4 The production of relative clauses

Summary 4.1 Introduction. – 4.2 The production of relative clauses by typically developing individuals. – 4.3 The production of relative clauses: the task. – 4.4 The comparison between typically developing children, adolescents and adults. – 4.4.1 Participants. – 4.4.2. Results. – 4.4.3 Answering strategies in subject relative clauses. – 4.4.4 Answering strategies for targeted object relative clauses. – 4.5 The asymmetry between subject and object relatives. – 4.6 The asymmetry between object relatives and passive relatives. – 4.7 The production of passive constructions. – 4.8 The production of relative clauses: further studies. – 4.9 The production of relative clauses in individuals with hearing impairment. – 4.10 The production of relative clauses in children with cochlear implants: the first results for Italian. – 4.11 Answering strategies for targeted subject relatives. – 4.12 The use of resumption in target object relatives. – 4.13 Answering strategies in target object relatives. – 4.14 The use of causative constructions in children with cochlear implants. – 4.15 The inter-individual variability in the CI group.

4.1 Introduction

This chapter focuses on the elicited production of relative clauses by typically developing individuals and children with cochlear implants.

The comparison between children, adolescents, and adults has been carried out to detect the variations in performance in the course of language acquisition and development until the attainment of full adult linguistic competence.

Elicited production of relative clauses in populations with different degrees of hearing loss was investigated in English (Quigley, Paul 1984; De Villiers 1988), Hebrew (Friedmann, Szterman 2006), Palestinian-Arabic (Friedmann, Haddad-Hanna 2014), and French (Delage 2008). These authors mainly tested individuals fitted with conventional hearing aids. Only Friedmann and Szterman (2006) included

DOI 10.30687/978-88-6969-392-2/004

in their experimental sample a small group of individuals with hearing impairment using cochlear implants.

Volpato (2010b) was the first study on the production of relative clauses by (Italian-speaking) children with cochlear implants.

In this chapter, I present the existing literature on the production of relative clauses by typically developing individuals, especially as far as the Italian language is concerned, and the study carried out during my PhD on different typically developing populations (Volpato 2010b). Then I focus on the production of relative clauses by individuals with hearing impairment, presenting the data on Italian-speaking children with cochlear implants published in Volpato (2011), Volpato and Vernice (2014), and Volpato and Cardinaletti (2015).

In Volpato (2011), the data of children with cochlear implants are compared with those of a language-matched control group of hearing children. In the study by Volpato and Vernice (2014), two additional control groups are included in the analysis. Children with cochlear implants are compared to three groups of children with normal hearing: a language-matched group, an age-matched group, and a group of children matched for time from cochlear implant activation. The aim of these analyses was to verify whether and to what extent children with cochlear implants differ from children with normal hearing in the development of relativization, when using an elicited production task, and the strategies they adopt to avoid object relativization.

4.2 The production of relative clauses by typically developing individuals

The research in Volpato (2010b) is at the heart of much linguistic research focused on the production of relative clauses by populations with typical and atypical language development across different languages. Much cross-linguistic research demonstrated that in English, French, Italian, and Greek, relative clauses are produced by typically developing children very early, around 3 years of age (Pérez-Leroux 1995; Crain, McKee, Emiliani 1990; McKee, McDaniel, Snedeker 1998; Varlokosta, Armon-Lotem 1998). Much research was also devoted to the elicited production of relative clauses (e.g. for English, Hamburger, Crain 1982; for Italian, Guasti, Cardinaletti 2003; Utzeri 2006, 2007; Re 2010; for French, Labelle 1990; Guasti, Cardinaletti 2003; for Hebrew, Novogrodsky, Friedmann 2006).

The earliest studies focusing on the elicitation of relative clauses in Italian by typically developing individuals were Guasti and Cardinaletti (2003) and Utzeri (2006, 2007). In Guasti and Cardinaletti (2003), a group of Italian-speaking children (age range 5;1-10;0) participated in an experiment eliciting different types of relative claus-

es (subject relatives, direct object relatives, indirect object relatives, locative relatives, genitive relatives). The elicitation task was an adaptation to Italian of the test used by Hamburger and Crain (1982). Results demonstrated that in the production of both subject and direct object relatives, children showed adult-like performance: the sentences were introduced by the complementizer *che* and rarely contained resumptive pronouns. Subject relatives were always correctly produced and were also used when other types of relatives were targeted. Target object relatives were sometimes avoided and turned into subject relatives through passivization of the verb, as in the following example:

(98) a. Tocca il cammello che il bambino ha comprato (9;3)
'Touch the camel that the child has bought.'
b. Tocca il cammello che è stato comprato dal bambino
'Touch the camel that has been bought by the child.'

In one case, in Italian, the relative operator *dove* replaced the complementizer in object relatives, and the child also inserted a resumptive pronoun in the embedded sentence:[27]

(99) Target: Tocca il panda che il bambino sta accarezzando
'Touch the panda that the child is striking'
Production Tocca il panda dove il bambino lo sta accarezzando
'Touch the panda where the child it is striking'(9;3)

Utzeri (2006; 2007) investigated the production of subject and object relative clauses by 41 Italian-speaking children aged between 6 and 11 years and 30 adults from 15 to 73 years of age. She elicited subject and object relative clauses by using a picture description task and a preference task, previously adopted by Novogrodsky and Friedmann (2006) and Friedmann and Szterman (2006) to test these structures in Hebrew-speaking typical and atypical populations. The DPs included in the experimental sentences of the task were all singular. Utzeri (2006; 2007) found that both children and adults correctly produced the targeted subject relatives. As for object relatives, children produced 22% of the elicited target sentences. Three types of object relatives were found in the corpus: with gaps (*La bambina che la mamma copre* 'The child that the mother wraps up'), with resumptive pronouns (*La bambina che la mamma la copre*

27 The study by Guasti and Cardinaletti (2003) also investigated the performance of a group of French-speaking children (age range 4;5-7;3). As in Italian, French direct-object relatives rarely contained resumptive pronouns. In French direct-object relatives, the complementizer *que* was sometimes replaced by *où*, and a resumptive pronoun also occurred (62% of cases).

'The child that the mother her wraps up'), and with resumptive DPs (*La bambina che il nonno bacia la bambina* 'The child that the granddad kisses the child').

Among the strategies adopted in order to simplify the production of object (and sometimes subject) relatives, resumption is largely used. Much research has demonstrated that children heavily rely on resumptive pronouns when producing relative clauses (for Italian, Belletti, Contemori 2010; Guasti, Cardinaletti 2003; Pivi 2014; Pivi, Del Puppo 2015; Utzeri 2006, 2007; Volpato 2010b; for French, Labelle 1990; Guasti, Cardinaletti 2003; for English, De Villiers 1988; Pérez-Leroux 1995; for Serbo-Croatian, Goodluck, Stojanovic 1996; for Spanish, Ferreiro et al. 1976; Pérez-Leroux 1995; for Hebrew, Friedmann, Szterman 2006). While in some languages the presence of resumptive pronouns is licit (e.g., Hebrew), in others, the massive use of resumptive pronouns in relative clauses is only attested in child language (e.g., French and Italian) and in informal speech and spoken colloquial language by people of different socio-economic backgrounds (Cinque 1988).[28]

Conversely, object relatives with resumptive DPs are frequent in young children's language (Pivi, Del Puppo 2015; Utzeri 2006, 2007; Volpato 2010b) but are not found in adults' productions.

The use of resumption has been identified as an important cue offering insights into the nature of grammar and language acquisition. Chomsky (1995; 2000; 2001) proposed that movement involves the creation of copies of the displaced constituent and deletion of all copies, but one. The use of resumption provides instances of sentences in which more than one copy is pronounced. Belletti (2005) accounted for this phenomenon in children's relative clauses by proposing that movement consists of two steps, copy + deletion. By adopting a raising analysis according to which all object relatives are derived through movement of the object head to a position in the CP projection (see chapter 2), different deletion degrees take place. Deletion is *total* in object relatives with gap, *partial* in object relatives containing resumptive pronouns, and *absent* in those containing resumptive DPs.

Note that while object relatives are frequent in child productions, they are almost absent in adults. Indeed, adults produced less than 1% of the targeted sentences. Children and adults adopted various

28 In Italian, as well as in other Romance varieties (Spanish, northern Italian dialects), resumptive pronouns are also used in other types of relatives (Cinque 1988):
(i) Indirect object relative:
Sono un tipo che gli piace rischiare
(ii) am a fellow that to-him 'pleases' [to] risk
(ii)Locative relative:
È una libreria che ci vado ogni tanto
(It) is a bookstore that (I) there go from time to time

strategies turning the targeted object relatives into subject relatives. The strategies that Utzeri (2006; 2007) identified were passive constructions (100) (also see (98)), causative constructions (101), use of 'receive+DP' (102), verb change (103):

(100) Target: il bambino che la mamma copre
the child that the mother wraps up
Production: il bambino che è coperto dalla mamma
the child that is wrapped up by the mother

(101) Target: Il bambino che il re pettina
The child that the king combs
Production: Il bambino che si fa pettinare dal re
The child that himself makes comb by the king
'The child that makes himself comb by the king'

(102) Target il bambino che la mamma bacia
the child that the mother kisses
Productionil bambino che riceve un bacio dalla mamma
the child that receives a kiss by the mother

(103) Target Il bambino che il nonno ascolta
The child that the granddad listens-to
ProductionIl bambino che legge al nonno
The child that read to the granddad

What is crucial in Utzeri (2006; 2007) is that children produced a considerable number of object relatives, whereas in adults, object relatives are nearly absent, and passivization is the prevailing strategy (93%).

