of his age linguistics (6; 0-6; 6).
Dative structures appear easy and fully comprehended by the age of 6;6. The whole group have a performance at the ceiling, except for S5 and S6 whose results are expected, and S11 who is not in line between the age of acquisition and the linguistic age.

3.4 Conclusion

TCGB is a standardized test which is used to evaluate the development of children’s comprehension abilities in those ranging in age from 3;6 to 8 years; the absence of linguistic tools for hearing impaired people has led to the necessity to use this test for investigating the comprehension abilities in the study group.

The results show a marked difference in the performance of individual subjects both in the different structures and in the total percentage. S1 and S5 performed very low in comparison with other participants; in fact in the first subject the difficulty was clearly visible and demonstrated by the quantity of unknown terms.

Locative sentences and dative sentences are better comprehended compared with others.

Also the performance of the group in relative clauses is considered relevant, since all the participants have high percentage of accuracy, except for S1 (38%).

Generally it is possible to observe that the acquisition of these structures by the hearing impaired subjects follows the stages of the language development of the hearing children with the same linguistic age.
## 4.1 On the comprehension of passive sentences

### 4.1.1 Material

To investigate the comprehension of passive sentences picture matching test designed by Verin (2010) was used; this test was adapted from a previous version devised by Driva and Terzi (2008) for Greek speaking children. The test contained 40 experimental sentences; including 24 sentences with transitive reversible actional verbs, and 16 with non actional verbs and animate subjects and objects.

The actional verbs tested were: *prendere a calci* ('to kick'), *inseguire* ('to chase'), *spingere* ('to push'), *imboccare* ('to feed'), *baciare* ('to kiss') and *colpire* (to hit).

The non-actional verbs were: *amare* ('to love'), *sentire* ('to hear'), *vedere* (to see) and *annusare* ('to smell').

Half of these sentences were composed using the by-phrase and the other half without. Moreover twenty sentences were built with the auxiliary *venire* and twenty with the auxiliary *essere*. 10 filler sentences were included in the battery in random order. These were simple sentences in the active form acting to distract the participant from the aim of the test.

The pictures were presented on the computer screen in a quiet room inside their school; each frame included three different photographs of which only one
corresponded to the stimulus sentence. Two examples of photographs, and associated stimulus, are exemplified below; the first is an experimental test (3) and the second is a filler sentence (4).

Figure 3. Picture representing the item ‘in quale foto Marco è baciato da Sara’

Figure 4. Picture representing the item ‘in quale foto Marco prende a calci il cuscino’

4.1.2 Procedure

The participants were tested in individual sessions, each lasting about 30 minutes. Before starting the test, the four characters (Marco, Sara, the mother, the father) represented in the photographs were introduced to the subjects as well as the various
verbs. The pictures were shown to the participants on a computer screen and then they had to select one of them corresponding to the stimulus phrase. Similarly for the TCGB test, the sentences were presented in a written form on a piece of paper. An example of a sentence tested with a description is exemplified below.

(44) In quale foto Sara viene/è colpita (da Marco)?
(45) In which picture is Sara being hit (by Marco)?

In a situation in which the sentence was offered with a by phrase, the correct picture shows the actors performing the associated action, whereas in a second picture the action displays the inverted thematic roles (Sara hits Marco), and in the last picture one of the two actors is being substituted (Sara is being pushed by the father). In the case of the sentence was indicated without the by phrase, the correct picture would show, for example, Sara is being hit by Marco, a second sentence with inverted thematic roles (Sara hits Marco), and a third one in which the patient is different from within the target phrase (Sara hits the father).

The pictures corresponding to the two possibilities described above are presented below, the former for the sentence with the by phrase (5) and the latter for the sentence without. (6)

All the items are shown in the appendix B.
4.1.3 Results

Results on comprehension of passive sentences were analysed considering three types of variables that the linguistic structures of the test contained, namely use of actional verbs versus non actional verbs, presence vs absence of the by-phrase and use of auxiliary venire vs essere.

The tables below show the contrast between these two elements. Table 4 shows the percentage of accuracy for each subject in passives with actional verbs and passives with non actional verbs:

<table>
<thead>
<tr>
<th>SENTENCE</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
<th>S8</th>
<th>S9</th>
<th>S10</th>
<th>S11</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIONAL VERBS</td>
<td>63%</td>
<td>54%</td>
<td>88%</td>
<td>96%</td>
<td>25%</td>
<td>42%</td>
<td>63%</td>
<td>63%</td>
<td>92%</td>
<td>92%</td>
<td>96%</td>
<td>70%</td>
</tr>
<tr>
<td>NON ACTIONAL VERBS</td>
<td>25%</td>
<td>19%</td>
<td>63%</td>
<td>75%</td>
<td>38%</td>
<td>56%</td>
<td>19%</td>
<td>38%</td>
<td>56%</td>
<td>50%</td>
<td>44%</td>
<td>44%</td>
</tr>
</tbody>
</table>

