Corso di Laurea magistrale
(ordinamento ex D.M. 270/2004)
in SCIENZE DEL LINGUAGGIO

Tesi di Laurea

The role of marked number features in the agrammatic comprehension of object relative clauses

Relatore
Prof. Anna Cardinaletti

Correlatori
Dott. Francesca Meneghello
Prof. Carlo Semenza
Prof. Giuliana Giusti

Laureando
Paolo Frugarello
Matricola 840308

Anno Accademico
2012 / 2013
INDEX

GENERAL INTRODUCTION ................................................................. I

CHAPTER 1
SYNTACTIC THEORIES REGARDING AGRAMMATIE COMPREHENSION

INTRODUCTION .................................................................................... 1
1.1 CARMAZZA & ZURIF (1976) found a deficit in comprehension ............. 2
1.2 Other theories and studies on agrammatism .................................... 5
1.3 The Trace Deletion Hypothesis ....................................................... 6
    1.3.1 Do further experiments confirm the TDH predictions? ................. 12
    1.3.2 Other studies and hypothesis on TDH ...................................... 14
1.4 GRILLO (2005) and the RM effects .............................................. 18
1.5 FRIEDMANN & SHAPIRO: OSV and OVS in the agrammatic comprehension ... 23
1.6 GARRAFFA & GRILLO (2007) and the canonicity effects .................... 24
1.7 FRIEDMANN & GVION: Intervention and Locality in agrammatic aphasia .... 28
1.8 FRIEDMANN, BELLETTI & RIZZI (2009) and the similarity effects ........ 30
CONCLUSIONS ................................................................................... 32

CHAPTER 2
PSYCHOLINGUISTIC THEORIES REGARDING AGRAMMATIE COMPREHENSION

INTRODUCTION ................................................................................... 34
2.1 ULLMAN (2004) and the Declarative - Procedural Model .................... 35
    2.1.1 The declarative-procedural model ......................................... 36
    2.1.2 Linguistic impairment as deficit of the declarative/procedural system .... 38
2.2 Linguistic models of procedural deficits ........................................ 39
    2.2.1 HICKOCK & AVRUTIN (1995): the contribute of the reference ........ 41
    2.2.2 AVRUTIN et al. (1999): the interpretation of contrastive stress .............. 41
2.3 Agrammatic deficit as a delay in building the structure of the sentence .... 44
    2.3.1 The slower-than-normal syntax: linguistic and experimental evidence 47
2.4 Conclusions about procedural deficits ........................................... 49
2.5 A mapping theory of agrammatic comprehension deficits ................ 50
CHAPTER 3
THEORETICAL FRAMEWORK

PART 1
NUMBER FEATURES IN AGRAMMATISM AND IN OTHER LANGUAGE DISORDERS

INTRODUCTION..............................................................................................................59
3.1 The Number Phrase ................................................................................................59
3.2 Number and Gender ..............................................................................................61
3.3 Gender and Number in FERRARI (2005) ..............................................................63
3.4 Gender status .........................................................................................................66
3.5 Number in Italian and the differences with Gender .............................................69
3.6 Number in language impaired populations .........................................................71
CONCLUSIONS.............................................................................................................75

PART 2
RELATIVE CLAUSES IN AGRAMMATISM AND IN OTHER LANGUAGE DISORDERS

INTRODUCTION..............................................................................................................77
3.7 Relative clauses in Italian ......................................................................................77
3.8 Relative clauses in agrammatism ...........................................................................79
3.9 Relative clauses in other language impaired populations .....................................83
CONCLUSIONS.............................................................................................................87

PART 3
THEORETICAL FRAMEWORK

INTRODUCTION..............................................................................................................88
3.10 Agreement in linguistic theory ..........................................................................89
3.11 The attraction principle ......................................................................................91
3.12 The attraction occurrences .................................................................................93
3.13 KAYNE (1989) and the attraction principle .....................................................96
CONCLUSIONS.............................................................................................................97
CHAPTER 4
THE TEST ASSESSING THE COMPREHENSION OF RELATIVES CLAUSES

PART 1
THE TEST

INTRODUCTION ................................................................. 99
4.1 The sentences ................................................................. 99
4.2 Embeddedness ............................................................... 107
4.3 The filler sentences .......................................................... 107
4.4 The pictures ................................................................. 108
4.5 Procedure ....................................................................... 110
4.6 Participants ...................................................................... 111
  4.6.1 The first group: Agrammatic subjects ......................... 111
  4.6.1.1 A1 status ................................................................. 111
  4.6.1.2 A2 status ................................................................. 112
  4.6.2 The second group: fluent patients ............................... 112
  4.6.2.1 F1 status ................................................................. 112
  4.6.2.2 F2 status ................................................................. 113
  4.6.3 Summary of language impaired subjects ..................... 113
  4.6.4 The third group: the control group .............................. 113

PART 2
RESULTS

INTRODUCTION ..................................................................... 114
4.7 Quantitative results in reversible and irreversible sentences .......... 114
4.8 Quantitative results in matched/mismatched number features .......... 115
4.9 Statistical evaluations ......................................................... 117
4.10 Response analysis ............................................................ 118
  4.10.1 Errors Coding ............................................................ 118
  4.10.2 A1 performance .......................................................... 119
  4.10.3 A2 performance .......................................................... 120
  4.10.4 F1 performance .......................................................... 124
  4.10.5 F2 performance .......................................................... 125
4.11 Errors analysis ............................................................... 129
CONCLUSIONS ..................................................................... 130
CHAPTER 5
DISCUSSION

INTRODUCTION.............................................................................................................132

5.1 First typology: Reversed number features errors .................................................133
  5.1.1 First typology: Reversed number features errors (SING-PLUR) .................133
  5.1.2 First typology: Reversed number features errors (PLUR-SING) ............138

5.2 Second typology: head’s number change errors ..................................................142
  5.2.1 Second typology: head’s number change errors (SING-SING) ..............142
  5.2.2 Second typology: head’s number change errors (PLUR-PLUR) ..........145
  5.2.3 Second typology: head’s number change errors (SING-PLUR) ..........147
  5.2.4 Second typology: head’s number change errors (PLUR-SING) ...........149

5.3 Third typology: reversed subject-verb agreement errors
  (SING-SING; PLUR-PLUR)..................................................................................150

5.4 General discussion ............................................................................................151

5.5 Final considerations ..........................................................................................157

Conclusions..............................................................................................................157

GENERAL CONCLUSIONS .....................................................................................160

REFERENCES ..........................................................................................................162

APPENDIX A: THE TEST .........................................................................................172

APPENDIX B: A1 RESULTS TABLE .........................................................................177

APPENDIX C: A2 RESULTS TABLE .........................................................................183

APPENDIX D: F1 RESULTS TABLE .........................................................................189

APPENDIX E: F2 RESULTS TABLE .........................................................................195

ABSTRACT ..............................................................................................................201
GENERAL INTRODUCTION

This thesis origins from linguistic and psycholinguistic studies on the influence of marked number features in typically developed (henceforth TD, ADANI et al., 2010) and language impaired populations (for hearing impaired children, henceforth HI, VOLPATO, 2010; for specific language impairment, henceforth SLI, ADANI et al., 2013). To our knowledge, the Number role in the agrammatic comprehension of relative clauses has not been assessed before.


The aim of this study was therefore to test the abilities of agrammatic patients, in order to determine whether and to what extent Number influences their performance in understanding relative clauses. Patients abilities were assessed using a sentence-picture matching task (following FRIEDMANN & NOVOGRODZKY, 2004; ADANI, 2008; VOLPATO, 2010).

The test was composed by reversible and irreversible object relative clauses, whose number features had been previously manipulated, in order to make DPs both similar (match condition) and dissimilar (mismatch condition) in terms of number features.

Outcomes revealed that the mismatch condition of number features is the most impaired one, and it will be hypothesized that patients’ comprehension is influenced by several phenomena: Attraction (FRANCK et al. 2006), Relativized Minimality (GRILLO, 2005), intermittent resource reduction (CAPLAN, 2007).

The organization of the study is as follows.
Chapter 1 offers a general overview of several theories about agrammatic comprehension. Starting from the *Trace Deletion Hypothesis* (Grodzinsky 1984), we will discuss more recent studies about this language impairment. Among others, Relativized Minimality states that an impaired comprehension would be sensible to the featural “similarity” between the DPs of the sentence, whereas a contingent dissimilarity improves performance.

In Chapter 2, agrammatic abilities in the comprehension will be examined from the psycholinguistic standpoint. One line of research argues that agrammatics could have lost or could not use the ability to compute complex sentences. The opposite counterpart sustains that the capacities of agrammatics would be intact: more complex computational operations could not be processed because of the reduction of available resources.

Chapter 3 illustrates and describes the theoretical framework of the thesis. The first section presents the most important studies on the number features, the difference with Gender, the role of Number in the other language impairment populations (SLI and hearing-impaired children). The second part of the chapter deals with relative clauses. After listing their properties, several studies regarding the comprehension of this typology of sentences in language impaired subjects will be discussed. The principle of attraction and its occurrences will be described and discussed in the third part.

Chapter 4 describes the experimental conditions and the variables adopted in the test, whereas the second section displays the scores achieved by the different populations, pointing out that patients’ performance is lower in the mismatch condition of number features. Finally, the errors’ coding will be reported.

Chapter 5 investigates the subjects’ performance, explaining the patients’ errors in the comprehension of relative clauses. The Attraction phenomenon (among others: Franck, Vigliocco & Nicol, 2002; Franck et al., 2006), the Relativized Minimality effects (Grillo 2005, 2007) and the intermittent resources reduction (Caplan 2006, 2007) can explain the patients’ performance in the comprehension of object relatives.