In addition to object relatives, children produced 23% of causative constructions. In the group of adults, this strategy shows a low percentage of occurrence (3%). Causative constructions are thus frequent in child's productions, but at some point, they tend to decrease (on a par with object relatives) with increase in age.

The materials included in Utzeri's (2006; 2007) task showed some limits. Subject relatives contained animate subjects and inanimate objects. Instead, in object relatives, both referents were animate. This fact may have some consequences on the type of sentences that the participants have produced. Indeed, since in object relatives, the embedded singular DP may occur postverbally, and since the head DP is also singular, the produced sentences might be ambiguous between a subject and an object reading.

Another limit of the study by Utzeri (2006; 2007) is the fact that adolescent participants are included in the group of adults. As pointed out in chapter 3, the linguistic competence of some adolescents is not adult-like yet, and the performance is, in some respects, simi-

lar to that of younger participants. For this reason, adolescents' performance should be analysed separately from adults' one (and from children's one).

The research I carried out during my PhD aimed at contributing to the debate on the production of relative clauses, taking into consideration all these aspects, namely the use of animate referents for both subject and object relatives, and the creation of a group of adolescent students to be compared with a group of young children and a group of adults. The detailed description of the task and the results obtained are presented in the following sections.

4.3 The production of relative clauses: the task

The production task was inspired by the studies carried out by Friedmann and Szterman (2006) and Utzeri (2006; 2007), but with important improvements.

The task was composed of thirty-six trials, 12 eliciting a subject relative, 12 eliciting an object relative, and 12 filler sentences. In experimental items, all DPs have animate referents, and number was manipulated: both singular and plural head DPs were used. In twelve sentences, the head was singular, and in twelve, the head was plural, thus allowing the production of sentences with match or mismatch conditions. The presentation of filler items required the production of simple SV or SVO word order sentences. The list of trials is shown in Appendix C.

Two examples of items eliciting a subject and an object relative clause with singular head DP are shown respectively in Figure 7 and Figure 8:[29]

29 In the original tasks (Friedmann, Szterman 2006; Utzeri 2006; 2007), the question by the experimenter was: "Which child would you rather be?" (Italian: *quale bambino vorresti essere*?). In the trials presented in this experiment, the question by the experimenter was "Which child/children do you like (the most)?". The question was changed because for individuals with hearing impairment, the use of the conditional mood may cause troubles in the interpretation of the question (*vorresti*) and/or in the targeted production (*vorrei*). In order to avoid incorrect responses due to the incorrect use of the conditional mood, the use of simple indicative tense sentences was preferred.

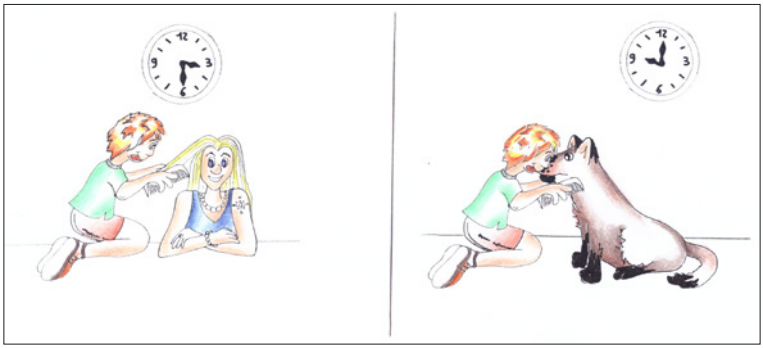


Figure 7 Elicitation of a subject relative (singular head)

Elicitation of subject relatives – Ci sono due disegni. Nel primo disegno, un bambino pettina la mamma. Nel secondo, un bambino pettina il cane. Quale bambino ti piace (di più)? Inizia con "Mi piace il bambino…" oppure "Il bambino…" Target: "(Mi piace) il bambino che pettina la mamma/il cane".
There are two pictures. In the first, a child is combing the mother. In the second, a child is combing the dog. Which child do you like? Start with "I like the child…" or "The child…" Target answer: (I like the child) that is combing the mother /the dog.

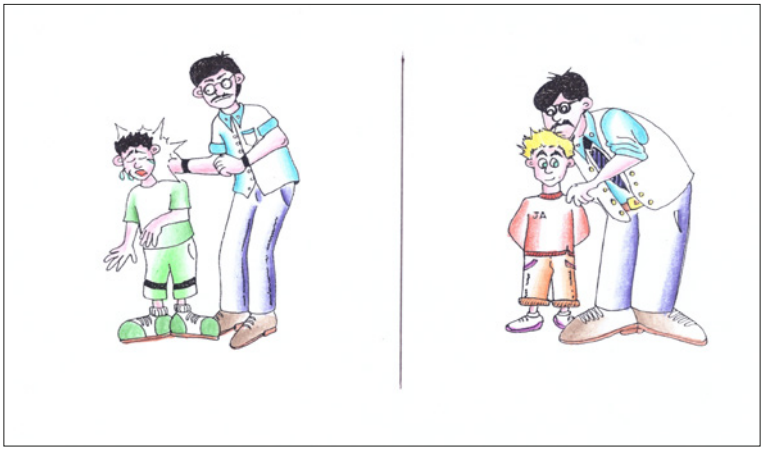


Figure 8 Elicitation of an object relative (singular head)

Elicitation of object relatives – Ci sono due disegni. Nel primo disegno, il papà colpisce un bambino. Nel secondo, il papà bacia pettina un bambino. Quale bambino ti piace? Inizia con "Mi piace il bambino…" oppure

"Il bambino..." Target: "(Mi piace) il bambino che il papà colpisce/bacia". *There are two pictures. In the first, the father is hitting a child. In the second, the father is kissing another child. Which child do you like? Start with "I like the child..." or "The child..." Target answer: (I like) the child that the father is hitting/ kissing.*

Two examples of items eliciting a subject and an object relative clause with plural head NP are shown respectively in Figure 9 and Figure 10:

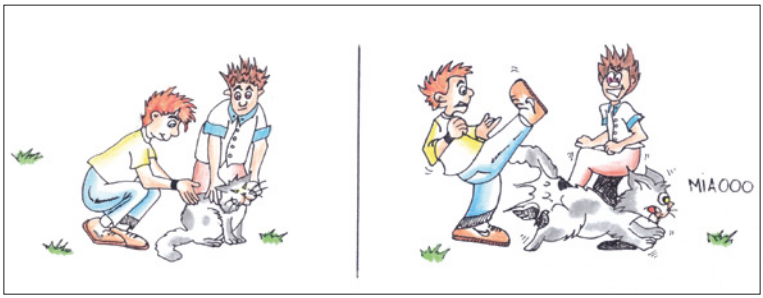


Figure 9 Elicitation of a subject relative (plural head)

Elicitation of subject relatives – Ci sono due disegni. Nel primo disegno, i bambini accarezzano il gatto. Nel secondo, i bambini colpiscono il gatto. Quali bambini ti piacciono (di più)? Inizia con "Mi piacciono i bambini..." oppure "I bambini..." Target: "(Mi piacciono) i bambini che accarezzano/ colpiscono il gatto".
There are two pictures. In the first, the children stroke the cat. In the second, the children hit the cat. Which children do you like? Start with "I like the children..." or "The children..." Target answer: (I like) the children that stroke/hit the cat.

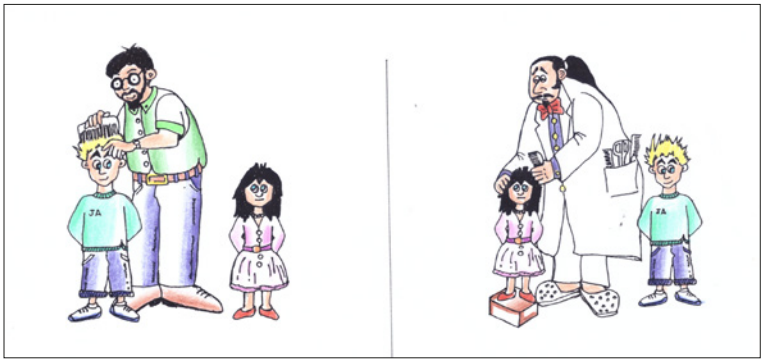


Figure 10 Elicitation of an object relative (plural head)

Elicitation of object relatives – Ci sono due disegni. Nel primo disegno, il papà pettina i bambini. Nel secondo, il barbiere pettina i bambini. Quali bambini ti piacciono? Inizia con "Mi piacciono i bambini…" oppure "I bambini…" Target: "(Mi piacciono) i bambini che il papà/barbiere pettina".
There are two pictures. In the first, the father is combing a child. In the second, the barber is combing another child. Which child do you like? Start with "I like the child…" or "The child…" Target answer: (I like) the child that the father/hairdresser is combing.

An example of item eliciting a filler sentence is shown in Figure 11:

Figure 11 Elicitation of a filler sentence

Cosa fa l'orso? Target: L'orso legge (un libro).
What is the bear doing? The bear is reading (a book).

The production task satisfies the felicity conditions pointed out by Hamburger and Crain (1982). Hamburger and Crain (1982) found that felicity conditions in the elicitation of relative clauses are met when at least two instances for the head of the sentence are placed in the experimental context. When these felicity conditions are satisfied, children's performance on relative clauses significantly improves. Moreover, through a preference task, the child's interest in the task is stimulated by the possibility of choosing the picture in which he/she can identify himself/herself. Although some choices might appear unusual to the child, he/she was asked to anyway express a preference for one of the two options.