Table (4). Percentage of accuracy with actional and non actional verbs

From these results, it is clearly evident that the sentences with actional verbs are understood much better than those with non actional verbs. The divergence between the two structures, in some participants, is very wide like as example in S1, S2, S7, S9, S10 an S11. However, there are two cases (S5 and S6) in which subjects performed better with non actional verbs. Also the participant S4, demonstrated comprehension
of sentences with both the actional and non actional verbs, and therefore having the best performance (96% and 75%).

Table 5 indicates the percentage of accuracy for each subject in passives built with the auxiliary *venire* and passives with the auxiliary *essere*:

<table>
<thead>
<tr>
<th>SENTENCE</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
<th>S8</th>
<th>S9</th>
<th>S10</th>
<th>S11</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUXILIARY ESSERE</td>
<td>30%</td>
<td>10%</td>
<td>75%</td>
<td>95%</td>
<td>20%</td>
<td>50%</td>
<td>40%</td>
<td>40%</td>
<td>80%</td>
<td>85%</td>
<td>60%</td>
<td>53%</td>
</tr>
<tr>
<td>AUXILIARY VENIRE</td>
<td>65%</td>
<td>70%</td>
<td>80%</td>
<td>80%</td>
<td>40%</td>
<td>45%</td>
<td>50%</td>
<td>65%</td>
<td>75%</td>
<td>65%</td>
<td>90%</td>
<td>66%</td>
</tr>
</tbody>
</table>

Table (5). Percentage of accuracy auxiliary *essere* and *venire*

The percentages of accuracy of each individual show that most of the constructions with the auxiliary *venire* were easier than those with the auxiliary *essere*, except for S4, S5, S9 and S10, where they showed the opposite results, with a more evident gap between the first and the last participants. The mean percentage of correct responses is higher with the auxiliary *venire* than the auxiliary *essere*.

Table 6 shows the percentage of accuracy for each subject in passives with the by phrase and passives without by phrase:

<table>
<thead>
<tr>
<th>SENTENCE</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
<th>S8</th>
<th>S9</th>
<th>S10</th>
<th>S11</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>WITH BY-PHRASE</td>
<td>50%</td>
<td>30%</td>
<td>70%</td>
<td>80%</td>
<td>50%</td>
<td>30%</td>
<td>50%</td>
<td>25%</td>
<td>75%</td>
<td>85%</td>
<td>75%</td>
<td>56%</td>
</tr>
<tr>
<td>WITHOUT BY-PHRASE</td>
<td>45%</td>
<td>50%</td>
<td>85%</td>
<td>95%</td>
<td>10%</td>
<td>65%</td>
<td>40%</td>
<td>80%</td>
<td>80%</td>
<td>65%</td>
<td>75%</td>
<td>63%</td>
</tr>
</tbody>
</table>

Table (6). Percentage of accuracy with or without by-phrase

The outcomes display the fact that there is no important difference between the presence or absence of the by phrase in the average percentages of accuracy; although there is a slightly higher percentage in sentences without the by phrase. However, there are same cases (S8, S6 and S5) in which sentences without by phrase are mastered better than those with.

To analyse this data, a repeated-measure logistic regression was adopted by using the software ‘R’.
Focusing on the type of the structure, the contrast between passives with actional verbs vs non-actional verb, presence vs absence of the by-phrase and sentences built with auxiliary *essere* vs auxiliary *venire* was considered. The results evidenced that sentences with actional verbs were comprehended significantly better than those with non-actional verbs (Wald $Z=-3.977$, $p<0.001$). This outcome is clearly visible also from the average percentages of accuracy between the two types of sentences. No significant difference was found between the existence and the absence of the by-phrase (Wald $Z=-0.972$, $p=0.33$), although the mean percentage of accuracy of the whole group shows that sentences with the by-phrase have a higher percentage than those without the by-phrase. Finally, the sentences built with the auxiliary *venire* are comprehended significantly better that those with the auxiliary *essere* (Wald $Z=1.961$, $p=0.05$).

With regard to an individual analysis, the results demonstrate that there are differences between the participant incidental to the degree of hearing loss; severe hearing impaired subjects performed better than those with profound impairments (Wald $Z=2.069$, $p=0.04$). The variable of Nationality produced no significant difference on the performance of the teenage boys and girls (Wald $Z=-0.627$, $p=0.53$).