By combining these linguistic and psycholinguistic proposals, I will try to account for the performance of the language impaired participants.
CHAPTER 1

Syntactic theories regarding agrammatic comprehension

Introduction

Although Broca's aphasia mainly concerns deficit in production, difficulties in comprehension are no less important. Despite that, comprehension problems had been largely ignored until Zurif et coll. began to investigate them (Zurif, Caramazza & Meyerson 1972; Zurif et al. 1974; Zurif & Caramazza 1976; Caramazza & Zurif 1976). Hence, our discussion will start from the study of Caramazza & Zurif (1976), which revealed deficits in comprehension even in agrammatism. Indeed, despite the fact that agrammatics do not reveal problems in assigning thematic roles in canonical ordered sentences and do not violate the theta criterion (“each argument in a sentence is associated with one and only one theta-role; each theta-role is associated with one and only one argument” Chomsky 1981), they are supposed to manifest serious deficiency in the comprehension of sentences with transformational movement. The nature of comprehension difficulties has to be investigated yet; actually it has only been established that the deficit involves other modalities, going beyond production pattern. Controversial is the hypothesis that the lack of comprehension counterparts the deficit in production; many authors debate even whether agrammatics suffer from a syntactic impairment (Grodzinsky 1990: 63)


Hence, in the next sections several theories about agrammatic comprehension will be discussed. Starting from the *Trace Deletion Hypothesis* (henceforth TDH, Grodzinsky 1984), which predicts a partial deficiency in the syntactic system, precisely in the assignment of thematic roles, we will examine whether the TDH has been either confirmed or invalidated.

Moreover, the most recent theories will be presented. Grillo (2005) proposes that the Relativized Minimality (RM) locality principle is responsible for asymmetries in agrammatic comprehension (Rizzi 1990, 2001; Starke, 2001). According to capacity limitations and complexity approaches, agrammatic comprehension would be influenced by the computational cost of complex syntactic structures. Hence, limited computational resources prevent agrammatic patients from processing morphosyntactic features.

In the same line, Friedmann & Shapiro (2003) and Friedmann & Gvion (2012) found that both a intervener element and locality principle exert their influence on agrammatic comprehension.

Finally, in the last section, the study of Friedmann, Belletti, Rizzi (2009) will be reported. According to the RM, an impaired comprehension would be sensible to the “similarity” between the moved element and the NP intervenient, whereas dissimilarity improves their performances.

All these studies confirmed the general hypothesis that agrammatic subjects have several problems and serious difficulties with processing not canonical ordered sentences, namely structures originated by movement.

1.1 Caramazza & Zurif (1976) found a deficit in comprehension

Caramazza & Zurif (1976) revealed deficits in comprehension even in agrammatism. Although the agrammatic abilities in building basic syntactic trees and in computing sentences with canonical order were preserved, serious deficiencies in the comprehension of sentences with transformational movement were found.

Even though the agrammatic impairments in comprehension and production impairments did not follow the same pattern, general difficulties have been observed in passive sentences, in object relatives, in center-embedded relatives, in which-questions.
For that reason, agrammatic subjects are divided into two main groups: the former affected by problems in the interpretation of syntactic relations (*asynaptic comprehension*); the latter with bigger deficits in the elaboration of grammatical morphemes (*agrammatic production*).

Hence, CARAMAZZA & ZURIF (1976) found the first proof that agrammatism involves even an impaired comprehension.

In the analysis of semantically reversible and irreversible relative clauses, the latter were successfully comprehended by the patients, since the inference and the semantic cues can improve interpretation. On the other hand, they showed poor comprehension of reversible sentences, where the correct interpretation has to rely only on the syntactic structure; their performance was at chance levels, that is they were guessing the correct response. Outcomes mirrored their predictions, namely that not all the typologies of sentences are affected, since the core of the deficit would lie in reversible ones. For the moment, it can be said that aphasic subjects would be not able to recover thematic information.

Consequently, it could be argued that agrammatics are not succeeded in using syntax during the processing of reversible clauses. However, their deficiency is even more specific, since only a subgroup of reversible sentences shows low performance: passives, object relatives and object clefts were harder to process, causing more serious problems with respect to actives, subject relatives, subject clefts and adjectival passives.

These findings somewhat anticipate the hypothesis that agrammatic impairment could stem from the lack of some syntactic ability rather than being influenced by the typology of sentence.

In CARAMAZZA & ZURIF (1976), agrammatic performance in reversible sentences was assessed in a sentence-picture matching task, composed by four pictures: an image corresponds to the content of the sentence; another one has reversed theta-roles; the third was a distractor picture with a different predicate adjective and the last one carries a different verb in the relative clauses. Results showed that they guess between “*the match and the mismatch condition*” (GRODZINSKY 1990: 66), between the images with the correct and the reversed set of roles.

Their study revealed that agrammatics have serious problems in the interpretation of reversible clauses, whilst not evident difficulties are expresses in
the comprehension of irreversible sentences. Their deficient comprehension could depend on the crucial role of syntactic structure to understand reversible clauses.

Indeed, the interpretation of the irreversible sentences is aided by the meaning of the words, since they can be processed simply by considering the semantic information. Conversely, the same does not occur in reversible one, whose interpretation depends on the correct decoding of the syntactic structure, the only way to understand the roles of the arguments. Therefore, the computation of reversible sentences must be based on syntactic parameters and patients cannot rely on semantic cues, and the correct interpretation of a semantic reversible requires the reactivation of the NP trace after the embedded verb.

Agrammatism was considered as a disorder caused by a lack of linguistic knowledge both in comprehension and production tasks. Their difficulty would be caused by the impossibility to recover and compute the syntactic structure of an ambiguous sentence adequately. CARAMAZZA & ZURIF (1976) argued that:

(1)

“The analysis of their comprehension skills suggests that such patients are as impaired in comprehension as they are in production. The impairment, moreover, is a specific one – they are unable to use syntactic-like algorithmic processes. Yet, of equal importance, they have retained the capacity to use heuristic procedures to assign a semantic interpretation to, at best, an incompletely represented syntactic organization”.


In their hypothesis “patients are unable to use syntactic-like algorithm processes” (1976:581). The only thing they could do is to deduce theta-roles by processing the semantics of words: “they have retained the capacity to use heuristic procedures to assign a semantic interpretation to an incompletely represented syntactic organization” (1976:579).

This incomplete syntactic representation would be responsible for the different performance in reversible and irreversible sentences, given that agrammatic subjects would be prevented from using semantic information to bypass their deficiency in reversible conditions.

However, the impairment could not involve the totality of syntactic abilities, as later experiments clearly suggest (GRODZINSKY 1990:67).
1.2 Other theories and studies on agrammatism

CAPLAN & FUTTER (1986) proposed that the agrammatic comprehension would be affected by a syntactic impairment.

These subjects could not use syntax in the sentence analysis and they would be forced to rely on compensatory strategies. According to these authors, agrammatics would use a “linear default strategy”, giving the first NP the role of agent, then causing inversion of theta-roles in constructions like passive and object cleft sentences, in which the first NP is the patient. Note that this strategy predicts an agrammatic below chance performance in sentences with non-canonical order, instead of the chance performance actually found (GRODZINSKY 1990:68).

LINEBARGER, SAFFRAN & SCHWARTZ (1983) formulated an opposite hypothesis. In this account, agrammatism does not involve syntactic deficits, since their poor performance would be determined by a deficit of cognitive systems. In addition to that, they demonstrated that agrammatics may perform at good level in grammaticality judgment tasks, succeeding in the recognition of syntactic violations, thus evidencing a preserved linguistic ability. Remind that the hypothesis of an incapacity in representing thematic roles is conflicting with these results.

Regarding the chance level performance in the comprehension of relative passives, SCHWARTZ, SAFFRAN & MARIN (1980) showed that their difficulties would be due to a mapping deficit, that is, an absent ability to map syntactic positions onto semantic roles (GRODZINSKY 1990:69).

The mapping theory infers that the deficit would depend on a deficiency in the interpretative system; the syntactic system would be spared, whilst agrammatic ability to assign thematic roles would be lost; consequently, they are prevented from the correct interpretation of the arguments, no matter whether the sentence structure is canonical or not linearly ordered (O’GRADY & LEE 2005:92-93).

Hence, following SAFFRAN & SCHWARTZ (1994), the damage would be due to the impaired access to the necessary syntactic information for the assignment of the thematic roles, rather than a complete loss of them.

Note that this hypothesis has not been confirmed experimentally on all patients. Furthermore, the agrammatic chance level performance in the comprehension of reversible passives invalids the mapping hypothesis, rather than confirming it.
The hypothesis of Saffran & Schwartz (1994) cannot therefore explain all cases of agrammatism, and the missing assignment of thematic roles does not always correspond to a deficit in production. Indeed, it has been demonstrated that the linguistic deficit is not unitary: difficulty in production tasks does not always correspond to a deficit in comprehension.

To explain these findings, Schwartz et al. (1998) reviewed the hypothesis by arguing that agrammatic performance can depend on complexity considerations; the notion of complexity refers to thematic transparency, that is whether a sentence has a canonical order. Agrammatics would perform not canonical ordered sentences at a lower level, since a structure derived by a transformational movement would be more complex to process.

However, this theory of Schwartz is still not accurate, since it does not predict precisely the level of subject’s performance.

Finally, authors have to postulate the presence of a partial syntactic deficit sensitive to sentence structure, since it is evident that comprehension is partially influenced by variables tied to grammatical construction (Grodzinsky 1990:70).

This discrepancy between indirect (in not-canonical ordered sentences) and direct theta-role assignment (in canonical ordered clauses) represents the basis for the Trace Deletion Hypothesis (Grodzinsky, 1986a).