Experimental trials were randomized and proposed in the same order to all participants. Only animate nouns were used, belonging to early vocabulary. All verbs were transitive, taking a direct object

as a complement, and were used in the present tense, in order to avoid difficulties deriving from the presence of auxiliaries and past participle morphology, which are often problematic for children with hearing impairment (Chesi 2006). The verbs used in the experimental task are: *lavare* (to wash), *colpire* (to hit), *inseguire* (to chase), *portare* (to bring), *tirare* (to pull), *spingere* (to push), *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), *visitare* (to visit).

Before beginning the task, all participants were familiarized with the nouns and verbs presented in the task. A training part preceded the experimental part, in order to familiarize participants with the items and the experimental setting, and to make sure that they had correctly understood instructions.

All participants' productions were audio-recorded and then transcribed for the analysis. For further details on the procedure adopted to test production, see chapter 2, section 2.11.

In the following sections, I present the results obtained comparing typically developing children, adolescents, and adults.

4.4 The comparison between typically developing children, adolescents and adults

The aim of this analysis is to check how the performance of children differs from that of older individuals. The group of adolescents was also included in the analysis, in order to investigate whether their performance was fully comparable to that of adults, or they still showed some different pattern of performance. This latter possibility might suggest that some syntactic properties are not yet fully developed at adolescence.

4.4.1 Participants

In this study, 16 monolingual Italian-speaking hearing children were compared to a group of 16 adolescents and a group of 16 adults.[30] A detailed description of the groups involved in this study is provided in chapter 2.

30 It would have been interesting to select a higher number of children for each age range (5-6-7- years), but it was not possible to create three homogeneous groups, therefore a single larger group with children belonging to the three age ranges was formed in order to avoid quantity unbalancing.

4.4.2 Results

The percentages of target subject relatives and object relatives correctly produced are shown in Table 25:

Table 25 Number and percentages of target responses for each group on each sentence type

	Children		Adolescents		Adults	
SR	174/192	91%	192/192	100%	190/192	99%
OR	34/192	18%	0/192	0	0/192	0

The table shows that for subject relatives, percentages of accuracy are very high for all groups. Adolescents performed at ceiling (100%), and adults were very close to 100%. The group of children made some errors in subject relatives. Despite this, the percentage of correct responses is very high, above 90%. However, children performed significantly lower than both adolescents and adults ($p<.001$ for both comparisons). As for object relatives, adolescents and adults never produced any of them, preferring instead the production of different types of subject relatives. Children produced a small amount of object relatives, replicating the findings by Utzeri (2006; 2007). The asymmetry found in previous studies between subject and object relatives is replicated.

4.4.3 Answering strategies in subject relative clauses

As we have seen in the previous section, in most cases subject relatives were correctly produced. In few cases, target (correct) subject relatives were replaced by incorrect productions.

In adults, only 2 sentences (out of 192) did not correspond to the target ones. One participant did produce a subject relative, but she used an intransitive verb instead of the target transitive (*Mi piace il bambino che corre dietro all'orso* instead of: *Mi piace il bambino che rincorre l'orso*). Another participant produced a passive relative instead of the target subject relative *(Il bambino che viene guardato dalla zebra* instead of: *Il bambino che guarda la zebra*).

Children produced the highest number of non-target responses, and in order to overcome the difficulties deriving from the production of a relative clause, they resorted to various strategies. They used other filling *wh-* elements instead of the complementizer (104), they produced incomplete sentences (105), they produced simple SVO sentences, preceded by *Mi piace che* 'I like that' (106) and in one case, a participant used a resumptive DP in the embedded subject posi-

tion (107):

(104) Target: Il bambino che bacia il cane
The child that kisses the dog
Production Il bambino perché bacia il cane
The child because he kisses the dog

(105) Target: I bambini che salutano il papà
The children that greet the father
Production salutano il papà
[they] greets the father

(106) Target: Mi piacciono i bambini che lavano il cane
I like the children that wash the dog
Production Mi piace che i bambini lavano il cane.
I like that the children wash the dog

(107) Target: Il bambino che pettina il cane
The child that combs the dog
Production Il bambino che il bambino pettina il cane
The child that the child kisses the dog

Table 26 summarizes the answering strategies used by each group and the number and percentage of occurrence of the different types of responses.

Table 26 Answering strategies for targeted subject relatives

	Children		**Adolescents**		**Adults**	
	No.	**%**	**No.**	**%**	**No.**	**%**
SR	174	90%	192	100%	190	99%
DP resumption	1	1%	0	0%	0	0%
Incomplete sentence	5	2%	0	0%	0	0%
wh- filler	6	3%	0	0%	0	0%
SR>OR	1	1%	0	0%	1	1%
SVO sentence	4	2%	0	0%	0	0%
Other strategies	1	1%	0	0%	2	1%

4.4.4 Answering strategies for targeted object relative clauses

Object relatives were much more problematic than subject relatives for all groups. An object relative was counted as correctly produced when the head moved from embedded object position, the embedded subject appeared in preverbal or postverbal position, and no resumptive element was produced (*Il bambino che il papà bacia* 'the child that the dad is kissing'). Neither adolescents nor adults pro-

duced any object relative. Only children produced object relatives. Some children produced object relatives with gap and with resumptive elements in the embedded clause. As already pointed out in section 4.2, object relatives containing resumptive clitic pronouns are found in colloquial Italian.

The strategies adopted to overcome the difficulties deriving from object movement are different. For some items in which the two DPs displayed the same number features, the participants produced ambiguous sentences (108).

(108) Target I bambini che i cani baciano
The children that the dogs kiss
Production I bambini che baciano i cani
The children that kiss the dogsor
The children that the dogs kiss

To avoid relativization of the object, in some cases, the participants used other strategies that are appropriate for the context, namely they turned the object relative into a subject relative producing causative constructions (109) and passive relatives (110).

(109) Target I bambini che i cani baciano
The children that the dogs kiss
Production I bambini che si fanno baciare dai cani
The children that make themselves kiss by the dogs

(110) Target I bambini che la maestra premia.
The children that the teacher prizes.
Production I bambini che vengono premiati
The children that are prized.

When avoiding beginning the sentence with the required hint "*Mi piace il bambino*", the participants turned the embedded subject into the head of the relative clause (head inversion), as in the following example:[31]

(111) Target: I bambini che il papà pettina
The children that the father combs
Production Il papà che pettina i bambini
The father that combs the children

In some cases, the correct relative clause was avoided by placing the complementizer *che* 'that' immediately after *Mi piace* 'I like' (see al-

31 In this case, thematic roles were correctly assigned.

so example (106) on subject relatives). In this way, a SVO clause is the subject of *piacere*, as the following example shows:

(112) Target: Mi piacciono i bambini che il cane rincorre
The children that the dogs run-after
Production: Mi piace che il cane rincorre i bambini
I like that the dog run-after the children

A variety of other strategies are found, however with lower percentages of occurrence: use of different *wh-* fillers (113), use of reflexive *si* (114), and production of subject relatives with theta role inversion (115):

(113) Target: Il bambino che la mamma bacia
The child that the mother kisses.
Production: (Mi piace) questo bambino, perché la mamma bacia lui…
(I like) this one because the mother kisses him

(114) Target: Il bambino che il papà lava
The child that the father washes.
Production: Il bambino che si fa la doccia
Il bambino that himself has a shower
'the child that is having a shower'

(115) Target: Il bambino che il cane insegue
The child that the dog chases.
Production: I bambini che inseguono il cane
The children that chase the dog

Some relatives were produced by modifying the verb and/or paraphrasing the sentence to avoid relativizing the object, and they were coded as 'other strategies' as in the following example:

(116) Target: I bambini che il cane rincorre.
The children that the dogs run-after.
Production: Quelli che stanno correndo e il cane li insegue.
Those that run and the dog run-after them.

The strategies adopted by each group when an object relative was targeted are summarized in the following table:

Table 27 Answering strategies for targeted ORs by each group (out of 192 expected responses for each group)

	Children		Adolescents		Adults	
	No.	**%**	**No.**	**%**	**No.**	**%**
Object relatives with gap (target)	34	18%	0	0%	0	0%
Object relatives with resump. clitic pronoun	37	19%	0	0%	0	0%
Object relatives with resump. DP	11	6%	0	0%	0	0%
Ambiguous sentences	22	11%	21	11%	3	2%
Passive relatives	6	3%	158	82%	189	97%
Causative constructions	18	9%	7	4%	0	0%
Ungramm. sentences/various errors	2	1%	3	2%	0	0%
Use of different *wh-* 'fillers'	5	3%	0	0%	0	0%
Use of reflexive 'si'	2	1%	0	0%	0	0%
Simple SVO sentence (no RC)	11	6%	0	0%	0	0%
Theta-role inversion	3	2%	1	1%	0	0%
Head inversion	29	15%	2	1%	0	0%
Other strategies	12	6%	0	0%	0	0%

As opposed to adolescents and adults, children adopted a wide variety of strategies. They produced a high number of object relatives (considering both target relatives and relatives with resumptive elements) as opposed to the older age groups. Conversely, the older participants (adolescents and adults) largely produced passive relatives. Sometimes the group of children produced subject relatives with causative constructions to avoid object relativization, replicating previous findings by Utzeri (2006; 2007). In some cases, due to the difficulty to handle object relatives, children produced subject relatives by turning the embedded subject into the relative head (15% of occurrences) or totally avoided the relative clause producing a simple SVO sentence instead.