### 4.1.4 Discussion

In the previous sections, the comprehension of passive sentences was investigated in order to explore the level of difficulty (or success) of these structures, in a group of hearing impaired teenage boys and girls. To do this, different variables (considered potentially helpful or unhelpful) were analysed in order to precisely identify the main factors affecting the comprehension of passives.

In particular, the best understanding of actional verbs in the contrast between actional verbs and non-actional verbs was an expected result. This confirms the results of previous studies on subjects with typical development for English, Maratos et al. (1985) Fox & Grodzinsky (1998), for Greek Driva & Terzi (2008) and for Italian Volpato et al. (2013). Given the scarcity of research on hearing impaired subjects, a comparison with other data is not possible, except for the results of Franceschini (2013), which further confirm this difference.
However, the images that indicate actions with a non actional verb are not easy to represent. The verb *amare* (to love), for example, in the Verin test was represented with a subject that embraced another, and this have led to further difficulties in the computation of the sentence.

The presence or the absence of the by-phrase in the sentences does not produce significant differences in the comprehension between these two options. However, the percentage of responses for each subject shows, albeit minimally, a higher accuracy in sentences with the by-phrase. There were episodes in which participants, on reading sentences without the by-phrase, asked *da chi?* (by whom?). For example, in the phrase *In quale foto Marco è baciato?* ‘in which photo is Marco kissed?’, the students asked *è baciato da chi?* ‘by whom is he kissed?’, then responding in a fairly random fashion.

These results confirm the results of Driva & Terzi (2008) and Volpato et al. (2013), but not those of Fox & Grodzinsky (1998), according to which the sentences with an actional verb and by-phrase was less problematic than those with the by-phrase but with a non actional verb.

An interesting outcome demonstrates a significant asymmetry between sentences built with the auxiliary *venire* and the auxiliary *essere*; namely, the former are better comprehended than the latter. The particular aspect of the Italian language that allows the construction of passive sentences correctly using two auxiliaries, both *essere* (to be) or *venire* (to come), may involve a different reading of the structures. Indeed, passives with the auxiliary *essere* may produce a stative, a resultative, or an eventive reading. On the contrary, passives with the auxiliary *venire* may only have an eventive reading, and so, the comprehension of passive sentences with *venire* indicates that the participants can master these kinds of structures.

The results show a significant difference in comprehension of passives between the participants with profound hearing impairment and those with severe hearing impairment. However, the degree of hearing loss is not always a predictive value; as argued in chapter 1, the variables that contribute to the linguistic difficulties of the subjects are multiple and are not limited to the degree of hearing loss. Sometimes linguistic difficulties are to be attributed to the interaction of different factors.

As concerning the variables of nationality, there is no significant difference related to
the country of origin; this result confirms the fact that the difficulties of deaf individuals depend on the linguistic, social and cultural input to which they have been and are exposed (Bertone & Volpato 2012).

4.2. On the comprehension of relative clauses

4.2.1 Material

The relative clauses were evaluated by utilizing an agent selection task (Volpato, 2010), this test was designed following the tools created by Friedman & Novogrodsky (2004), Arnon (2005) for Hebrew, and by Adani (2008) for Italian. In contrast with previous methodologies, this test included a larger number of experimental sentences, in which number features were manipulated, whereby the head of the relative clauses and the embedded DP, could be either singular or plural, or one singular and the other plural (or vice versa). In addition, in this test the participants had to select one of four characters offered in two images, in contrast to Friedman & Novogrodsky (2004) in which he was asked to select one of the images. The battery of the test included:

- 12 subject relatives (SR),
- 24 object relatives with a preverbal embedded subject (OR),
- 12 object relatives with a post verbal embedded subject (ORp),
- 12 ambiguous sentences (AMB),
- 20 filler sentences.

10 different sentence conditions were tested and each of them included 6 items. Among the 12 ambiguous sentences were considered; these were built with both DP singular, or were both plural (AMB_SG_SG or AMB_PL_PL). In this type of sentence either the first or the second DP may be interpreted as the subject of the embedded verb.
The table (7) shows examples of the ten conditions:

| AMB | AMB PL PL | La pecora che lava il cavallo
The sheep that washes the horse |
|-----|-----------|-------------------------------|
| AMB | AMB PL PL | I topi che spingono le galline
The mice that push the hens |
| SR  | SR PL SG  | L’orso che pettina la giraffa
The bear that combs the giraffes |
| SR  | SR PL SG  | Gli orsi che pettinano la giraffa
The bears that comb the giraffe  |
| OR  | OR SG SG  | L’orso che la giraffa petteina
The bear that the giraffe combs |
| OR  | OR SG SG  | L’orso che le giraffe petteinano
The bear that the giraffe combs |
| OR  | OR PL PL  | Gli orsi che le giraffe petteinano
The bears that the giraffe combs |
| OR  | OR PL PL  | Gli orsi che la giraffa petteina
The bears that comb the giraffe  |
| ORp | OOp PL SG | L’orso che petteinano le giraffa
The bear that comb the giraffes |
| ORp | OOp PL SG | Gli orsi che petteina la giraffa
The bears that combs the giraffe |

Table (7). Experimental condition of relative clauses.