1.3 The Trace Deletion Hypothesis

Proposed for the first time by Grodzinsky (1984), the Trace Deletion Hypothesis predicts a partial deficiency in the syntactic system, precisely in the assignment of thematic roles. Following the theory of traces and the theory of thematic roles, Grodzinsky argues that moved elements leave a trace in their base position, indicated graphically by the symbol $t$.

(2a)  
Cosa $t_i$ pensi Paolo abbia fatto $t_i$?  
What do you think Paolo did $t_i$?

(2b)  
Hence, traces are always assigned to, regardless of the nature of the NP (Grodzinsky 1990:81).

A lexical NP in a thematic position receives its theta-role directly. On the contrary, the movement of an element creates a trace in its base position, which
receives a thematic role from the verb; then the role is transmitted to the moved element through a chain (GRODZINSKY 1990:82).

The Trace Deletion Hypothesis (henceforth TDH) formulates that agrammatic impairment in comprehension stems from a disability to represent traces, which are finally deleted, in particular those in $\theta$ position. Moreover, the deletion of traces leads to a failure in the elaboration of the correct interpretation of the thematic roles, since traces are essential for the transmission of the theta-role to the moved element.

According to the TDH, which predicts the deletion of the traces, the moved NP cannot receive any thematic role, causing the complete misunderstanding of the sentence. The loss of the traces does not affect the comprehension of structures without movement, whereas sentences derived by syntactic movement are claimed to be more complex. Hence, sentences with canonical order should be performed at above chance level, whereas the comprehension of those derived by syntactic movement should be affected by the deletion of the traces. However, this prediction resulted not completely confirmed, since subject relative clauses and subject clefts have been performed at above chance level (GRODZINSKY 1990:83).

Hence, the deletion of traces does not seem sufficient to explain the misunderstanding of sentences derived by movement, since subject relatives are well comprehended, despite being originated by movement.

Another problem for the TDH comes from the VP-Internal-Subject Hypothesis (KOOPMAN, SPORTICHE 1988), which predicts that syntactic movement would be present also in active sentences; according to the TDH, these sentences should not be easily understandable, a prediction clearly erroneous, given that active sentences are at above chance level.

Conversely, many studies have revealed agrammatic’s problems in the understanding of passive sentences. We can generalize by saying that agrammatic syntactic representations are almost totally preserved, except for the traces which are deleted. Since traces are missing from the syntactic structure, the link between them and the moved elements, and the assigning of theta-role, would be absent.

To explain these contradictory results, GRODZINSKY hypothesized a default strategy. To elude their deficiency, agrammatics would elaborate an extra-linguistic principle: a NP without a theta-role receives a default one, that is
“NPs in nonthematic positions are associated to a theta-role by Default Principle” (GRODZINSKY 1990:83). According to these predictions, the following table illustrates the agrammatic performance levels in the comprehension of different sentences: better performance is found in subject relative clauses, subject clefts and adjectival passives.

\[(3)\]

<table>
<thead>
<tr>
<th>Construction Type</th>
<th>Performance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active sentences: The girl pushed the boy</td>
<td>Above chance</td>
</tr>
<tr>
<td>Subject relatives: The girl who pushed the boy was tall</td>
<td>Above chance</td>
</tr>
<tr>
<td>Headed subject relative: Show me the girl who pushed the boy</td>
<td>Above chance</td>
</tr>
<tr>
<td>Subject Cleft: It is the girl who pushed the boy</td>
<td>Above chance</td>
</tr>
<tr>
<td>Adjectival Passive: The boy was interested in the girl</td>
<td>Above chance</td>
</tr>
<tr>
<td>Adjectival Passive: The woman was uninspired by the man</td>
<td>Above chance</td>
</tr>
<tr>
<td>Passive: The boy was pushed by the girl</td>
<td>Chance</td>
</tr>
<tr>
<td>Object relatives: The boy who the girl pushed was tall</td>
<td>Chance</td>
</tr>
<tr>
<td>Headed object relative: Show me the boy who the girl pushed</td>
<td>Chance</td>
</tr>
<tr>
<td>Object Cleft: It is the boy who the girl pushed</td>
<td>Chance</td>
</tr>
<tr>
<td>Verbal Passive: The woman was unmasked by the man</td>
<td>Chance</td>
</tr>
</tbody>
</table>

As expected, agrammatics performed better in irreversible sentences and in sentences without transformations.

In the sentence the dog follows the cat, agrammatics use a non-syntactic way to interpret the sentence, assigning a role to NPs by a default linear strategy: they would assign the first NP (the dog) the agentive interpretation. Although their comprehension is influenced by this wrong strategy, in active sentences they perform at above-chance level, since the conflict between the Default Principle and the normal assignment of theta-roles does not arise (the first NP has the same role it would have been assigned by normal comprehension).

In irreversible sentences like the girl eats the apple, Broca’s aphasics apply this extra-linguistic cognitive strategy, then assigning the agent role to the first NP. It is presumable that this strategy will improve their performance when the first NP

---

is the real agent (as it happens in subject relatives, subject clefts...), whereas it will generate confusion whenever the first NP has the role of patient (in object relatives, object clefts, passives...) (GRILLO 2005:108). In the sentence the girl was pushed by the boy the theta-role is not assigned directly to the first NP (the girl) due to the deletion of the trace. Since the first NP occupies a nonthematic and clause-initial position, the application of default principle will assign it the agentive theta role. Since the second NP is in the subject position of the sentence, it will receive the agent role directly by the VP (GRODZINSKY 1990:83).

The presence of two NPs with the same agentive theta role (in the same sentence) is argued to create deficiencies in agrammatics, who actually perform at chance level (1990:84). Thus, problems are encountered whenever a S-structure is originated by transformation and the element which moves to the first position does not have the role of agent.

(4a)

Normal Assignment

Active reversible sentence

[the boy]i [VP t_i pushed] [the girl]i

Agent

Theme

Agrammatic assignment

(4b)

Normal Assignment

Passive reversible sentence

[the boy]i was [VP t_i pushed t_i] by [the girl]

Agent

Agent

Agrammatic Assignment

Summing up: agrammatics assign the agent role to the first DP of the sentence by a linear default strategy to elude the deletion of the trace. The above chance performance in some sentences (actives, subject relatives, subject clefts) is due to an accidental correspondence between the role assigned by the default principle
and the role that the moved element would have had; in this account, even those constructions with above chance performance are processed in an abnormal manner (AVRUTIN 2001:89).

Indeed, the same strategy creates confusion in passive sentences, in which the first DP has the role of patient/theme. What appears important to predict deficient and above chance performance is the identity between the default and the syntactic assignment of theta-role.

GRODZINSKY conceives the trace deletion hypothesis as “a descriptive generalization that captures given data in an economical way, while distinctions are motivated by a theory of syntactic representation... This account focuses on representations, not processes” (GRODZINSKY 1990:85).

This theory is valid for the majority of passive structures, apart from the passives with psychological verbs (adjectival passives). Though they have an identical structure to verbal passives, GRODZINSKY (1995b) found that these adjectival passives are better comprehended by agrammatics.

(5)

a. The boy (Experiencer) was interested in the girl (Theme).
b. The woman (Experiencer) was uninspired by the man (Theme).

The difference between the adjectival and the verbal passives is due to the thematic roles involved in the interpretation. Since no agentive thematic roles is concerned, the application of the default strategy does not constitute an obstacle to the correct interpretation.

Since it is not implied by the structure and the verb morphology, the assignment of the agentive thematic role does cause neither confusion nor competition, as happened between the arguments of the verbal passives examined above. Indeed, after the default strategy, we obtain a representation in which one thematic role is associated with only one element:

(6)

a. The boy (Agent) was interested in the girl (Theme).
b. The woman (Agent) was uninspired by the man (Theme).

The success of agrammatics in adjectival passives is assumed by GRODZINSKY (1995b) as another proof for the validity of the strategy Agent-first, which provides an explanation for the different agrammatic performance in verbal and
adjectival passives, both characterized by syntactic movement and both affected therefore by the deletion of the traces.

GRODZINSKY wrote:

(7) “Performance is thus deduced through either thematic competition or compensation: The strategy always assigns an Agent label to clause-initial NPs. Thus, if a moved constituent is linked to a different \( \Theta \)-role normally (as is the case in passive, object-gap relatives, object clefts, and the like), this constituent now becomes Agent, and since there is another, grammatically assigned Agent in the thematic representation, the two Agents compete, thereby inducing chance performance by agrammatics. In cases where the moved NP was supposed to be Agent […] , this role is not assigned normally through the trace due to Trace-Deletion, yet strategy correctly compensates by assigning that NP the Agent role by default”. (GRODZINSKY 1995a:34)

To be verified, the Trace Deletion Hypothesis needed to be confirmed in various and different tasks. Although GRODZINSKY predicted the failure in grammatical judgment tasks of sentences derived by syntactic movement, this prediction is not completely proved experimentally. Indeed, LINEBARGER et al. (1983) demonstrated that the ability to give grammaticality judgments is spared even in severe agrammatism. In addition to that, the prediction that the typology of the task does not cause variation of performance resulted partially erroneous, since LINEBARGER et al. (1983) showed that agrammatics performed at higher levels in grammaticality judgments with respect to comprehension tasks (GRILLO 2005:109).

Despite that, the hypothesis that the deletion of the trace could be noted in the execution of on-line tasks was actually correct. SWINNEY et al. (1989) revealed that the computation of transformational sentences differs from the off-line interpretation.

The example commonly used is the following:

(8) The priest enjoyed the drink, 1 that the caterer was 2 serving 1,3 to the guests.
The comprehension of these gap-filling sentences requires the re-interpretation of the empty position $t$, by the recovering and the reactivation of the moved element. The cross-modal lexical priming revealed that the presence of the NP the drink in position 1 and its reactivation in position 3 would determine a easing effect (namely the priming effect) in presence of another word semantically correlated, for example juice.