Adolescents differed from children as far as the types of answering strategies are concerned. They never produced object relatives, which were replaced by subject relatives. Instead, they produced a very high percentage of passive relatives (92%), thus showing a trend towards adult-like performance. Nonetheless, many ambiguous sentences (11%) and a small percentage of causative constructions (4%) and ungrammatical sentences (2%) were found, replicating a linguistic behaviour found in younger participants. In 1 sentence, they incorrectly considered the head as the subject of the embedded clause (Theta role inversion), and in 2 sentences, they comprehended the-

matic roles correctly, but in order to avoid the production of an object relative, they turned the embedded object into the head of the main clause (head inversion).

Adults, like adolescents, avoided the production of object relatives. They only produced subject relatives, in almost all cases, through passivization of the verb. Only in three trials, the adult participants produced ambiguous structures.

What is worth pointing out is that in the group of children some causative constructions are found. Then, this strategy starts being avoided with increase in age, and in adolescents the percentage of occurrence is very small. In the group of adults, the causative construction is no longer found.

In sum, these data replicate previous findings on children and adults, and most interestingly, show that the performance of adolescents differs to some extent from that of adults. These findings suggest that adolescent students must be kept separate from adults in studies on language acquisition and that it is important to also investigate the linguistic behaviour of this population, as it can provide interesting insights into the process of language development.

Based on the results and on the answering strategies used by participants, the following sections are devoted to the discussion of the results, focusing on the asymmetry between subject and object relative clauses, and on the asymmetry between object relatives and passive relatives.

4.5 The asymmetry between subject and object relatives

The first important finding of the comparison between children, adolescents, and adults is that the percentages of target subject relatives are very high for all participants, while object relatives show very low percentages of occurrence. This result replicates previous studies on Italian (as well as other languages). Processing-based and grammatical approaches (see chapter 2 and 3) explain this asymmetry by pointing out that in subject relatives, a short (local) movement of the subject from its original position to the landing site in the CP domain occurs (117), as opposed to object relatives, in which the movement takes place from the embedded object position (118), involving the establishment of a longer relation between the two positions:

(117) Mi piacciono [i bambini [che <i bambini> accarezzano il gatto]
▲ _____|

(118) Mi piacciono [i bambini [che il papà pettina <i bambini>]
▲_____|

Several studies highlighted that syntactic complexity and long-distance relations place a heavy load on performance systems (De Vincenzi 1991; Gibson 1998; Jakubowicz, Tuller 2008; Contemori, Garraffa 2010; Jakubowicz 2011; Tuller et al. 2011).

Friedmann, Belletti, and Rizzi (2009) discussed the asymmetry between subject and object relatives in terms of locality and intervention (RM) effects due to the presence of an intervening lexically restricted noun phrase in object relatives between the head in the main clause and its trace in the embedded object position.

Belletti (2009) and Friedmann, Belletti, and Rizzi (2009) suggested that in object relatives, the derivation is blocked and disfavoured for children due to the intervention of the full DP in the embedded subject position. Hence, a rigid version of RM is at play in child grammars.

However, these findings raise some important questions. If this assumption is correct and RM is at play in immature grammars, why do young children also correctly produced object relative clauses? This is unexpected. Conversely, if RM is a source of difficulty especially for children, why do we not find any object relatives in the adults' production corpus?

In what follows, I suggest that children's and adults' performance does not have to be traced back to RM but to some other linguistic phenomenon occurring in the derivation of object relatives together with developmental processes. I will discuss these aspects in the next sections.

4.6 The asymmetry between object relatives and passive relatives

When object relatives were targeted, children adopted a high number of strategies in order to avoid object relativization. Despite the difficulty of these structures, typically developing children do produce object relatives, replicating data collected by Guasti and Cardinaletti (2003), Carpenedo (2009) and Utzeri (2006; 2007) on other Italian-speaking children.

Typically developing children produced a considerable number of object relative clauses (36%). Adults and adolescents did not produce any target object relative and preferred producing subject relatives through passivization of the verb (passive relative clauses). Adults produced 97% of passive relative clauses, whereas the percentage of production of these structures by adolescents was 82%. The high percentage of passive relatives in adults replicates the data collected by Utzeri (2006, 2007) on this population (93%). In children, the percentage of passivized structures is very low (3%), as opposed to older participants.

Since the main trend is that passive relatives consistently increase and object relatives finally disappear with increase in age, the discussion focuses on the use of these two options, leaving aside all the other strategies. I will try to account for the presence of object relatives in early stages of language acquisition and the switch from these structures to passive constructions at a later stage of language development.

To explain the behaviour of typically developing children, adolescents, and adults, the recent proposal by Collins (2005) on the representation of passive sentences and those in Belletti (2009) on the source of difficulty in the acquisition of object relative clauses are discussed.

4.7 The production of passive constructions

Passivization involves the transformation of a targeted object relative into a subject relative. Since subject relatives are easier than object relatives, we would expect that children use the former strategy more often than the latter. However, passive sentences appear far from being fully mastered at early stages of language development. How can this be explained? To answer this question, it is necessary to proceed step by step, first analyzing the syntactic properties of passive sentences.

The active sentence in (119) may be passivized as in (120):

(119) Il papà pettina il bambino.
The father combs the child.

(120) Il bambino è pettinato dal papà.
The child is combed by the father.

Turning an active sentence into a passive sentence involves the reorganization of grammatical functions. The object (internal argument) of the active sentence, *il bambino* 'the child', becomes the grammatical subject of the passive sentence. The subject (external argument) of the active sentence, *il papà* 'the father', becomes the oblique object of the passive sentence introduced by the preposition *by.* Passive sentences represent problematic structures because they contain movement and long-distance dependencies between the sentence constituents.

Early accounts (Jaeggly 1986) suggested that passive sentences involve A-movement and are derived through direct raising of the object DP to the specifier of IP. The internal argument receives the thematic role from the trace in the original position, with which it is coindexed. By reaching the subject position, the internal argument triggers agreement on the inflected verb.

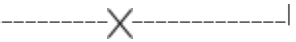
More recent theories (Collins 2005), based on data from English, proposed that the derivation of passive sentences is slightly more complex, because more derivational steps are involved. Collins proposed that passive sentences are derived through *smuggling*. *Smuggling* occurs when the movement of the internal argument over an external argument is required, but minimality effects arising between elements of the same featural class (Rizzi 2004b, see section 3.2) block the relationship between the original object position and its final landing site.

Smuggling is defined by Collins (2005, 97) as follows:

(121) Suppose a constituent YP contains XP. Furthermore, XP is inaccessible to Z because of the presence of W, some kind of intervener blocking any syntactic relation between Z and XP. If YP moves to a position c-commanding W, YP smuggles XP past W.

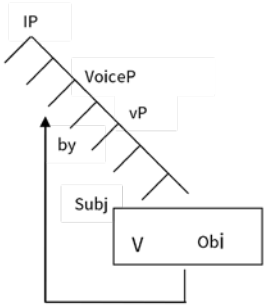
This definition is illustrated as follows:

(122) Z [$_{YP}$ XP] W <[$_{YP}$ XP]>



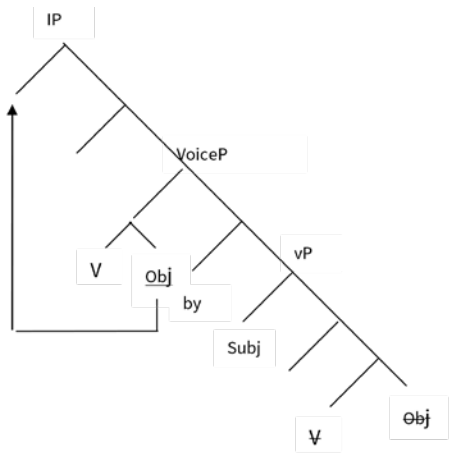
Smuggling is the operation which avoids intervention in passive sentences. The external argument, the subject in Spec/vP, represents a blocking element for the movement of the VP-internal direct object to a position higher than vP. For this reason, *smuggling* of the Verb+Object (VP) projection makes it possible for the object to cross over the external argument and land in a higher projection, namely the specifier of the Voice/P projection, whose head is the preposition *by*.

(123)



From there, the object alone moves to a still higher position, the specifier of IP, without producing any RM violation:

(124)



In the same way as (simple) passive sentences, passive relatives are derived through *smuggling* and subsequent object extraction to perform relativization in a higher position (Belletti 2009):[32]

(125) DP [$_{CP}$ NP_{obj} che [$_{IP}$ *pro* aux [V <NP_{obj}>] *by*… [$_{vP}$ DP_{subj} < [V NP_{obj}]>]]]]
▲_____|_____|
il bambino che è pettinato <il bambino> dal papà <pettinato il bambino>
the child that is combed <the child> by the father <combed the child>

A first step is necessary for the VP, containing the verb and the object, to smuggle the subject in the vP-internal position, and a second step is necessary for the object to reach the head position inside CP. The preverbal subject position is filled with the expletive pronoun *pro*. As (125) shows, differently from passive sentences, in passive relatives the object reaches an A' position, namely the specifier of CP. Hence, differently from object relatives, in passive relatives, both A

32 Following (Belletti 2009), we assume that in passive subject relatives, subject movement does not occur through the EPP preverbal subject position, because this is a criterial position and movement would be blocked there (Rizzi 2006; Rizzi, Shlonsky 2007).

and A' movements occur in the derivation. Therefore, the presence of two different chains is involved.

In object relatives, the head (object) moves from a low position inside the VP, as a complement of the verb, and raises to a higher position in the CP node. Therefore, object relatives are derived through A' (long) movement of the VP-internal object to the left-peripheral position, CP, as the following example shows:

(126) DP [$_{CP}$ NP$_{obj}$ che [$_{IP}$ DP$_{subj}$ [$_{vP}$ V <NP$_{obj}$>]

▲_____|

Il bambino che il papà pettina <il bambino>

'the child that the father combs <the child>'

The correct production of target object relatives by (young) children leads us to exclude relativized minimality as the source of difficulty. The early use of object relatives could instead be explained in terms of a preference for the lowest number of steps required in the sentence derivation. Indeed, object relatives are derived through a unique (long) step (126), as opposed to passive relatives, in which more local steps are necessary to build up the syntactic structure (125).