Figure (7) shows an example of the picture matching the sentence ‘I topi che spingono la gallina’ and figure (8) an example of the filler sentence ‘la mucca che suona la tromba’.

Figure (7)
All sentences were semantically reversible; moreover, in the test only animate nouns and transitive verbs in the present tense were used in order to avoid difficulties caused by the presence of auxiliaries or past participle elements. The verbs used were: *lavare* (‘to wash’), *colpire* (‘to hit’), *inseguire* (‘to chase’), *portare* (‘to bring’), *tirare* (‘to pull’), *beccare* (‘to peck’), *spingere* (‘to push’), *spaventare* (‘to scare’), *toccare* (‘to touch’), *pettinare* (‘to comb’), *fermare* (‘to stop’), *baciare* (‘to kiss’), *guardare* (‘to look at’), *mordere* (‘to bite’), *seguire* (‘to follow’), *salutare* (‘to greet’), *rincorrere* (‘to run after’).

With regard to the pictures matching the stimulus, two pictures showed the same action performed by different characters and were illustrated on the same page. This image was different from the other because the thematic roles were reversed; each character was labelled with the letters A, B, C, D.

The list of stimuli is shown in Appendix C.

### 4.2.2 Procedure

Each student was assessed individually and each test lasted about 30 minutes; some participants were offered a break in mid-trial so as not to lose their overall concentration. Before starting the test, knowledge of the proposed verbs was verified;
in the folder containing the pictures a list of verbs was included on the first page, and for each word the participant had to indicate the drawing with the corresponding action, showing if they understood the meaning, (each page contained 4 illustrations). In addition, 2 items that operated as preparation for the experimental part were offered before actually starting the experimental part, and was helpful in verifying that the participant had understood the test instructions. Similarly to the two previous tests, the items were provided in written form, on strips of paper. For each stimulus, 2 pictures and 4 referents (characters or groups of characters) were shown to the participants who had to touch/indicate one out of four referents labelled with the letters A, B, C, D.

4.2.3 Results

Table (8) shows in detail the percentages of responses for each condition and for each subject.

<table>
<thead>
<tr>
<th></th>
<th>S1</th>
<th>S2</th>
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<th>S5</th>
<th>S6</th>
<th>S7</th>
<th>S8</th>
<th>S9</th>
<th>S10</th>
<th>S11</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>67%</td>
<td>75%</td>
<td>83%</td>
<td>75%</td>
<td>25%</td>
<td>64%</td>
<td>75%</td>
<td>58%</td>
<td>83%</td>
<td>100%</td>
<td>83%</td>
<td>75%</td>
</tr>
<tr>
<td>OR</td>
<td>13%</td>
<td>17%</td>
<td>13%</td>
<td>4%</td>
<td>13%</td>
<td>0%</td>
<td>96%</td>
<td>4%</td>
<td>25%</td>
<td>83%</td>
<td>4%</td>
<td>30%</td>
</tr>
<tr>
<td>ORp</td>
<td>25%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>25%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>AMB</td>
<td>67%</td>
<td>58%</td>
<td>67%</td>
<td>100%</td>
<td>50%</td>
<td>100%</td>
<td>100%</td>
<td>33%</td>
<td>92%</td>
<td>100%</td>
<td>92%</td>
<td>78%</td>
</tr>
</tbody>
</table>

Table (8). Percentage of accuracy in the different main types of sentences

The results shown in table (8) appear to indicate that the average percentage of accuracy in the responses is very low and variable among participants (except for S7 e S10). From this table, it is possible to consider the accuracy of the subjects in each type of relative clause; it is clear that SRs and AMBs are comprehended much better than ORs and ORps. Particularly in four participants (S4, S5, S7, S10) ambiguous sentences are at ceiling, (two referents out of four are correct), and only in one subject (S10) SRs are comprehended at ceiling. Interestingly, in some subjects there is
a wide gap between the SRs and ROs of both types. In particular, some subjects, (S4, S6, S11) have rather high percentages in SRs but in ORs and ORp the percentage of accuracy is 0% or slightly higher.

To analyse this data, a repeated-measure logistic regression was adopted by using the software 'R'.