To SWINNEY et al. (1989) this priming effect is clearly observable in normal subjects by the reduction of the reaction time for the judgment. No analogous results were found in agrammatics, confirming the aforesaid hypothesis that they are not able to compute syntactically traces. GRODZINSKY (1990) ascribed these findings to the deletion of the trace, which inhibits the link between the drink and the empty position 3, avoiding the reactivation of the former. Conversely, normal subjects revealed priming effects for a word semantically related to the antecedent when presented immediately after the complementizer. Even to ZURIF et al. (1993) the priming effect (that symbolizes a faster recognition of a word) represents the connection (established in the comprehension process) between the gap and its antecedent.

Though Broca's aphasics appear to understand certain sentences, they would use a wrong approach, since they are claimed to fail in establishing the link between the trace and the moved element. (AVRUTIN 2001:90)

### 1.3.1 Do further experiments confirm the TDH predictions?

The development of linguistic theory and the studies about the agrammatic comprehension partially confirmed the original formulation of the trace deletion hypothesis, thus imposing a re-formulation thereof.

The TDH has been criticized by focusing on two main arguments. The first one (CAPLAN 2001; CARAMAZZA et al., 2001; DRAI et al., 2001) focuses on whether a uniform pattern of performance among different subjects exists.

The second one (AVRUTIN 2006) tries to relate the representational approaches to our knowledge about agrammatism; that is the connection between the deletion of traces and the other patterns of agrammatism (telegraphic speech, omission/substitution of tense morphology, omission of determiners…).

According to the processing account, different degrees of impairment can explain different processing resources.
Similarly, more complex structures require more processing resources, thus different patterns of comprehension and production can be attributed to the same source (Garraffa & Grillo 2007:3).

Although the first version of the TDH assumed the deletion of all the traces, the discovery of A’ e A movements, made clear that only the former obstacles the interpretation, whereas traces would be preserved in the latter. Hence, the loss of the traces would be limited to the A’ syntactic chain, causing the reformulation of the TDH:

(9)
Restrictive TDH (rough version I): Traces of XP movement are deleted (Grodzinsky 1990:39).

This assumption will be further modified, since the deficit would not cause the complete loss of traces, rather it would cause the unavailability/invisibility of the traces for the operation of thematic assignment. Thus, a second restriction of the TDH was formulated:

(10)
Trace-Based Account (TBA): Traces in Θ-positions are deleted from agrammatic representation (or are invisible to Θ-role assignment).

Despite this adaptation, the TDH was still inadequate to explain the contradictory findings. Hickok & Avrutin (1995) showed that different typologies of interrogative sentences have not been interpreted in the same way by agrammatics:

(11)
a. Object question: Who did the girl push t?
b. Subject question: Who pushed the girl?
c. Object question: Which boy did the girl push t?
d. Subject question: Which boy pushed the girl?

As expected, agrammatics showed a better comprehension of subject interrogatives, failing in the interpretation of which questions. Remarkably, patients’ good comprehension of who object questions was unforeseen. Hickok & Avrutin (1995) explained this results by using the notion of referentiality (Rizzi 1990), which states that linguistic elements are referential (D-linked, that is
discourse linked) if their interpretation needs contextual information as well, whilst they are not referential when their interpretation does not require any inference.

Moreover, the movement of referential elements (which) and not referential (who) would determine the creation of two different syntactic chains: binding chains in the former, government chains in the latter. HICKOK & AVRUTIN concluded by saying that the agrammatic deficit was limited in the malfunctioning of the binding chains regarding the movement of D-linked elements (AVRUTIN 2001:90).

To explain the success in the interpretation of who object questions, GRODZINSKY argued that the application of the default strategy would be limited only to the referential elements (which). Thus, sentences with not referential element should be well comprehended. This would explain even the agrammatic success with quantifiers, which are not referential elements.

Thus the resulting TDH is:

(12)

a. Trace-Based Account (TBA): Traces in Θ-positions are deleted from agrammatic representation (or are invisible to Θ-assignment).
b. R-strategy: Assign a referential NP a role by its linear position if it has no Θ-role.

1.3.2 Other studies and hypothesis on TDH

Analogously to CAPLAN (2000), who claimed that agrammatic comprehension does not show a precise deficit in the representation of traces, HICKOK (2000) argued that even the comprehension of center embedded relatives would be damaged (The dog that chased the cat is brown), since agrammatics would not be succeeded in establishing any relation between the subject and its predicate.

In addition to that, agrammatic comprehension is not perfect even in sentences with locative prepositions (The dog is behind the cat), contradicting the predictions of GRODZINSKY.

SHALOM (2000) concerned the syntactic processing of traces composed by three operations: 1) the construction of the trace; 2) the recovery of the element to which the trace refers; 3) the creation of the link between the trace and the moved element. According to GRODZINSKY, the deficit would compromise the third operation.
Despite that, Shalom notes that no study had demonstrated that traces are built and then deleted. The deficit of agrammatics would therefore stem from the absent construction of the trace, rather than depending on the difficulty of maintaining it. To Edwards & Lightfoot (2000) the results obtained in grammaticality judgment tasks may suggest that the trace remains intact. Thus, the deficit would rather consist in an intermittent access to this knowledge.

Beretta & Munn (1998) showed that agrammatics process a sentence without involving double Agents. The task was composed by several pictures, one of which containing two arguments that could be interpreted as agents of an action. When agrammatics have to interpret a passive sentence (e.g. “the girl was pushed by the boy”), they rarely choose the picture depicting both characters as agents. These results clearly contradict the TDH hypothesis that both NPs are interpreted by agrammatics as agents and would refute the default strategy (Avrutin 2001:90).

Beretta (2000) and Newmeyer (2000) concentrated on the inadequacy of the default strategy. Since agrammatics seem to maintain the lexical representation of verbs, the loss of a thematic role would be not sufficient to determine the application of the default strategy. Moreover, the knowledge of the correct thematic role should allow them to infer correctly also the role of the second NP.

The assumption of the VP-Internal Subject Hypothesis (henceforth VPIS Hypothesis) and the abandonment of the default strategy could explain the agrammatic failure in sentences such as The psychologist that attacked the linguist is tall.

To Grodzinsky these sentence should be correctly comprehended, whereas the VPIS Hypothesis predicts the failure in the interpretation. in VPIS account, the subject the psychologist is generated VP internal, and then moved to the canonical subject position, receiving its role by the predicate is tall. However, the assignment cannot take place because of the deletion of the trace; thus, both NPs without thematic roles should actually result not interpretable.

Newmeyer (2000) claimed that the TDH would be unable to explain the agrammatic impairment, since it has been found that these subjects maintain intact the ability to recognize syntactic violations; this fact should prevent the association of two agentive thematic roles and the assignment of the role of agent to the first NP in passive sentences.
ZURIF et al. (1993) proved that agrammatics do not elaborate the antecedent in the same manner as normal speakers do. Comprehension of subject relatives (*the baby, who tᵢ pushes the mother tᵢ is blonde*) is above chance, but they are not able to answer to a related question (es. *Who is blonde*?), showing a decreased performance to chance level.

Contrarily to these assumption, CAPLAN (2007) argues that poor performance on transformational sentences could stem from a reduction of processing resources (HILDEBRANDT et al., 1987 and CAPLAN & HILDEBRANDT, 1988, reported that traces are vulnerable to resource reduction as well). GRODZINSKY (2000) answered them back, by hypothesizing that TDH should be applied only to Broca’s aphasics (agreeing with ZURIF & PIÑANGO 1999), even though a number of agrammatics do not show the expected performance (CAPLAN 2007:105).

PIÑANGO (1999) demonstrated that agrammatics exhibit a good performance in comprehending inaccusative sentences, suggesting that these patients could represent subject NP traces.

Since her patients performed at chance level in comprehension of passive constructions, she supposed that syntactic movement is responsible for the reversal of thematic roles (Argument Linking Hypothesis) (AVRUTIN 2001:90).

HARTSIKER & KOLK (1998) argued that agrammatic problems with passives do not stem from a structural deficit but rather from a processing limitation. They claimed that agrammatics, who do not produce passives spontaneously, would become capable in processing them after the “syntactic priming effect” (AVRUTIN 2001:90): after having been exposed to a passive sentence like “*the speaker is interrupted by the noise*”, agrammatics were inclined to use passives in a following production task. Thus, the ability to use these sentences, although after priming, would invalid the hypothesis that traces are deleted. To HARTSIKER & KOLK (1998), the deficit would lie in the reduction of processing capacities involved in the computation.

An impairment has been found even in structures with concealed phrasal movement. AVRUTIN et al. (1999) demonstrates that agrammatics have problems in elaborating the reference for a pronoun when there are two other possible antecedents, as happens in: *First John hit Bill, and then Mary hit him* (AVRUTIN 2001:90).
Though normal speakers refer *him* to Bill, agrammatics performed at chance level, showing a random choice between the possible antecedents.

All the data from this study seem to indicate that agrammatic impairment might be due to reduced processing resources, which are indispensable for computing certain linguistic knowledge (AVRUTIN 2001:91).

CARAMAZZA, CAPASSO, CAPITANI, MICELI (2005) verified the TDH predictions of above chance performance in active reversible sentences and at chance level in passive reversible sentences. To achieve this goal, they investigated subjects’ comprehension with a sentence-to-picture matching task with active and passive reversible sentences. Notably, their results did not validate the TDH: indeed, only 15% of patients’ performance mirrored the TDH predictions. The level of agrammatics’ performance on passive sentences was in many cases higher than chance level (CARAMAZZA et al. 2005:43).