Belletti (2009) suggested that the use of passive relatives represents the most economical solution to realize the structure, since intervention effects are no longer present. The availability of *smuggling* makes it possible for children to shift from object relatives to passive relatives when they grow older. There is not an exact moment in which this property becomes available. Indeed, as we have seen, children also produce passive relatives. Children seem to have a wide range of possible strategies available in their grammar to convey meaning. Then, depending on the linguistic resources available at a specific stage, they will opt for either a structure or the other.

Importantly, it is not possible to argue that maturation is at stake here. If *smuggling* were not available at all in early grammars, passive sentences should never be comprehended or produced by very young children. Evidence to the contrary has however accumulated over the years across different languages (a.o., for English, O'Brien, Grolla, Lillo-Martin 2006; Bencini, Valian 2008; Messenger et al. 2009; for Sesotho, Demuth, Moloi, Machobane 2010; for Italian, Verin 2010; Tagliaferro 2011; Manetti 2013; Volpato et al. 2013; Volpato, Verin, Cardinaletti 2014; 2016).

The higher percentage of object relatives than passive relatives in child language can be explained in terms of agreement relations between sentence constituents. Along the lines of Franck et al. (2006) and Guasti and Rizzi (2002), in object relatives with SV word order, the agreement relationship is established both under AGREE and in the local Spec-Head configuration, as shown in the following repre-

sentation:

(127) [$_{DP}$ I bambini [$_{CP}$ che [$_{IP}$ il papà [$_{t}$ pettina] [$_{vP}$ ~~il papà~~ [$_{VP}$ ~~pettina <i bambini>~~]]]]]
|Spec-Head||_AGREE|

In passive relatives, which display a VS word order, the agreement relation between the inflected verb and the internal argument, the patient only occurs under AGREE (after *smuggling* has taken place):

(128) [$_{DP}$ Il bambino [$_{CP}$ che [$_{IP}$ è [pettinato <il bambino>] dal [$_{vP}$ papà [$_{VP}$ ~~pettinato <il bambino>~~]]]]]
|___AGREE____|

Object relatives are therefore more accessible than passive relatives since the agreement relationship occurs both under AGREE and in the Spec-Head configuration (see (127)). On the other hand, in passive relatives this relationship is more fragile since no local checking in a Spec-head configuration takes place (128) (cf. Franck et al. 2006).

Summing up, the preference for object relatives in the early stages of language acquisition is explained by the presence of a unique step in the structural derivation, strengthened by the robustness of agreement between the embedded subject and the verb, occurring both under AGREE and in the Spec-Head configuration. In passive relatives, in which more local steps are involved, the delayed access to *smuggling* depends on the fragility of agreement based on AGREE only. When *smuggling* becomes fully available, local movement steps constitute the most economical solution and are therefore highly preferred over one unique long relationship.

The preference for a unique (long) chain is also predicted by the Derivational Complexity Metric, which states that "merging α n times gives rise to a less complex derivation than merging α (n+1) times" (Jakubowicz, Strik 2008, 106; see also Jakubowicz 2011).

In the course of language development, children replace the preference for the unique long-distance relationship (as in object relatives) with the preference for more local relationships (as in passive relatives).

4.8 The production of relative clauses: further studies

In the same years as my PhD (Volpato 2010b), the study by Belletti and Contemori (2010) also investigated the strategies that Italian-speaking typically developing children and adults adopt when object relatives are elicited.

Belletti and Contemori (2010) tested 48 children (age range: 3;4-6-5), who were compared to 28 adults (age range: 20-30 years). As in

Utzeri (2006; 2007), a preference task was used to test 10 subject and 10 object relatives. The items eliciting subject relatives contained animate subjects and inanimate objects, while in the items eliciting object relatives both the subject and the object were animate. Since a condition in which both referents are singular may cause the production of ambiguous sentences in Italian (see the discussion in chapter 2, section 2.8.2), 6 trials were added in which the agent was plural and the patient singular in order to elicit the production of unambiguous structures. A second preference task assessed the production of unambiguous object relatives in which the head was plural, and the embedded DP was singular. The analysis of all results confirmed previous findings. The percentage of subject relatives produced by the children approached (or was above) 90% by the age of 4, while the percentage of unambiguous object relatives produced at the age of 4 to 6 years is around 50%. In adults, subject relatives were at ceiling, while the percentage of object relatives was about 10%. Once again, the prevailing strategy consisted in the production of passive relatives (88%). This structure occurred at lower rates in 5- to 6-year-old children. The authors attributed the low percentage of passive relatives in the group of children until the age of 6;5 to the fact that the passive voice starts being acquired by that age. However, this cannot be the case, since, as pointed out in section 4.7, Italian children are able to produce and comprehend passive sentences already at a younger age.

In the following years, Contemori and Belletti (2013) investigated the elicited production of subject and object relatives in a larger sample of children, including 97 participants aged 3;4-8;10 years. The results confirmed the trend observed in the study by Belletti and Contemori (2010) and the behaviour observed in the data collected during my PhD and presented in the previous sections. As children grow older, the percentage of passive relatives increases more and more, while object relatives decrease and are almost avoided in adulthood, as the following table (adapted from Contemori and Belletti 2013) shows.

Table 28 Percentage of object relatives and passive relatives produced at the different ages (adapted from Contemori and Belletti 2013)

Task	Conditions	Age					
		3	4	5	6	8	Adults
Elicitation task 1	Object relatives	26%	55%	44%	39%	40%	3%
	Passive relatives	0%	5%	12%	15%	40%	97%
Elicitation task 2	Object relatives	39%	52%	52%	65%	32%	10%
	Passive relatives	0%	0%	11%	10%	55%	88%

4.9 The production of relative clauses in individuals with hearing impairment

The preference task presented in section 4.3 was also used to test a group of Italian-speaking children with cochlear implants. This part of the research was inspired by the study carried out by Friedmann and Szterman (2006), who tested a group of 14 Hebrew-speaking children with hearing impairment, ranging in age from 7;7 to 11;3 years. The group was quite heterogeneous, since it included children with different degrees of hearing loss (from moderate to profound), using either conventional hearing aids or a cochlear implant. Results demonstrated that these children crucially showed significant difficulties with both subject and object relative clauses, although non-target responses were more attested in the latter type of sentences. They produced correctly about 80% of subject relatives. The majority of errors concerned the production of ungrammatical sentences and the avoidance of relative clause by producing a sentential complement (129) instead:

(129) hayiti roce she-safta texabek yeled exad
Would-1sg-past want that-grandma hug-future boy one
'I would want that grandma would hug one boy'.

The Hebrew-speaking children with hearing impairment experienced great difficulties in producing object relatives. They refrained from the production of an object relative either by turning it into a subject relative or by producing a sentence without a relative clause (10% of productions). In many cases, they ended up with producing ungrammatical sentences (24% of cases). Ungrammatical sentences included the use of resumptive object DPs (*This is the girl that grandma is combing the girl*), resumptive subject DPs (*This is the teddy bear that the teddy bear is hugging the clown*), and resumptive subject pronouns in subject relatives (*This is the boy that he is washing the father*). In 19% of responses, children produced grammatical object relatives without resumptive pronouns (target object relatives); instead, 42% of responses were grammatical object relatives with resumptive pronouns (*I would like to be a boy that grandma dresses him*), 6% of object relatives were turned into grammatical subject relatives (Target: *This is the girl that the nurse is photographing;* produced: *This is the girl that is looking at the camera).* Friedmann and Szterman (2006) interpreted the avoidance of object relativization and the use of the different strategies as a sign of a linguistic deficit. Indeed, the responses produced by the children with hearing impairment were different from those produced by the controls. The conclusion the authors draw was that the problematic production of object relative clauses documented a significant difficulty in

using movement-derived constructions, due to delayed and reduced access to the linguistic input.

The acquisition of subject and object relative clauses was previously investigated in English-speaking individuals with hearing impairment by De Villiers (1988). This study presented data collected from 36 orally trained adolescents with hearing impairment wearing conventional hearing aids and ranging in age from 11 to 18 years. They were compared to 20 5-to-6-year-old children. The task was an elicitation task through which the participants were forced to produce restrictive subject and object relative clauses like those shown in the examples in (130):

(130) SS. The cowboy who brushed the horse is washing the cow
OS. The policeman is grabbing the man who broke the window
OO. The farmer is kicking the pumpkin that the racoon licked
SO. The cat that the boy brushed is chasing the mouse

Normal hearing children aged from 4 to 6 years produced sentences like those in (130) without any difficulty, but the participants with hearing impairment made several types of errors, among which the introduction of resumptive pronouns, mistakes in the relative pronoun, and relativization of the incorrect noun phrase. Although the performance of the participants with hearing impairment patterned with that of much younger hearing children as far as the gradient of difficulty of the four types of relative clauses, the type of sentences they produced (e.g. *the girl that petted the dog, her father is feeding the dog the food*, Target: *the girl is petting the dog that the man fed*) led the author to the conclusion that relative clauses were extremely delayed in these participants. In a later study, De Villiers, De Villiers, and Hoban (1994) suggested that the CP node is impaired in individuals with hearing impairment.