The analysed group manifests the typical gradient of difficulty for the different types of sentences, namely ambiguous sentences (AMB) are comprehended better than subject relatives (SR), which are comprehended better than object relatives with a pre verbal embedded subject (OR), which in turn are comprehended better that object relatives with a post verbal embedded subject (ORp). In addition, the mean percentage of correct responses for each type of sentences show the following values: 78%>75%>30%>10%.

Focusing on the experimental conditions, in the distinction between SRs and AMB sentences it emerges that these two relatives do not perform with a significant differential accuracy (Wald Z=-0.924, p=0.356) in the whole group. In fact, the mean percentage indicates that AMBs sentences have 78% of accuracy with respect to SRs, which have 75%.

The contrast between SRs and ORs indicates that the former are comprehended significantly better than the latter (Wald Z=-3.382, p<0.001*); and with regard to difference between ORs and ORps, the accuracy in significantly better in the former compared with the latter (Wald Z=-4.023, p<0.001*).

Although there are no significant differences between the degrees of hearing loss in the comprehension of the different conditions (Wald Z=1.426, p=0.15), in the SRs, the severe hearing impaired participants performed significantly better than profound hearing impaired participants (Wald Z=2.513, p=0.011*).

This data can also be seen from the percentages of accuracy, which additionally show a very high level accuracy by one participant with a profound hearing impairment (S3).
Table (9). Percentage of accuracy for each type of sentences.

<table>
<thead>
<tr>
<th></th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
<th>S8</th>
<th>S9</th>
<th>S10</th>
<th>S11</th>
<th>Mean</th>
</tr>
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<tr>
<td>1</td>
<td>AMB_PL_PL</td>
<td>33%</td>
<td>50%</td>
<td>33%</td>
<td>100%</td>
<td>67%</td>
<td>100%</td>
<td>100%</td>
<td>50%</td>
<td>83%</td>
<td>100%</td>
<td>83%</td>
</tr>
<tr>
<td>2</td>
<td>AMB_SG_SG</td>
<td>100%</td>
<td>67%</td>
<td>100%</td>
<td>100%</td>
<td>33%</td>
<td>100%</td>
<td>100%</td>
<td>17%</td>
<td>100%</td>
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<td>100%</td>
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<tr>
<td></td>
<td>Individual Mean</td>
<td>67%</td>
<td>58%</td>
<td>67%</td>
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<td>50%</td>
<td>100%</td>
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<td>33%</td>
<td>92%</td>
<td>100%</td>
<td>92%</td>
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<tr>
<td></td>
<td>AMB Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SVO_SG_PL</td>
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<td>83%</td>
<td>83%</td>
<td>100%</td>
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</tr>
<tr>
<td>3</td>
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<td>75%</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td>OSV_SG峡谷</td>
<td>17%</td>
<td>33%</td>
<td>17%</td>
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<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>17%</td>
<td>33%</td>
<td>83%</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>OSV_PL峡谷</td>
<td>17%</td>
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<td>0%</td>
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<td>83%</td>
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<td>17%</td>
<td>100%</td>
<td>17%</td>
<td></td>
</tr>
<tr>
<td>6</td>
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<td>33%</td>
<td>17%</td>
<td>17%</td>
<td>33%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>17%</td>
<td>67%</td>
<td>0%</td>
</tr>
<tr>
<td>7</td>
<td>OSV_PL峡谷</td>
<td>0%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>33%</td>
<td>83%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
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<td>13%</td>
<td>17%</td>
<td>13%</td>
<td>4%</td>
<td>13%</td>
<td>0%</td>
<td>96%</td>
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<td>83%</td>
<td>4%</td>
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<tr>
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<td>OR Mean</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>OVS_SG峡谷</td>
<td>17%</td>
<td>0%</td>
<td>33%</td>
<td>0%</td>
<td>33%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
</tr>
<tr>
<td>10</td>
<td>OVS_PL峡谷</td>
<td>33%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
<td>33%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Individual Mean</td>
<td>25%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>25%</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>ORp Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With regard to the role of the number features, the results do not evidence relevant differences; ROs built with match conditions do not show any differences to those built in mismatch conditions (AMBs have not been taken into account). However, in the case of sentences where the head DP is singular and the embedded DP is plural, a slight divergence appears compared to those in which the head DP is plural and the embedded DP is singular; this occurs either in SR, or OR or ORp. In fact sentences like SR_SG_PL were comprehended better than SR_PL_SG (76% vs 69%); the performances in OR_SG_PL were better than OR_PL_SG (27% vs 21%), and also in ORp the accuracy was higher in ORp_SG_PL than ORp_PL_SG (11% vs 9%).