Methodologically this study demonstrates that we cannot infer the structure of cognitive processes from aphasic syndromes. Although subjects were all clinically classified as agrammatic Broca’s aphasics, their comprehension was clearly not homogeneous. Comprehension impairment has different performance, reflecting a different level and typology of damage.

Only a minority of Broca’s aphasics showed the predicted performance (CARAMAZZA et al. 2005:51). Moreover, the majority of them did not show different comprehension performance in active and passive sentences. Since agrammatics show different patterns in production and comprehension, it is clear that a unified linguistic account is counter-productive (CARAMAZZA et al. 2005:52).

DICK et al. (2001) tested normal subjects under stressful conditions and brain-damaged subjects (presenting different clinical forms of aphasia) in a sentence comprehension task.

Interestingly, Broca’s aphasics did not perform differently from other clinical groups; the fact that they behaved in a similar way (although with a worse performance) with respect to normal subjects under stress, led DICK et al. to hypothesize that the impaired comprehension does not stem from any damaged syntactic principles.
In their view, agrammatism is conceived as a disorder placed between normal and severely damaged performance. Notice that this position is actually opposite to GRODZINSKY (2000), who restricted his hypothesis to only a subgroup of subjects.

Patients who make more errors of comprehension in reversible sentences (both in active and passive clauses) and reversal errors in production (e.g., describing a picture showing a baby pushing a boy as *The boy pushed the baby*), however preserving a good control of morphological processing in both comprehension and production, would have rather a deficit in thematic role assignment.

These contrasting performance could be explainable with the assumption that morphosyntactic principles and the assignment of the thematic role may implicate some mechanisms independent from language processing.

**1.4 GRILLO (2005) and the RM effects**

GRILLO (2005) proposes that the responsibility for asymmetries in agrammatic comprehension has to be attributed to the Relativized Minimality (henceforth RM) locality principle (RIZZI 1990, 2001; STARKE, 2001).

According to capacity limitations and complexity approaches, agrammatic comprehension would be influenced by the computational cost of complex syntactic structures. GRILLO argues that limited computational resources prevent agrammatic patients from processing *morphosyntactic features* carried by syntactic heads. This approach should be capable to explain and predict the canonical/non-canonical asymmetry in agrammatic comprehension.

He hypothesized that the movement of a NP over another similar one is harder to process; in this account, even sentences with long distance relationship over an intervening NP would be more difficult to compute than sentences characterized by a short distance movement or by a movement which does not involve any intervener (GRILLO 2005:107). Hence, the RM principle should block the formation of the link whenever an intervening element cannot be differentiated because of reduced processing capacities.

Simplifying RIZZI (1990, 2001) claims that:
“Y is in Minimal Configuration (MC) with X if there is no Z such that Z is of the same structural type as X, and Z intervenes between X and Y”, in which great importance is assumed by the definition of the same structural type.

CHOMSKY (1995) explained the RM in Minimal Link Condition term:

(13b)“K attracts a only if there is no b, b closer to K than a, such that K attracts b”.

In this view, the “same structural type” is defined in terms of identity of features, whilst in RIZZI (1990) the structural type was defined in term of belonging respectively to an A or A’ chains.

However, these assumptions do not consider that quantificational adverbs and negations may interfere with wh-elements, despite of being different from them in terms of features (GRILLO 2005:110).

Consequently RIZZI, by resorting to cartographic studies, hypothesized several positions (with the split of the CP node), which can allow the needed distinctions between quantifiers, negations and wh-elements:

(14) Force Top* Int Top Focus Mod* Top* Fin IP (RIZZI 1997, 2001b).

Thanks to the split-CP hypothesis, the same structural type is identified as a specific class which contains a specific set of morphosyntactic features:

(15)

a. Argumental: person, gender, number, case
b. Quantificational: Wh-, Neg, measure, focus…
c. Modifiers: evaluative, epistemic, Neg, frequentative, celerative, measure, manner…
d. Topic.

In this account, RM effects should occur whenever NP features belong to the same class, whereas they would not create interference when NP features differ from each other. It can be argued that only one feature of the same class is sufficient to create the possibility of a block in the chain formation.

Hence, the ability to create a chain over an intervening element is influenced by the NP features’ class. Pattern variations are expected whenever a class somewhat changes because of an impoverishment in the number/quality of NP features.
Several causes can be taken into account for explaining the underspecification of morphosyntactic features: a limitation of their computational abilities, a fast decay of their lexical information, a general deficit in the recovery of information (Grillo 2005:111).

Whatever the cause is, the impoverishment of features allows the RM to block the chain formation, preventing the assignment of the correct theta role to the arguments. Agrammatic comprehension would be therefore affected by potential interveners between a moved NP and its trace, whereas it could be spared when no potential antecedent intervenes. If the feature set is full interpreted, the formation of the chain is possible even in the case of a NP intervener, as happens in the following sentence (Garraffa & Grillo 2007:2):

(16)

\[(N, \theta_2:ϕ_s, acc, wh)_{ClassQ} (D, N, \theta_1:ϕ_s, acc, nom)_{ClassA} (N, \theta_2:ϕ_s, acc, wh)_{ClassQ}\]

\[it\ is\ the\ boy_\ x,\ [who_\ x,\ [the\ girl_\ i,\ [<the\ girl>_i,\ kissed\ <who>_i]],]\]

On the other hand, if features are not fully processed, whatever NP intervener can block the chain formation and the moved argument cannot receive any role from its trace (Garraffa & Grillo 2007:2):

(17)

\[(N, \theta_2:ϕ_s, \ldots)_{ClassA} (D, N, \theta_1:ϕ_s, \ldots)_{ClassA} (N, \theta_2:ϕ_s, \ldots)_{ClassA}\]

\[it\ is\ the\ boy_\ x,\ [who_\ x,\ [the\ girl_\ i,\ [<\ldots>_i,\ kissed\ <\ldots>_i]],]\]

This account predicts that subject relatives should be correctly interpreted by agrammatics, since no NP intervenes between the moved constituent and its trace, and no RM effects can take place.

(18)

\[NP\quad NP\quad NP\quad NP\]

The boy [who [<the boy> greeted the girl]]

The same happens in a subject cleft, in which the chain is correctly formed, and the thematic information can be processed correctly, thanks to the absence of potential interveners between the moved element and its trace.
Different situation have been observed in object relatives. In a subject relative, no NP obstacles the relation between the moved subject and its trace, whereas in object relatives like “This mouse that the cat eats” RM effects are predicted to occur:

(19)

\[
\text{NP} \quad \text{NP} \quad \text{NP} \quad \text{NP} \\
[\text{The mouse}] \quad [\text{< the mouse}> \text{ that }] \quad \text{the cat} \quad \text{eats< the mouse>}] \\
\]

Indeed, whilst above chance performance is hypothesized in subject relatives, the same clearly does not occur in object relatives, in which the subject NP intervenes between the moved object and its trace. Only a full representation of the sets of features does permit the avoiding of any RM effect (GRILLO 2005:113), since RM cannot interfere if the two NPs are correctly interpreted and shown to belong to different morphological classes. However, agrammatic’s impoverished representation does not allow to link the moved phrases to their traces, causing the impossibility to assign the correct theta role to each argument (GRILLO 2005:114).

After having proved that comprehension of semantically reversible passives is compromised in agrammatism, we could expect minimality effects in these sentences, given that the internal argument moves through the verbal passive morphology to which external argument is linked. Indeed, this account is supported by PIÑANGO (1999) and GRODZINSKY et al (1991), who investigated the agrammatic comprehension of unaccusative and adjectival passives (GRILLO 2005:114).

Specifically, PIÑANGO (1999) argued that agrammatics are able to understand unaccusative sentences such as the girl spun because of the boy. In this case, the subject originates in a post-verbal position, and then moves. Given that the moved NP does not cross any other argument, no RM effect should intervene, even in the case of an underspecified representation. Hence, RM account is up to predict a positive performance in these sentences and in adjectival passives, already shown unimpaired by GRODZINSKY et al. (1991).

Being the subject of adjectival passives generated in [SpecVP] (as in John was interested in Mary), no minimality effects are expected to arise, contrarily to what happens in verbal passives (GRILLO 2005:114).
HICKOK (1992) noted that agrammatics performed weaker in comprehending double object constructions than normal datives. Analogously, CAPLAN & FUTTER (1986) tested an agrammatic subject who showed good comprehension of datives like *the tiger gave the lion to the elephant*, though he systematically failed in the assignment of theta roles in double object sentences as *the tiger gave the elephant the lion*. Briefly, a double object construction is syntactically derived by a passivization of the VP. Moreover, the indirect object (*the elephant*) received a role through a chain crossing the object NP (*the lion*). This fact is predicted to cause a minimality effect in case of reduced interpretation of the feature sets.

(20)

The tiger [ gave [the elephant the lion <… >]]

In this sentence, the DP (*the lion*) obstacles the link between the elephant and its trace. Conversely, no minimality effect is expected to occur in normal datives (GRILO 2005:115).

Furthermore, GRILO (2005) noted that certain features are more likely to be omitted and deleted by agrammatics. This would depend on the grades of markedness and complexity, since we would tend to compute general features rather than specific ones (since these require more computational resources) (GRILO 2005:116).

Consequently, the impoverishment of the feature sets changes the feature class in object relatives, object clefts, passives, double object sentences; the deletion of the relative feature [+ R] from the trace and from the moved element would transform their Quantificational class into the Argumental one, which is the same class of the subject, finally causing interference. In conclusion, the deficit in these constructions would stem from an association between a limited access to the features sets and the Relativized Minimality effects (GRILO 2005:117).
1.5 FRIEDMANN & SHAPIRO: OSV and OVS in the agrammatic comprehension

FRIEDMANN & SHAPIRO (2003) tested agrammatic comprehension of SVO and OSV-OVS active sentences in Hebrew. OSV clauses are obtained simply by moving the object to the beginning of the sentence, whereas OVS sentences require the additional movement of the verb to the C head (FRIEDMANN & SHAPIRO 2003:289).