On a par with Hebrew and English, some asymmetries in the production of relative clauses (pseudo-relatives) was found in French-speaking children with mild-to-moderate hearing loss ranging in age from 7;11 to 13;11 years (Delage 2008). The group of participants with hearing impairment was split into two subgroups, distinguishing young from older individuals. In the former group, the mean age was 9;8 years, and in the latter, it was 12;6 years. The control group was composed of younger children, whose mean age was 6;4. Replicating previous results, subject relatives showed higher percentages of correct responses than object relatives in all groups (84% for the hearing group, 73% for the younger group of children with hearing impairment and 93% for the older one). In the experimental group, errors in the production of subject relative clauses included the use of simple SVO sentences, thus avoiding relativization, and the use of

où 'where' as replacing filler for the complementizer.[33]

For object relatives, the percentages of target responses were 41% for the hearing group, 23% for the young experimental group, and 0.7% in the older group. Two young participants with hearing loss produced 100% of target object relatives. However, in order to avoid object relativization, most participants turned object relatives into subject relatives, by using causative and passive constructions. The use of passive relatives was the strategy prevailing in the group of older participants with hearing impairment. Some participants also produced simple SVO sentences, sentences in which the complementizer was missing, and sentences in which the complementizer was replaced by the filler *'où'*.

Starting from these findings on other languages, my research also focused on the production of subject and object relative clauses by Italian-speaking children with hearing impairment fitted with cochlear implants. As said in section 4.2, this study was the first one in which both referents were always animate (for both subject and object relatives) and reversible, and in which the head and the embedded DP were both in the plural and in the singular, thus yielding sentences in both match and mismatch conditions. The next sections present the results of the study.

4.10 The production of relative clauses in children with cochlear implants: the first results for Italian

This section will present the results of the study carried out on Italian children with cochlear implants.

The group of 13 Italian-speaking children with cochlear implants (CI, age range 7;9-10;8) presented in section 2.10.1 was compared to a group of 13 language-matched hearing children (LA, age range 5;7-7;9) (Volpato 2010b; 2011; Volpato, Vernice 2014), to a group of 13 children matched on the length of exposure to the oral language through cochlear implants (AA, age range 4;11 to 9;4) and a group of 13 age-matched children (CA, age range 7;5 to 10;3) (Volpato, Vernice 2014). The children with hearing impairment were tested at the clinical centres where they went for their follow-up visits. Normal hearing children were tested at their schools during school hours. For further details on the procedure adopted to test production, see chapter 2, section 2.11.

The production of subject and object relatives was investigated by using the preference task presented in section 4.3. Through this task, children were forced to produce a relative clause. The list of trials is shown in Appendix C.

33 For the use of *où* in French typically developing children, see Labelle (1990) and Guasti and Cardinaletti (2003).

All participants' productions were audio-recorded and then transcribed for the analysis. In coding the responses provided when both subject and object relatives were targeted, a wide number of strategies was observed in all groups. Subject and object relatives were considered as target when they had the structure as shown in (131) and (132), respectively:

(131) I bambini che lavano la tigre
'The children that wash the tiger'

(132) I bambini che (il papà) pettina (il papà)
'The children that (the dad) combs (the dad)'

In object relatives with DP number mismatch (as in 132), the embedded subject was considered as correct when it was placed either in pre-verbal or postverbal position. In object relatives with DP number match, the structure was considered as target when the embedded subject was placed in preverbal position, in order to avoid ambiguous structures.

The percentages of target subject relatives (SR) and object relatives (OR) produced by each of the four groups are shown in the following table, taken from Volpato and Vernice (2014):

Table 29 Number (No.), Mean (M), and Standard Deviation (SD) of target responses in each type of sentence (SR: subject relative; OR: object relative) in each group (CI: children with cochlear implants; LA: language-matched hearing children; AA: children matched on auditory age; CA: age matched hearing children)

	SR			OR			TOT		
	No.	M	SD	No.	M	SD	No.	M	SD
CI (7;9-10;8)	138/156	88%	6%	10/156	6%	8%	148/312	47%	5%
LA (5;7-7;9)	154/156	99%	0.1%	22/156	14%	29%	176/312	56%	2%
AA (4;11-9;4)	150/156	96%	5%	29/156	19%	30%	179/312	57%	3%
CA (7;5-10;3)	156/156	100%	0%	21/156	13%	27%	177/312	57%	2%

Overall, results showed that for all groups (both the experimental and the control groups), accuracy is higher in subject relatives than in target object relatives. Although the pattern of performance is the same for all groups, in the group of children with cochlear implants, the percentages of accuracy of subject and object relatives is lower than in each of the control groups.

In Volpato and Vernice (2014), data were statistically analysed following Dixon (2008) and Jaeger (2008). Repeated-measure logistic regression analyses were carried out in order to analyse accuracy data, using the statistical software R (R Development Core Team 2008). Comparing the CI and LA groups, no significant difference was found

between the groups. A significant predictor was sentence type (subject vs. object relatives): $\chi^2(1) = 73.12$, $p < .001$. Overall, subject relatives are easier to produce than object relatives (Wald Z=13.02, $p < .001$). Analyses within the CI and the LA groups showed that subject relatives were more accurate than object relatives (CI: Wald Z=10.04, $p < .001$; LA: Wald Z=6.50, $p < .001$). In the comparison between the CI and the CA groups, the latter was found to perform better than the former (Wald Z= 1.93, $p < .05$). Moreover, overall, subject relatives were significantly easier than object relatives (Wald Z=11.14 $p < .001$).

In the comparison between the CI and AA groups, on overall performance, the AA group was found to perform better than the CI group (Wald Z= 1.92, $p < .05$). A significant main effect of sentence type as well was found, namely subject relatives are easier to produce than object relatives (Wald Z= 13.64, $p < .001$).

The asymmetry between subject and object relatives found in both the group of children with cochlear implants and the three groups of normal hearing children, was previously found by a considerable number of studies carried out on different populations across different languages (see 4.2 above).

Subject relatives (133) are easier than object relatives (134) because the relation between the relative head and the position from which it has moved and in which it is interpreted is short.

(133)	Mi piacciono	[i bambini	[che <i bambini>	lavano la tigre]]
	I like	[the children	[that <the children	wash the tiger]]
		|_____|	

(134)	Mi piacciono	[i bambini	[che il papà pettina	<i bambini>]]
	I like	[the children	[that the father combs	<the children>]]
		|_____|	

Moreover, in subject relatives the canonical unmarked SVO word order is maintained. Instead, object relatives are characterized by a longer movement and a long-distance relationships between the position in which the object is pronounced in the main clause and the merge position in which it is interpreted (134). Movement of the object produces a marked OSV (or OVS) word order. As pointed out in section 4.5, syntactic complexity and long-distance relations place a heavy load on performance systems (De Vincenzi 1991; Gibson 1998; Jakubowicz, Tuller 2008; Contemori, Garraffa 2010; Jakubowicz 2011; Tuller et al. 2011; Volpato, Vernice 2014).

The low percentage of accuracy of children with cochlear implants as opposed to normal hearing controls in both subject and object relatives may be explained by the type of dependency establishing between the position of first merge of head and the final landing position (Volpato, Vernice 2014). Although subject relatives maintain

a SVO word order, they involve A' movement. Right-branching relatives are characterized by the presence of two thematic relations, since the subject or the object of the relative clause are the object of the main clause. The fact that also subject relatives are problematic for children with cochlear implants is likely due to the presence of movement and the computation of an element with respect to two verbs. In example (133), for instance, the DP *i bambini* 'the children' is the object of the verb *piacere* 'to like', but it is also the subject of the verb *lavare* 'to wash'.

A further analysis carried out by Volpato and Vernice (2014) on the group of children with cochlear implants aimed at investigating whether a correlation exists between performance on subject and object relatives and clinical variables (i.e., length of cochlear implant use, age of hearing aid fitting, and age of cochlear implantation). Interestingly, the length of cochlear implant use was found to positively correlate with the production of subject relatives ($r = .23$ $p < .004$). Children using a cochlear implant for a longer time appear to have better linguistic outcomes in this structure than children using it for a shorter period of time. Previous studies highlighted the association between syntax development and duration of use of cochlear implants in children with hearing impairment (e.g. Schorr, Roth, Fox 2008).

In the elicitation of both subject and object relatives, different strategies were found. These strategies are detailed in the following sections separately for subject and object relatives.

4.11 Answering strategies for targeted subject relatives

In subject relatives, only the target structure shown in (131) is appropriate for the context. The other strategies, which were not appropriate, consisted in the production of simple SVO word order sentences without relativization (135), relative clause in which the complementizer *che* 'that' was replaced by a different wh-filler (such as *dove* 'where') (136), subject relatives with theta-role inversion, in which an object relative was produced instead of a subject relative (137), sentences in which the complementizer *che* was omitted (138), ungrammatical sentences (139), incomplete relatives (140):

(135) Target: Il bambino che rincorre l'orso
'The child that runs after the bear'
Production: Il bambino rincorre l'orso
'The child runs after the bear'

(136) Target: Il bambino che alza l'elefante
'The child that lifts the elephant'
Production: Mi piace il bambino quello dove alza l'elefante

'I like the child where (he) lifts the elephant'

(137) Target: I bambini che baciano la bambina
'The children that kiss the child.FEM'
Production: I bambini che bacia la bambina
the children that kisses the child.FEM
'The children that the child.FEM kisses'

(138) Target: Mi piace il bambino che guarda la tigre
'The child that looks at the tiger'
Production: Mi piace il bambino … guarda la tigre
'I like the child... looks at the tiger'

(139) Target: Il bambino che rincorre l'orso
'The child that run after the bear'
Production: Il bambino rincorrere l'orso
'The child to-run-after the bear'

(140) Target: Mi piace il bambino che pettina il cane
'I like the child that the combs the dog'
Production: Mi piace il cane
'I like the dog'

Sentences which were not included in one of the previous options were classified under the label 'Other strategies'.