In analysing all types of phrases in the whole group, it appears that the factor of ‘age’ affects the comprehension of the experimental sentences; younger participants are more accurate than those older (Wald Z =-3.291, p=0.001*). This phenomenon

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9 The abbreviation SG corresponds with ‘singular’, and PL for ‘plural’; the first element appearing in linear order indicates the number features for the head of DP, and the second for the embedded DP.
manifests itself as well in the analysis which referred to the contrast both between ambiguous sentences (AMB) and SRs (Wald Z=-4.011, p<0.001*), and SRs and OR (Wald Z =-3.382, p<0.001*). However, in the contrast between OR and ORps ‘age’ does not appear to be significant.

Table (10) indicates the type of referent that was chosen incorrectly by the participant; considering figure (9), for example, the selection of the Reversible character occurs, when in sentences like *gli orsi che la giraffa pettina* ‘the bears that the giraffe combs’, participants choose the referent A, ‘the bears’, namely the bears that are combing. The selection of an Agent character manifests when subjects choose C, the giraffe that is combing the bears. Other errors occur when the participant selected a character different from the previous cases.

![Figure 9. Example of the picture matching the sentence ‘gli orsi che la giraffa pettina’](image)

The following table indicates the mean percentage of incorrect responses for each condition:
<table>
<thead>
<tr>
<th></th>
<th>reversible</th>
<th>agent</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR_SG_PL</td>
<td>9%</td>
<td></td>
<td>21%</td>
</tr>
<tr>
<td>SR_PL_SG</td>
<td>5%</td>
<td></td>
<td>26%</td>
</tr>
<tr>
<td>OR_SG_SG</td>
<td>26%</td>
<td>41%</td>
<td>45%</td>
</tr>
<tr>
<td>OR_SG_PL</td>
<td>21%</td>
<td>45%</td>
<td>8%</td>
</tr>
<tr>
<td>OR_PL_SG</td>
<td>20%</td>
<td>44%</td>
<td>12%</td>
</tr>
<tr>
<td>OR_PL_PL</td>
<td>20%</td>
<td>55%</td>
<td>8%</td>
</tr>
<tr>
<td>ORp_SG_PL</td>
<td>45%</td>
<td>30%</td>
<td>8%</td>
</tr>
<tr>
<td>ORp_PL_SG</td>
<td>39%</td>
<td>39%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Table (10). Percentage of incorrect response.

In the ORs the participants made more agent-type errors, but in the case of OR_SG_GS, other errors appear with a very high percentage. Conversely in the ORp the errors committed are the reversible-type, but in ORp_SG_PL and in ORp_PL_SG there is no distinction between the selection of the reversible or agent referent. In both, the value is the same.

4.2.4 Discussion

In the previous section the comprehension of relative clauses was investigated in order to explore the difficulties with this type of structure in a group of hearing impaired teenage boys and girls. Different types of restrictive relative clauses have been tested in order to investigate the performance with the various structures; the relative clauses tested were; subject relatives (SR), object relatives with a preverbal embedded subject (OR), object relatives with a post verbal embedded subject (ORp), and ambiguous sentences (AMB), An analysis based on the number features of the head DP and the embedded DP was also carried out, in order to consider if comprehension changed according to the use of match or mismatch conditions. It has also been possible to analyse the type of error made in relation to the selected character during the test.

The results of the analysis confirm the asymmetry in comprehension between subject
and object relative clauses which has already been established in many studies on different populations. Moreover, object relatives with preverbal subjects are easier to comprehend than object relatives with post-verbal subjects, and this confirms the results of previous studies (Arosio, 2005; Adani, 2008; Friedmann & Szterman, 2006; Volpato & Adani, 2009; Volpato, 2010).

Between SRs and AMB sentences there is no significant difference in accuracy (75% compared to 78%). In the other sentences, the gradient of difficulty is clearly visible between SRs, ORs and ORp (75%>30%>10%).

A significant result was found to be the factor of ‘age’, in younger subjects the accuracy is higher than that of older participants. This result has been found in previous studies on the production of relative clauses in children and adults with typically language development (Utzeri 2007), and in a comparison between children, adolescents and adults with hearing impairment (Volpato 2011).

Finally, there were no differences in the comprehension of the relatives in match or mismatch conditions, differently from Volpato’s findings (2012). Indeed in her study, a group of hearing impaired children fitted with a cochlear implant were tested and they performed significantly better in match condition.

However, an interesting result is that the performance of the experimental group with SR, OR, and ORp, appears more accurate in cases in which the head DP is singular and the embedded DP is plural compared with the cases in which number features are reversed.

4.3 Conclusion

This chapter has reported a study on the comprehension of passive sentences and relative clauses in a group of adolescents with hearing deficits. To analyse these two types of sentences two tests have been administered: a picture matching test (Verin, 2010) and an agent selection task (Volpato, 2010).
The results show a great individual variability in the accuracy of the responses from the participants, and in general, the subjects have shown the ability to better master passive sentences than relative clauses. The latter in fact create more problems than the former due to the subordination and non-canonical order of the constituents (Chesi 2006; Friedmann & Szterman 2006); and with regard to language development these are acquired later than passives.