(21)
SVO: The cat eats the mouse.
OSV: The mouse the cat eats <the mouse>.
OVS: the mouse eats the cat <eats> <the mouse>.

For these sentences the TDH predicts a chance-level performance, since to the deletion of the trace, the moved object receives agentive role only by the default strategy, the same role of the subject (which, in the first formulation of the TDH, receives role thanks to its immobility). Having two agents, agrammatics would be forced to guess the correct featural set.

In their study, authors compare TDH with theories about a total lack of syntax (CAPLAN & FUTTER 1986), which predict a below-chance performance in OSV and OVS, since the agrammatic thematic assignment would rely only on lexical clues and linear order.

In addition to that, it is proposed a comparison with the assumptions of the Capacity Constraint theories (CAPLAN et al., 1985; HAARMANN, JUST, CARPENTER 1997; MIYAKE et al., 1994). Indeed, following the Capacity Constraint theories, OSV and OVS sentences should reveal better performance, since they are characterized by one verb and thus by only one thematic grid (FRIEDMANN & SHAPIRO 2003:290).

Remarkably, the data disclosed that agrammatics performed at chance level in comprehending the derived OSV-OVS active sentences, whereas they performed above chance in SVO. Although SVO, OVS, OSV sentences show different patterns, and given that the only syntactic difference between these sentences is the presence/absence of NP movement, the impairment in agrammatism has to lie necessarily in NP movement. Furthermore, we have seen that OSV and OVS do
not differ in performance, hence verb movement (which syntactically distinguish the two structures) does not influence the impairment.

Finally, according to the VPIS Hypothesis, the subject moves from its base position and, in TDH terms, this movement should prevent its role assignment. Consequently, both the subject and the object would receive their role only by the default strategy (FRIEDMANN & SHAPIRO 2003:294). In this view, the object would become the agent and the subject would receive the role of theme in OSV and OVS, leading to a systematic reverse interpretation and a below chance performance, instead of the chance level actually found (FRIEDMANN & SHAPIRO 2003:295).

To explain this pattern, the TDH is modified by an “Avoid Movement” strategy; agrammatics would avoid any movement, giving roles to elements in their base position, consequently guessing the assignments. This would lead to a chance rather than a below chance level performance in comprehension tasks.

In effect, this hypothesis (TDH with the “Avoid Movement” strategy) could explain the discrepancies between the chance performance effectively found in OSV, OVS, object relatives, object clefts, object questions and the below chance level erroneously predicted by the TDH (FRIEDMANN & SHAPIRO 2003:295).

Although these outcomes seem to confirm the TDH, such data can clearly validate the RM hypothesis (as implicitly admitted by the authors in a footnote) as well. Agrammatics would have difficulties whenever a sentence contains a NP crossing another similar one (GRILLO 2005:115).

1.6 GARRAFFA & GRILLO (2007) and the canonicity effects

This study recalls the hypothesis that asymmetry between canonical/non-canonical sentences would be due to RM effects (GRILLO 2003, 2005; RIZZI 1990, 2004a; STARKE 2001). Interpreting RM as a principle of economy in the syntactic representation, they argue that syntactic relation is restricted to the closest suitable element; thus, complexity effects would depend on the length of the movement of an element. GRILLO (2003, 2005) claimed that a reduction in the processing abilities may affect the representation of the morphosyntactic feature carried by an element, causing the Minimality effects (GARRAFFA & GRILLO 2007:2).

In a normally processed object clefts like it is the boy who the girl kissed, RM allows the formation of the chain between the moved NPs and their traces after
the recognition that the subject NP (the girl) and the object NP (the boy) bear different features.

(22)
\[(N,\theta_2,\phi_s,\text{acc},\text{wh})_{\text{ClassQ}} (D,N,\theta_1,\phi_s,\text{acc},\text{nom})_{\text{ClassA}} (N,\theta_2,\phi_s,\text{acc},\text{wh})_{\text{ClassQ}}\]

\[\text{it is the boy}, [\text{who}, [\text{the girl}], [ < \text{the girl}, \text{kissed} < \text{who}> ]\]

The element who belongs to the Q class (it carries a wh-feature), differing from the subject (the girl) which belongs to the Argumental class.

The situation radically changes in an agrammatic subject, who carries an impoverished set of features (GARRAFFA & GRILLO 2007:2):

(23)
\[(N,\theta?,\phi_s,\ldots)_{\text{ClassA}} (D,N,\theta?,\phi_s,\ldots)_{\text{ClassA}} (N,\theta?,\phi_s,\ldots)_{\text{ClassA}}\]

\[\text{it is the boy}, [\text{who}, [\text{the girl}], [ < \ldots?, \text{kissed} < \ldots?> ]\]

In agrammatism, the impossibility to compute wh-features causes RM effects that prevent the chain formation; as a consequence, the absent assignment of the correct thematic role to the elements would lead them to misunderstand the sentence.

This approach predicts that subject relatives should be correctly interpreted by agrammatics. Given that these sentences do not contain any NP intervener between the moved constituent and its trace, RM effects are not predictable (2007:2).

The property of locality is central in RM; syntactic relations have to be satisfied in the smallest possible distance. This idea is strictly correlated to the minimal chain principle (DE VINCENZI 1991), which assumes that the human mind prefers the most minimal compatible structure.

A formal definition of RM is given:

(24) MINIMAL CONFIGURATION: \ldots X \ldots Z \ldots Y \ldots

\[Y \text{ is in a minimal configuration (MC) with } X \text{ if there is no } Z \text{ such that } Z \text{ is of the same structural type as } X, \text{ and } Z \text{ intervenes between } X \text{ and } Y \text{ (GARRAFFA & GRILLO 2007:4-5)}\]
Consequently, RM effects depend on whether the intervening element belongs to the same class (with the same features set) of the other NPs. GRILLO (2005) argued that an impoverished ability to process syntactic information leads to underspecify the morphosyntactic feature sets; minimality effects would be consequent to that deficit.

Still referring to GRILLO (2005), certain features (operator class, scope-discourse related, those related to the periphery of the clause and to the vP) would be more likely compromised in case of processing deficit. Even features later learnt would be easily compromised.

Moreover, AVRUTIN (2006) claimed that agrammatics are affected by weakened syntax, a reduction of syntactic abilities that changes the hierarchy of the *Primitives of Binding* (REULAND 2001); the fact that agrammatics would be forced to avoid certain syntactic elements (certain tenses, determiners…wh-movement, binding of pronouns) has been interpreted by GRILLO as an additional evidence that the source of the problem lies in the syntactic representations (GARRAFFA & GRILLO 2007:6).

If the cost overcomes their computational capacities, the activation of features associated with the CP-layer is not possible.

Subsequently, the cause of the asymmetries with canonical/non-canonical sentences will be reduced to an application of RM to impoverished syntactic structures in agrammatism.

GARRAFFA & GRILLO (2007) therefore hypothesized that structures characterized by movement through an intervening NP are more complex to process and thus more likely to be compromised.

These structures (derived by movement over an intervening NP) will be performed at chance level, while structures which do not involve any intervening NP will be correctly comprehended (GARRAFFA & GRILLO 2007:7).

The following table summarizes what has been said so far (GARRAFFA & GRILLO 2007:7):
Experiments investigated whether the mismatch of animacy between the moved NP and the intervener could influence agrammatic comprehension.

Specifically, they predicted that mismatch condition could help to distinguish between the two NPs, since the interrogative element *who* differs from *what* for the marked feature [+animate], being the latter characterized by [-animate] (Garraffa & Grillo 2007:8-10).

An agrammatic subject performed at above chance level (75%) in *who* and in *what* subject questions (83.3%). Conversely, he totally failed in *who* object questions, whilst in *what* questions he performed at above chance (75%). As expected, he does not succeed when structure involves the crossing over an intervening NP (Garraffa & Grillo 2007:13).

Reversible relative clauses are performed at above chance levels if they are subject relatives, whereas at chance level (40%) if they are object relatives. The same asymmetry is found in cleft sentences.

Finally, it is clear that agrammatic comprehension is affected by an impoverishment of the processing resources, that prevents the complete computation of the feature sets. This weakening is also responsible for the RM effects, since the formation of the chain is blocked by the intervener NP (Garraffa & Grillo 2007:14).

Since comprehension of *wh*-questions needs full recovery of *wh*-features carried by the moved element and its trace, again comprehension of object *who*-questions is impaired when the syntactic chain crosses a potential intervener NP, which becomes an obstacle at the moment of an impoverishment of feature sets.
processing. If the same occurs in subject *who*-questions, no RM effects are expected, because of the absence of a NP intervener (2007:15).

The above chance performance in *what* object questions is due to the presence of a morphological mismatch (+ and - animate) that improves the comprehension, avoiding any minimality effect. Here the moved object carries a [-animate] feature whereas the intervening NP has [+ animate]. Finally, this mismatch condition is not influential in an unimpaired system, however it becomes crucial in an impaired system (GARRAFFA & GRILLO 2007:16).

To sum up, agrammatics’ problems are caused by an impoverishment of the feature sets which provokes the intervention of an NP, blocking the chain formation between the moved element and its trace. They would be affected by a capacity limitation in processing resources as well (2007:17).