The following table shows the percentages of responses provided for the different strategies when a subject relative was targeted:

Table 30 Mean (M) and Standard Deviation (SD) of answering strategies for target subject relatives in the four groups (taken from Volpato, Vernice 2014)

	CI		LA		AA		CA	
	M	SD	M	SD	M	SD	M	SD
Target SRs	88%	23%	99%	5%	96%	8%	100%	0%
I bambini che accarezzano il gatto								
SVO sentence	5%	16%	1%	2%	2%	4%	0%	0%
Il bambino rincorre l'orso								
***Wh*-fillers**	2%	5%	0%	0%	0%	0%	0%	0%
Il bambino quello dove alza l'elefante								
Ungrammatical sentences/various errors	1%	3%	0%	0%	0%	0%	0%	0%
Il bambino rincorrere l'orso								
Omission of *che*	1%	2%	0%	0%	0%	0%	0%	0%
Mi piace il bambino guarda la tigre								
Theta-role inversion	1%	2%	0%	0%	0%	0%	0%	0%
I bambini che bacia la bambina								
Incomplete sentences	0%	0%	0%	0%	1%	2%	0%	0%
Mi piace il cane								

Other strategies	2%	4%	1%	2%	1%	3%	0%	0%

While for almost all trials, the groups of normal hearing children produced subject relatives correctly, children with cochlear implants used other strategies. The most frequent strategy consisted in the use of simple SVO sentences. This strategy was rare in the groups of younger hearing children, and completely absent in the group of older ones. The CI group used different *wh*-fillers instead of the complementizer *che* (*dove* 'where', *quando* 'when'), and produced ungrammatical sentences. These strategies were never used by any of the hearing groups.

The presence of a considerable number of simple SVO sentences and ungrammatical structures in productions by the participants with cochlear implants is a phenomenon observed cross-linguistically and found in studies assessing relative clause production in other populations with hearing impairment, for instance in Hebrew (Friedmann, Szterman 2006) and French (Delage 2008). Both the use of simple SVO and ungrammatical sentences can be considered a marker for atypical performance or linguistic delay in acquisition.

4.12 The use of resumption in target object relatives

In addition to the target structure with a gap in the object position, some children produced object relatives with resumptive elements, either clitic pronouns (141), or full DPs (142):

(141) Il bambino che l'orso ***lo*** accarezza
the child that the bear ***him*** caresses
'The child that the bear caresses him'

(142) Il bambino che l'orso accarezza ***il bambino***
'The child that the bear caresses ***the child***'

The following table shows the number and percentage of the three types of object relatives (target object relatives, object relatives with resumptive pronouns, and object relatives with resumptive DPs) out of the total number (156) of sentences (taken from Volpato, Vernice 2014).

Table 31 Mean (M) and Standard Deviation (SD) of resumptive relatives in the four groups (taken from Volpato, Vernice 2014)

	CI		LA		AA		CA	
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
Target ORs (with gap)	6%	8%	14%	29%	19%	30%	13%	27%
Il bambino che il papà lava								
ORs with resumptive clitic	10%	23%	15%	22%	8%	14%	1%	5%
Il bambino che il papa lo lava								
ORs with resumptive DP	7%	13%	4%	9%	3%	7%	0%	0%
Il bambino che il papà lava il bambino								
Total ORs	**23%**		**33%**		**30%**		**15%**	

The LA group is the group in which the percentage of occurrence of resumptive clitic pronouns is the highest as opposed to the other groups. A chi square analysis revealed a significant difference in the use of this strategy across groups [$\chi^2(3) = 9.35$ $p<.01$]. In this case, mostly the LA group contributed to the result. As for object relatives with resumptive DPs, they are more frequent in the CI than in the other groups. However, no significant difference across groups is attested. Interestingly, both strategies (resumptive DPs and resumptive clitic pronouns) are (almost) absent in the group of older normal hearing participants. As children grow older, only object relatives with gap are observed in their productions. Notice that resumptive clitic pronouns and DPs were not found when subject relatives were elicited.

The use of resumptive elements in object relatives by children with hearing impairment was previously pointed out by Friedmann and Szterman (2006) and Friedmann et al. (2008). Hebrew-speaking children with hearing impairment heavily rely on resumptive pronouns in object relatives (occurring in 42% of productions), while children with normal hearing children use this strategy more rarely (only 30% of productions). The authors justified the use of resumptive pronouns as a strategy to rescue the structure when movement is impaired, since the presence of these elements does not imply movement.

In Italian, resumptive pronouns in object relatives are found to the same extent in both the group of children with cochlear implants and the group of younger normal hearing children (LA and AA groups), but they are almost absent in the group of older children (CA group). For Italian, the hypothesis proposed for Hebrew cannot be adopted. The percentage of object relatives with resumptive pronouns is very similar in the CI group and in the LA and AA groups, and it is not possible to hypothesize that normal hearing children cannot access syntactic movement (Volpato, Cardinaletti 2015). Furthermore, empirical evidence shows that the relative clauses produced by Italian-

speaking children are derived by movement (Guasti, Shlonsky 1995; Guasti et al. 1997; Guasti, Cardinaletti 2003), and the same is true for relatives containing resumptive pronouns in Italian (Belletti 2005).

Moreover, resumptive pronouns in Hebrew and Italian have a different status: they are strong in Hebrew and clitic in Italian. This entails a different analysis for these elements in the two languages. Italian should be considered on a par with Palestinian Arabic, another language in which object relative clauses contain resumptive clitic pronouns and for which a movement analysis is proposed (Friedmann, Costa 2011). The proposal put forward for Hebrew cannot be adopted for the Italian participants with cochlear implants, since these children are able to perform syntactic movement. Rather, they prefer opting for strategies (resumptive pronouns) that are typical of the Italian colloquial register (Guasti, Cardinaletti 2003).

In addition to object relatives with resumptive clitic pronouns, structures with resumptive DPs were also found in children with cochlear implants as well as in the groups of younger typically developing children. In the group of age-matched controls, this construction is not found. Resumptive DPs were also observed in Hebrew children with hearing impairment, with a percentage of occurrence similar to that of the Italian participants with cochlear implants (7%). The hypothesis put forward for Hebrew by Friedmann et al. (2008) is that the copy of the head DP in the first merge position is spelled out because of an impaired PF component.

Again, this hypothesis cannot be adopted for Italian. As we have seen, Italian normal hearing children (groups LA and AA) also produce object relatives with resumptive DPs. For this populations, it cannot be hypothesized that the PF component be impaired. A different hypothesis should be formulated. Although object relatives with resumptive DPs (referred to as *double-headed* by Cinque 2011) are not grammatical in Italian, they are found in many adult languages (e.g., Papuan, Niger-Congo, Austronesian, and Chadic). Hence, Italian children who use resumptive DPs in object relatives are exploiting a possibility made available by UG. Volpato and Cardinaletti (2015) suggested that language acquisition is characterised by a learning-by-forgetting mechanism. Children have a wide variety of possible relative clauses made available by UG. Thanks to the input to which they are exposed, they abandon (forget) the possibilities which are not consistent with the target language. The fact that in children with cochlear implants, the percentage of occurrence of resumptive DPs is higher than in age-matched control and comparable to young hearing children may be a sign of linguistic delay due to the auditory deficit. Exposure to language starts later for them and, due to the partial and degraded input they manage to access, they probably need more time to set the parameters correctly and acquire the possibilities offered by the target language. The

authors conclude that the presence of resumptive DPs in object relatives does not imply problems with syntactic movement and/or impairments in the PF component.

4.13 Answering strategies in target object relatives

Several different strategies were found in the participants' productions when object relatives were targeted. Sometimes, when in object relatives both DPs displayed the same number features, children produced ambiguous sentences, namely sentences in which either a subject or an object reading was possible:

(143) Target: Mi piacciono i bambini che i vigili salutano.
I like the children that the policemen greet.
Production: Mi piacciono i bambini che salutano i vigili.
I like the children that greet the policemen.

Although Italian allows for postverbal subjects, we are not sure that the children were using an object relative. For this reason, sentences like those in (143) were kept separate in the analysis from both subject and unambiguous object relatives.