In addition the comprehension of passive sentences with *venire* indicates that the participants can master these kinds of structures because they may only have an eventive reading.
CONCLUSIONS

The main intention of this work was to study the comprehension of passive sentences and relative clauses in a group of adolescent students with profound and severe hearing losses.

At the time of the research they ranged in age from 14;7 to 17;8 and were attending the first and second class of I.S.I.S.S. ‘A. Magarotto’ high school in Padua.

In order to verify their linguistic abilities three tests were administered: a TCGB test to assess the morphosyntactic and general linguistic abilities, a picture-matching task for the comprehension of passive sentences and an agent selection task for the comprehension of relative clauses.

Participants from the sample of students included within these tests shared common characteristics only associated with their age. The other differing characteristics were their degrees of hearing loss which varied from profound to severe, the differences in parents’ background (hearing or non hearing), and the level of use of hearing aids. Some aspects, however, were not possible to find, such as the period of onset of deafness. During my interaction with them, it was possible to observe the code of communication to which they were exposed, that varied in relation to when they communicated with each other using the LIS, or educational periods in which many teachers or school staff used a bimodal approach. The heterogeneity in terms of the characteristics of each participant can also be found in the results of their performance which emerged from the tests.

From the results indicated by the TCGB test, it is possible to observe a general framework of their language development, and in particular this development in eight Italian sentence constructions which are: locative phrases, inflectional clauses, affirmative and negative active sentences, affirmative and negative passive sentences, relative clauses and dative sentences. The comparison of the results with the data reported in the TCGB manual show that the performance of each participant is comparable to that of younger typically-developing children. In particular S1 and S5,
respectively, are those who had the lowest performance; amongst others there is no difference between the profound or the severe hearing impaired participants. Structures that proved easier were the locative and dative sentences, whereas greater difficulty was experienced with sentences in the active and the passive voice, both with negative and affirmative elements. This is probably due to the fact that these sentences were divided into probable, neutral and improbable sentences and some implied deductive reasoning, and perhaps these particular items confused participants who often rely on personal knowledge in choosing the answer. Relative clauses did not create any particular problems in their comprehension, but this does not reflect the results that emerged from the specific test of comprehension of relative clauses.

However, the agent selection task (Volpato, 2010) to evaluate these kinds of structures were organized in a more complex way in which the number features were manipulated, and whereby the head of the relative clauses and the embedded DP, could be either singular or plural, or one singular and the other plural (or vice versa). In addition in this test the participants had to select one of four characters offered in two images and this had a processing cost higher than the choice of the figure associated with the sentence that was offered in the TCGB test.

In this test different types of clauses were investigated, namely ambiguous sentences (AMB), subject relatives (SR), object relatives with a pre verbal embedded subject (OR), and object relatives with a post verbal embedded subject (ORp). The findings indicate that the gradient of difficulty of sentences is the same as that found in previous studies (Arosio, 2005; Adani, 2008; Friedmann & Szterman, 2006; Volpato, Adani, 2009; Volpato, 2010) and is: AMB>SR>OR>ORp.

Another significant result was the factor of ‘age’, namely in younger subjects the accuracy was higher than that of older participants, and in the contrast between all the clauses except for OR vs ORp. This result has been found in previous studies on the production of relative clauses in children, adolescents, and adults with typical language development (Utzeri 2007, Volpato 2010), and in a comparison between typically developing children and children with hearing impairment (Volpato & Adani, 2009; Volpato 2012).
Although there are no significant differences between the degrees of hearing loss in the comprehension of the different conditions, in the SRs, the severe hearing impaired participants performed significantly better than profound hearing impaired participants; this data can also be seen from the percentages of accuracy, which additionally show a very high level of accuracy by one participant with a profound hearing impairment (S3).

Focusing on the analysis of the number features, there do not appear to be differences in the comprehension of the relative clauses in match or mismatch conditions. However, the performance of the participants appears more accurate in cases in which the head DP is singular and the embedded DP is plural (SR_SG_PL, OR_SG_PL, ORp_SG_PL) compared with the cases in which number features are reversed (SR_PL_SG, OR_PL_SG, ORp_PL_SG).

With regard the comprehension of passive sentences a picture matching test (Verin 2010) was used. This ability to comprehend passive sentences was analysed considering three types of variables that the linguistic structures of the test contained, namely the use of actional verbs in contrast with non actional verbs, the presence or absence of the by-phrase and use of the two auxiliary possible for Italian language essere and venire.