### 1.7 FRIEDMANN & GVION: Intervention and Locality in agrammatic aphasia

FRIEDMANN & GVION (2012) investigated how locality principles influence the comprehension patterns. Studies demonstrated that agrammatics can compute the lowest nodes of the tree, whereas the highest ones (like the CP layer) are inaccessible to them (FRIEDMANN 2001, 2006). Their impairment affects both production (they do not succeed in embedded sentences and *wh*-question) and comprehension (e.g. certain typologies of relative clauses) (FRIEDMANN & GVION 2012:192).

Subject and object reversible relatives, with or without an intervener NP, were examined in order to verify whether comprehension depends on the structure rather than on locality and intervention principles (2012:193).

They also examined whether a particular position of the lexically restricted NP (closer to the verb and to the trace than the antecedent) can influence agrammatic comprehension (FRIEDMANN & GVION 2012:195). Authors found that the sentence structure does not have any role, whereas comprehension performance is clearly subject to the presence of an NP intervener (2012:196).

Although agrammatic performance depends on the presence of a NP, the number of lexical material between the moved element and its trace does not seem to influence the comprehension processing.

These results confirm that syntax is not totally absent in agrammatics: whilst specific syntactic abilities are impaired, other capacities (as the ability to construct
low syntactic trees) remain active. However, if we assume that agrammatics cannot construct traces, it remains not totally explained how the NP intervener can obstacle chain formation (2012:198).

Given that agrammatics cannot project higher nodes, they would not be able to comprehend embedded sentences, nor identify the trace position. In center-embedded sentences like “The boy who greeted the girl smiled”, the link between the verb greeted and its agent would be deleted. They predicted that locality might influence someway comprehension; it could represent a strategy to give sense to a sentence processed as a cluster of independent elements (2012:199).

In effect, comprehension of these embedded sentences showed a chance level performance, given that the participants choose the closest local DP as the agent of the verb.

Thus, previous findings are confirmed: agrammatic aphasics would be able to understand subject relatives, unless a NP/CP intervenes between the verb and its agent. In this case, they are “forced” to rely on a locality strategy (FRIEDMANN & GVION 2012:201) assigning the agent role to the DP that immediately precedes the main verb (2012:202).

Summing up, the comprehension of relative sentences is seriously impaired only when an NP intervener is placed in a determinate position. Agrammatics would follow locality clues to elude their deficit in embedded relatives, selecting the closest DP as the agent of the verb.

Remind that the “Agent-first strategy” predicts an above chance performance also in subject relatives like This is the father that the boy sprays (with order SOV), in which the application of this strategy should assign the role of agent to the first NP. However, the performance of agrammatics (at chance level in these sentences, below chance on those like The man that visited the physician is drawing) contradicts the agent-first strategy (FRIEDMANN & GVION 2012:203). These subjects evidently assign the role of agent to the closest DP to the verb (the boy), which is instead the direct object of the sentence.
1.8 FRIEDMANN, BELLETTI & RIZZI (2009) and the similarity effects

The typology of an object relative may influence children’s performance. According to the RM, an impaired comprehension would be sensible to the “similarity” between the moved element and the NP intervenient, whereas an eventual dissimilarity improves their performances; this account is mirrored in wh-questions as well (FRIEDMANN, BELLETTI, RIZZI 2009:67).

Even adult performance in object relatives and wh-questions is affected by this NP intervenent. Although their comprehension process is not impaired, object relatives require more computational abilities (2009:68).

Thus, poor performance in certain object dependencies would be caused by the possible presence of a lexical NP restriction; comprehension of free object relatives Show me the one that the boy is wetting (2009:74) and who-object questions Whom does the cat bite? (2009:78) would be not affected, since no lexically restricted NP intervenes.

The same occurs in headed object relatives across an impersonal subject like Show me the horse that someone is brushing, in which the NP is restricted and the moved element belongs to another class (FRIEDMANN, BELLETTI, RIZZI 2009:75).

Conversely, the comprehension of headed object relatives like Show me the elephant that the lion is wetting (2009:70) and which object questions Which dog does the cat bite? (2009:78) is seriously impaired since both the NP subject and the moved element are lexically restricted (2009:81).

However, it has to be noted that the RM does not focus enough on the similarity between arguments and the intervenent, being the concept of “similarity” based on the feature set associated with X, Z, and Y.

Given that the feature(s) set, which allows movement and the chain formation, defines the structural type of a position as well, the triggering movement could be originated by this lexically restricted NP, subsequently causing potentially RM effects (FRIEDMANN, BELLETTI, RIZZI 2009:82).

As for wh-questions, their performance depends on whether the lexical restriction is clustered with the wh-element: if it is so, their comprehension significantly improves, as it happens in How many problems don’t you know how to solve?

The child grammar would not be able to compute correctly the full array of features associated with each argument of the sentence; it follows that this
underspecification causes difficulties in object relatives, which are not problematic for adults, whose computational system is able to process every feature, giving the necessary distinction between the element (FRIEDMANN, BELLETTI, RIZZI 2009:83). Children, not adults, would have problems in condition of:

(26)


Although children cannot process features, which require a mature linguistic system, they show an improved performance when features are disjointed as in:

(27)

Disjointedness: +A . . . . . +B . . . . <+A>,

This particular feature condition is predicted to not overwhelm their computational capacity (FRIEDMANN, BELLETTI, RIZZI 2009: 84).

Impaired structures may therefore result more simply to process when elements belong to different morphological classes.

Analogous findings are in GRILLO (2005, 2009), in which agrammatic performance in object relatives, object wh-questions and object clefts were seriously impaired, given that patients’ were able only to process feature sets partially; agrammatics would be more affected when NPs are similar, due to the poor features specification (GRILLO 2009: 1434-1435).

Finally, it has to be noticed that authors do not impute the children’s poor performance to a lack of grammatical competence. Their deficit would stem from a not totally matured computational system. Indeed, a mature linguistic system is able to process the full array of features associated with the elements of the sentence. Children would access to the correct comprehension only when NPs do show disjointedness, since the establishment of these relations involves less computational resources (FRIEDMANN, BELLETTI, RIZZI 2009:85).
Conclusions

In this chapter we have seen most of the theories and hypotheses regarding agrammatic comprehension, showing that they are affected by serious deficiencies in the comprehension of sentences with transformational movement. However, the nature of comprehension difficulties has to be understood yet.

Indeed, several theories have been attempted with the purpose of explaining agrammatic deficit in not canonical ordered sentences.

First, the Trace Deletion Hypothesis (TDH) formulates that agrammatic impairment in comprehension stems from a disability to represent traces, which are finally deleted, in particular those in $\theta$ position. Hence, the deletion of traces would lead them to the failure in the elaboration of the correct interpretation of roles, since traces are essential for the transmission of the theta-role to the moved element.

In this account, the loss of the traces does not affect the comprehension of structures without movement, whereas sentences derived by syntactic movement should be more complex. However, this prediction resulted not confirmed experimentally, since subject relatives and subject clefts, which are transformational sentences, are performed at above chance level. To explain this pattern, Grodzinsky hypothesized a default linear strategy which agrammatics would use during the comprehension process: agrammatics would assign the role of the agent to the first DP of the sentence by this linear default strategy to elude the deletion of the trace.

However, this hypothesis has been surpassed by studies regarding Relativized Minimality (Rizzi 1990, 2001; Starke, 2001). Grillo (2005) proposes that the responsibility for asymmetries in agrammatic comprehension has to be attributed to Minimality effects. Specifically, agrammatic comprehension would be influenced by the computational cost of complex syntactic structures. Limited computational resources would prevent agrammatic patients from processing the morphosyntactic features carried by syntactic heads. Hence, he hypothesized that the movement of a NP over another similar one is harder to process. Thus, the RM principle should block the formation of the link whenever an intervening element cannot be differentiated because of reduced processing capacities.
Even in Friedmann & Shapiro (2003) the asymmetry between the performance in SVO and OVS, OSV sentences would be due to the RM effects. Since RM is conceived as a principle of economy in the syntactic representation, they argued that the syntactic relation is restricted to the closest suitable element; thus, complexity effects would depend on the length of the movement of an element.

In Friedmann, Belletti, Rizzi (2009), the typology of an object relative might influence children’s performance. According to them, an impaired comprehension would be sensible to the “similarity” between the moved element and the NP intervenient, whereas an eventual dissimilarity improves their performance. Hence, agrammatic poor performance in certain dependencies would be caused by the presence of lexical NP restrictions and, more generally, by the intervention of a underspecified (because of their impairment) element. These patterns seem to explain agrammatic performance in comprehension almost entirely.
CHAPTER 2

_Psycholinguistic theories regarding agrammatic comprehension_

**Introduction**

Several psycholinguist theories about agrammatic comprehension will be presented in the next sections. Some of these argue that agrammatic subjects have lost or cannot use the ability to compute complex sentences, whereas the others suggest that more complex computational operations cannot be processed for the reduction of available resources.

First, I will depict the declarative-procedural model of ULLMAN (2004), who conceives agrammatism as a weakness in the cognitive models also involving the linguistic system, whilst AVRUTIN et al. (2006) consider agrammatics affected only by linguistic impairment.

Then, several studies regarding agrammatism will be presented (BRADLEY, GARRETT & ZURIF, 1980; KOLK et al., 1985; HICKOK & AVRUTIN, 1995; AVRUTIN, 1999). To these hypotheses, agrammatic impairment would not depend on structural loss, but on the weakness of some computational capacities. Moreover, they establish that agrammatism does not entail the deletion of grammatical knowledge, rather it consists in a weakness of procedural abilities, which affects the required grammatical knowledge.

Hypotheses about agrammatism as a delay in building the syntactic structure will also be reported. In these accounts (SWINNEY et al., 1989; ZURIF, 2003 HAARMANN & KOLK, 1991), the delayed processing would prevent the execution of the linguistic operations in adequate temporal limits to the linguistic comprehension.