In some cases, when object relatives were targeted, the participants used the same strategies they also used for targeted subject relatives. They produced non-target sentences with theta-role inversion in which a subject relative was produced instead of an object relative (144), object relatives in which the complementizer *che* was replaced by a different *wh*-filler (such as *dove* 'where') (145), sentences in which the complementizer *che* was omitted (146), ungrammatical structures (147), and incomplete sentences, in which only a portion of the sentence was uttered (148):

(144) Target: I bambini che i cani baciano
'The children that the dogs kiss'
Production: I bambini che baciano il cane
the children that kiss the dog

(145) Target: Il bambino che il papà lava
'The child that the father washes'
Production: Mi piace il bambino quello dove il papà lava
'I like the child the one where the father washes'

(146) Target: Mi piace il bambino che il dottore guarda
'The child that the doctor looks at'
Production: Mi piace il bambino … il dottore guarda
'I like the child... the doctor looks at'

(147) Target: Il bambino che il cane segue
The child that the dog follows
Production: Mi piace il bambino così cammina e così il cane insegua
I like the child so walks and so the dog follow.SUBJ.MOOD

(148) Target: I bambini che la maestra premia
'The children that the teacher praises'
Production: Premia i bambini
'(She) praises the children'

In addition to these context-inappropriate productions, other strategies, which are only found when object relatives were elicited, consisted in the production of passive relatives (149) and causative constructions, built with *farsi* + verb 'to make oneself + verb', as in (150). Both types of sentences, in which a subject relative is produced instead of an object relative, are grammatical and appropriate for the context:

(149) Il bambino che è pettinato dal papà
'The child that is combed by the father'

(150) Il bambino che si fa pettinare dal papà
the child that himself makes comb by the father
'The child that has himself combed by the father'

Answering strategies that were not included within any previous coding category were classified as 'Other strategies'. One of these strategies is shown in the following example:

(151) Target: Il bambino che il cane segue
'The child that the dog follows'
Production: Il bambino che porta a spasso il suo cane
'The child that takes his dog for a walk'

The list of all strategies used by each group when object relatives were elicited are reported in Table 32. Under the label 'Object relatives', target object relatives with gap, object relatives with resumptive clitic pronouns, and object relatives with resumptive DPs are all grouped together ('Total ORs' in Table 31):

Table 32 Mean (M) and Standard Deviation (SD) of the different answering strategies for targeted object relatives (taken from Volpato, Vernice 2014)

	M	SD	M	SD	M	SD	M	SD
Object relatives	23%	30%	33%	34%	30%	30%	15%	27%
Ambiguous sentences Il bambino che bacia la mamma	17%	16%	11%	7%	15%	15%	13%	20%
Passive relatives Il bambino che è lavato dal papà	26%	41%	14%	28%	15%	26%	42%	39%
Causative constructions Il bambino che si fa lavare dal papà	3%	12%	21%	32%	21%	33%	27%	35%
***Wh*-fillers** Il bambino quello dove il papà lava	6%	14%	0%	0%	0%	0%	0%	0%
Simple SVO sentence Il papà pettina i bambini	6%	12%	2%	5%	1%	2%	0%	0%
Theta-roles inversion I bambini che baciano il cane	4%	6%	1%	2%	1%	2%	1%	5%
Head inversion Il papà che pettina i bambini	3%	6%	10%	16%	6%	14%	0%	0%
Omission of'*che* Mi piace il bambino…guarda il dottore	1%	3%	0%	0%	0%	0%	0%	0%
Incomplete sentences Premia i bambini	0%	0%	1%	5%	1%	5%	0%	0%
Ungramm. sent./other errors Il bambino così cammina e così il cane insegua	3%	5%	0%	0%	0%	0%	0%	0%
Other strategies	8%	9%	8%	12%	10%	12%	2%	5%

Volpato and Vernice (2014) investigated the asymmetries observed between the different groups (CI, LA, AA, and CA) when object relatives were elicited. For some strategies, namely object relatives and passive relatives, the CI group is at an intermediate position between the groups of younger hearing children (LA and AA) and the group of older participants (CA group). The CI group produced less object relatives than the LA and AA groups, but more than the age-matched controls. Conversely, the CI group produced more passive relatives than the LA and AA groups, but less than the CA group. The CA group is the group in which the use of passive relatives showed the highest percentage of occurrence. Indeed, the significant difference in the use of passive relatives [$\chi^2(3) = 9.27$, $p<.01$] is provided by the CA group.

A strategy which was very frequent in normal hearing children, but rare in the group of children with cochlear implants consisted in the use of causative constructions (*farsi* + verb 'to make oneself + verb'). Conversely, some other strategies were more frequent in the CI group than in the normal hearing groups (simple SVO sentences and theta-role inversion).

Some strategies which are only used by children with cochlear implants are the production of *wh*-fillers replacing the complementizer (such as *dove* 'where', *quando* 'when'), the production of sentences in which the complementizer is omitted, and the production of ungrammatical sentences. These strategies are never used by the three control groups. Remember that ungrammatical sentences were also found in the subject relatives produced by the CI group (see section 4.11).

In the two groups including young hearing children (LA and AA), object relatives were replaced by subject relatives by turning the embedded subject into the relative head. Although such a structure is not appropriate for the context, it nonetheless shows that thematic roles are correctly assigned, contrasting with what happens in sentences in which theta-roles are reversed.

A strategy occurring to the same extent in all populations and showing no performance difference across groups consists in the use of ambiguous sentences.

Volpato (2011), Volpato and Vernice (2014), and Volpato and Cardinaletti (2015) discussed some of these findings focusing on the use of some specific strategies, namely resumptive relatives, causative constructions, target object relatives, and passive relatives.

4.14 The use of causative constructions in children with cochlear implants

A strategy that was largely found in the groups of normal hearing children, especially in the younger ones, consisted in the production of causative constructions, an example of which is reported in (152):

(152) I bambini che si fanno lavare dal papà
the children that make themselves washed by the dad
'The children that have themselves washed by the dad'

As shown in section 4.2, causative constructions are frequent in typical language development around the age of 6-7 years. Hence, such a production is not unexpected in the hearing control groups. Surprisingly, children with cochlear implants rarely used this strategy (only 3% of the elicited object relatives). Volpato (2011) and Volpato and Vernice (2014) suggested that the low percentage of occurrence in the experimental group's productions is to be attributed to the presence of the functional verb *fare* 'to make' in the causative construction, which involves the assignment of an additional thematic role.

To understand the complexity of this structure, it is necessary to consider a simple causative construction as in (153):

(153) I bambini fanno lavare il pupazzo dal papà
the children make wash the puppet by the dad
'the children have the puppet washed by the dad'

In this sentence, three thematic roles are assigned. The verb *lavare* 'wash' assigns thematic roles to the DPs *il pupazzo* 'the puppet' and *il papà* 'the father'. The verb *fare* 'to make' assigns a thematic role to the DP *i bambini* 'the children'.

If the internal argument is realized by a reflexive pronoun instead of a DP, we obtain the following sentence:

(154) I bambini fanno lavare se stessi dal papà
the children make wash themselves by the dad
'the children make have themselves washed by the dad'

In (154), the verb *lavare* 'to wash' assigns two thematic roles, one to *se stessi* 'themselves' and the other to the DP *il papà* 'the dad', while the DP *i bambini* 'the children' receives its thematic role from the verb *fare* 'to make', as in (153). The sentence in (152) differs from (154) in that it contains the reflexive clitic *si* instead of *se stessi*. In addition, the DP *i bambini*, which is the subject of the verb *fare* 'to make', has been relativized.

The assignment of an extra thematic role by *fare*, the presence of the reflexive clitic pronoun *si*, and the computation of a relativized element probably constitute a non-trivial problem for children with cochlear implants, resulting in the rather frequent absence of this structure from their productions.

4.15 The inter-individual variability in the CI group

Much cross-linguistic research carried out on children with hearing impairment, and especially on cochlear implant users, have emphasized the wide inter-individual variability within the experimental groups (e.g., Moeller 2000; Tuller, Jakubowicz 2004; Friedmann, Szterman 2006). Volpato (2010b) and Volpato and Vernice (2014) also observed much inter-individual variability within the group of children with cochlear implants.

The following table (taken from Volpato, Vernice 2014) shows the distribution of the individual responses of the participants with cochlear implants in the production of targeted object relatives.

Table 33 Individual productions within the CI group in the elicitation of object relatives (OR=object relatives, PR=passive relatives, CS=causative sentences, AMB=ambiguous sentences)(taken from Volpato, Vernice 2014)

							SRs instead of ORs		Ungrammatical sentences		
Subj.	**OR**	**PR**	**CS**	**AMB**	**Simple SVO**	***Wh*-fillers**	**Theta roles inv.**	**Head inv.**	**'che' omission**	**Other errors**	**Other strategies**
1	5			4	1		1		1		
2		10		1	1						
3	2	1		7			2				
4			5	1	1		1			1	3
5	9			2							1
6		12									
7		11		1							
8	6			3			1				2
9	10			1						1	
10	1	7		1				2			1
11	1			3		6	1				1
12				2	2	1		2	1	2	2
13	2				5	2				1	2
Total	**36**	**41**	**5**	**26**	**10**	**9**	**6**	**4**	**2**	**5**	**12**
Mean	**23%**	**26%**	**3%**	**17%**	**6%**	**6%**	**4%**	**3%**	**1%**	**3%**	**8%**
SD	**30%**	**41%**	**12%**	**16%**	**12%**	**14%**	**6%**	**6%**	**3%**	**5%**	**9%**

Much variability is found within the CI group. Some children with cochlear implants produced passive relatives and some others produced object relatives. One participant produced a small number of causative constructions, which are nonetheless correct strategies for the task, but then, he/she produced sentences that were not appropriate.

Some children showed difficulties with the task and produced grammatical but context-inappropriate answers (SVO sentences, relative clauses with theta-role inversion, and head inversion), sentences in which different *wh*-fillers replaced the complementizer *che*, or ungrammatical sentences (incomplete sentences and sentences in which the complementizer *che* is omitted). Interestingly, children producing passive relatives never or rarely used other answering strategies.

As we have seen, in typically developing children, passive relatives are more frequent in older than in younger children, who prefer producing other types of structures, among which object relatives. In adolescence and adulthood, the use of passive structures is the prevailing strategy. The fact that in the CI group, some children opt for this strategy is a sign that those children have attained a good com-

petence of Italian, despite the delayed exposure to the linguistic input during the time window crucial for language acquisition.

In cases in which the strategy of passive relatives does not yet represent an available option, some children produced object relatives.

The fact that some children with cochlear implants produced ungrammatical sentences shows that their performance deviates from that of normal hearing controls, for whom these constructions were never observed. The presence of ungrammatical sentences or other incorrect constructions in the production of children with cochlear implants may prove that they were not able to make up for the lack of exposure to the linguistic input in the early stages of language acquisition.