Once again the results show a large variability between individual participants, but however, there were some interesting results in the group analysis.

In particular, the sentences with actional verbs were comprehended significantly better than those with non actional verbs, confirming the results of previous studies on subjects with typical development (Maratos et al. 1985, Fox & Grodzinsky 1998, Driva & Terzi 2008, and Volpato et al. 2013). However, to indicate actions with a non actional verb in pictures is not easy to represent, and this could have led to further difficulties in the computation of the sentence. No significant difference was found between the existence and the absence of the by-phrase. In addition, the sentences built with the auxiliary venire are comprehended significantly better that those with the auxiliary essere. Differently from the auxiliary essere, passives with the auxiliary venire may only have an eventive reading, and so, the comprehension of passive sentences with venire indicates that the participant can master these kinds of structures.
The comprehension of passive sentences showed differences between the participants, incidental to the degree of hearing loss, severe hearing impaired subjects performed better than those with profound impairments. The same results were also found in the comprehension of subject relative clauses but not in other conditions.

In conclusion, taking into account the varying characteristics of the participants in this work, this research has demonstrated the particular difficulties that are experienced with certain linguistic structures by hearing impaired subjects.
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MIT Working Papers in Linguistics 48, 159-209


http://www.asha.org/public/hearing/Hearing-Loss/
APPENDIX A: TCGB

1. La palla è sotto il tavolo
2. Il gatto è vicino alla sedia
3. La casa è dietro l'albero
4. Corre giù
5. Il cane è dentro la macchina
6. La palla è tra il tavolo e la sedia
7. Il cane corre dalla casa all'albero
8. Il cane è sopra la sedia
9. Il gatto è lontano dalla sedia
10. Vola su
11. Il bambino è fuori
12. Il bambino è tra il babbo e la mamma
13. Il cane è davanti alla cuccia
14. L'uccellino vola dalla casa al nido
15. Sedie
16. Bambino
17. La mamma lava
18. Cane
19. Camminano
20. La bambina si petteina
21. Maestra
22. Il bambino fa il bagno
23. Vola
24. Il loro cane
25. La mamma pettina la bambina
26. Il bambino non dorme
27. Il gatto ha saltato
28. La sua mamma
29. Il gatto rincorre il cane
30. Il gatto salta
31. Il bambino rincorre la bambina che è in bicicletta
32. La mamma lava la bambina
33. Il suo cane
34. Il bambino imbocca la mamma
35. La loro mamma
36. La bambina non corre
37. Il bambino spinge la bambina
38. Il bambino ha fatto il bagno
39. Il bambino che è sul tavolo mangia la marmellata
40. La macchina è lavata dal bambino
41. Il gatto salta sul topo che è sulla sedia
42. La macchina tira il camion
43. La bambina dà la cartella al bambino
44. Il gatto non mangia il pesce
45. La guardia che ha il fucile ferma il ladro
46. La rondine porta il verme all’uccellino
47. La mela è mangiata dalla bambina
48. Il bambino non mangia la minestra
49. Il bambino disegnerà
50. Il topo che il gatto rincorre ha il formaggio in bocca
51. Il bambino porta il gatto al topo
52. La bambina è vestita dalla mamma
53. La bambina non spinge il bambino
54. Il babbo porta le sigarette al bambino
55. Il cane è tirato dall’uomo
56. Il bambino farà il bagno
57. Il cestino non è stato svuotato
58. Il bambino è spinto dalla bambina
59. Il pianoforte non è suonato
60. Il babbo tiene il palloncino che il bambino rompe
61. La mamma è presa in braccio dal bambino
62. Il bambino non è spinto dalla bambina
63. La pipa non è fumata dall’indiano
64. Il babbo mette le scarpe al bambino
65. Il libro è letto dal bambino
66. La mela non è presa dalla bambina
67. La bambina è pettinata dalla mamma
68. Il babbo non bacia la mamma
69. Il vaso che il bambino dipinge è sulla sedia
70. La palla colpisce il bambino
71. Il cane è morso dal bambino
72. Il cane morde la palla che il bambino colpisce
73. Il film è visto dal bambino
74. Il cane porta il maiale alla pecora
75. La carta brucia il bambino
76. Il cane non è rincorso dal gatto
## APPENDIX B:
### PASSIVE SENTENCES COMPREHENSION TASK

<table>
<thead>
<tr>
<th>Frasi</th>
<th>Foto 1</th>
<th>Foto 2</th>
<th>Foto 3</th>
</tr>
</thead>
<tbody>
<tr>
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APPENDIX C

RELATIVE CLAUSES COMPREHENSION TASK

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| TRAINING                             | Tocca il cane che indica i topi |
| TRAINING                             | Tocca il topo che corre          |

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