The Weak syntax or Slow-syntax model will be described, in order to explain agrammatic delay as a specific weakness of the syntactic module.

Finally, two studies (CAPLAN, 2006; CAPLAN et al., 2007) regarding the concept of agrammatic _intermittent reduction_ of processing resources will be discussed. The intermittent functioning of the parsing/interpretive mechanism would occur more frequently in sentences which require a higher computational cost.
2.1 Ullman (2004) and the Declarative - Procedural Model

Since the majority of TDH limits stems from its base assumption -the idea that agrammatic impairment consists in a complete loss of syntactic abilities-, several perplexities can be solved by considering agrammatism as a weakness in linguistic capacities.

The hypothesis of a procedural impairment provides the explanation for the asymmetries among different typologies of sentences, for the different grades of agrammatic deficit, as well as for the strategies adopted in certain situations. Several theories have been elaborated in order to explain the procedural impairment of the linguistic capacities. Ullman (2004) conceives a weakness in the cognitive system which involves other linguistic modules, whilst Avrutin et al. (2006) consider agrammatics affected only by linguistic impairment.

A common point between these theories establishes that agrammatic impairment does not entail the deletion of grammatical knowledge, rather it consists in a weakness of procedural abilities, which affect the required grammatical knowledge.

The model elaborated by Ullman (2004:231-270) is composed of two kinds of cognitive memory and two main linguistic components. The latter correspond to the memorized mental lexicon and to the computational mental grammar (Chomsky, 1965, 1995; De Saussure, 1959; Pinker, 1994).

Mental lexicon represents in Ullman “a repository of all idiosyncratic word-specific information”, namely a box containing “all words whose phonological forms and meanings cannot be derived from each other” (2004:233). Then, it includes non-compound words, irregular or specific information (as the kind of argument of a verb or irregular verbal forms), distinctive information of syntactic elements (e.g. bound morphemes) and idiomatic expressions, whose meanings cannot be derived simply by analyzing the linguistic input (Ullman 2004:233).

On the contrary, words understandable by the regularity of language (which have not to be memorized) belong to the computational Grammar (Ullman 2004:234).

Grammatical rules participate in the operations of linguistic formation and determine how forms have to be derived by combining simple memorized words (e.g. the creation of the English simple past requires the verbal base form and the morpheme –ed); they establish the sequential order of the lexical elements in
compound words, in phrases and in sentences, as well as determining hierarchic relations among these elements (ULLMAN 2004:234).

Grammatical rules are important especially for the linguistic interpretation of a sentence, providing the comprehension of complex words never seen or heard before.

In the sentence Clementina glicked the plag, though Clementina is not known, and though it is impossible to understand to what the verb and the second NP refer, everybody can understand that a subject named Clementina did accomplish an action over an element (the plag) (ULLMAN 2004:234).

These information are guaranteed by the inherent knowledge of grammatical rules. Not only this knowledge has to be considered unconscious, since it does not depend on learning, but also its activation is mainly unconscious, being automatically activated by the presence of a linguistic input (ULLMAN 2004:234).

2.1.1 The declarative-procedural model

The core assumption of this model is the idea that the cerebral systems of declarative and procedural memory have an analogous role in language and in extra-linguistic processes; functions of the lexical/declarative memory and of the grammatical/procedural system would interact in several ways (ULLMAN 2004:247).

Declarative memory constitutes a repertory not only of facts and events, but also of words, containing all the arbitraries and idiosyncratic information, as the association between phonological form and meaning, their abstract representation and their grammatical category (2004:245).

It contains even regular elements, stored for their frequency or for some peculiar characteristics. Declarative memory encloses even an associative super-positional memory, which allows the generalization of the information.

More specifically, the memorization of the association among certain verbal roots and their irregular past form depends on the subject’s ability to generalize this phonologic similarities to other verbs (ULLMAN 2004:245).

On the other hand, the computational grammar seems to depend on procedural memory, being the ability to apprehend regular rules of the language and the capacity of controlling rules already acquired.
According to ULLMAN, the procedural memory would be responsible for the implicit acquisition of grammatical rules, from which the linguistic construction is built up.

Hence, it would have a central role in merging operations, permitting the derivation of complex forms from the abstract representation contained in the declarative memory (ULLMAN 2004:245).

Although it displays common aspects between the two linguistic components and the two memory systems, ULLMAN’s model does not predict an isomorphism between lexicon/declarative memory and computational grammar/procedural memory. On the contrary, he claims that there are parts of each system not implicated in any linguistic function, since there are aspects of language not derived from the interaction of the two systems. In addition to that, other neuronal structures or cognitive/computational components could have an important role in lexicon and grammatical systems (ULLMAN 2004:247).

Despite that, declarative and procedural memory systems may interact in different ways: elements selected by the declarative system are maintained in working memory by some cerebral structures of the procedural structure. Analogously, the procedural memory is involved in the maintaining of complex representations in the working memory.

Note that complex structures are built starting from the simplest forms, generated by the combination of lexical elements in declarative memory with grammatical rules in procedural memory (ULLMAN 2004:247).

However, the impairment in one of the two forces the spared system to a more intensive work, and the two systems can actually compete reciprocally.

Consequently, we can have competitive interaction when a lexical representation, derivable also through procedural operations, is instead accessed by the declarative memory, which blocks the application of linguistic rules by the grammar system (e.g. when a verbal irregular form is required, rather than a regular one) (ULLMAN 2004:247).

In this account, an impairment in the declarative system would determine a reinforcement of the procedural system’s capacity to acquire and process. In the same way, an impairment in the procedural system, would force the declarative memory to supply to the lost procedural functions almost partially (ULLMAN 2004:247).
2.1.2 Linguistic impairment as deficit of the declarative/procedural system

ULLMAN (2004) conceives aphasic language impairments as damages in one or both the two memory systems. According to him, the majority of fluent aphasias would mirror impairments in the declarative system (ULLMAN 2004:252-253). This kind of pathologies is determined by damages in left temporal and temporo-parietal regions and presents opposite characteristics with respect to Broca’s aphasics: difficulties in comprehension, almost absent in production; problems in reading, in identifying phonological forms, in processing the meaning of functional words, in conceptual knowledge; difficulties in the expression of grammatical judgments of irregular forms (ULLMAN 2004:253).

Contrarily to that, Broca’s aphasia would reflect a damage in the procedural memory (2004:252). Generally, their production is mainly characterized by the omission of grammatical morphemes, demonstrating that agrammatic difficulties are mainly caused by the usage of regular rather than irregular morphology (2004:252).

Although they achieved a good performance in recognizing and comprehending the meaning of simply words, the recovery of those requires a high computational cost, leading to a widespread omission. In addition to that, the fact that Broca’s aphasia causes motor deficit both in linguistic (e.g. in phonological aspect) and extra-linguistic level (in the execution of specific task) can confirm the idea that this kind of aphasia correspond to a procedural deficit (ULLMAN 2004:256).

This model conceives the cognitive system as a modular organization, in which different cerebral areas are involved in different computational and cognitive functions. Despite that, this procedural/declarative system is claimed to be different from previous theories, since it is incompatible with many of the assumptions made by GRODZINSKY (2000a), particularly with the linguistic functions attributed to the Broca’s area by the TDH.

ULLMAN (2004) did recognize a heterogeneity of cerebral areas, in which an analogous task would be accomplished in different domains. Hence, the Broca’s area can be considered neither the locus of specific syntactic activities (as GRODZINSKY previously proposed), nor the place of general syntactic or grammatical activities. Indeed, the procedural role of this area in the linguistic
operations is analogous and parallel to the role it has in the execution of activities of other domains (e.g. motor sequences).

This model differs even from Fodor (1983), since the neuronal circuits, which are responsible for the procedural memory in Ullman, are actually independent from the various domains in which they are employed. In addition to that, these circuits are involved even in the execution of extra-linguistic functions or at least they are strictly bound to them.

Finally, the DP system is dissimilar from connectionist models. Even hypothesizing that language stems from an interaction of a network of not specifically linguistic cerebral areas, the DP model does not contemplate the existence of associations between the syntactic-lexical domains and the memory systems.

The most important innovation of Ullman consists in the idea that different cerebral areas, despite of being function-specific, should not be considered also domain-specific. Thus, functions or cerebral modules exclusively dedicated to language would not exist in the cognitive system. The consideration of the non-uniqueness of human language would be supported by several observations, from the topographic organization of the cerebral structures (different sub-regions would carry analogous tasks out in different domains) to the hypotheses that the actual human biological structures represent the evolution of structures formerly assigned to different tasks. The opinion that human language constitutes an unique domain simply stems from the little knowledge of its procedures.

Concluding, Ullman attributes the deficit of not fluent aphasias to a weakening of procedural memory which would compromise linguistic operations which depends on it; this would explain the omission of inflected morphemes found in agrammatic production and the difficulties in the interpretation of some syntactic structures.

2.2 Linguistic models of procedural deficits

The hypothesis that agrammatic impairment does not depend on structural loss, but on the weakness of some computational capacities, is claimed by many linguistic theories. However, these theories do not apply the distinction between the memory systems (as Ullman did), and they do not consider aphasia as a
deficit which compromises one general cognitive system (procedural/declarative), but as the expression of an exclusively linguistic damage.

Hence, agrammatic deficits in comprehension patterns would be attributed to a reduction of the procedural resources required for the execution of some linguistic operations. Specifically, agrammatic and not-impaired systems would not differ qualitatively (as Grodzinsky affirmed), since the former would be only characterized by a slower processing.

This prediction has been confirmed by Swinney et al. (1989), who analyzed the priming effect in gap-filling sentences. They observed that the reactivation of the antecedent is not totally absent in agrammatic interpretation, although it occurs 500 milliseconds later than in normal interpretation.

The idea that agrammatic deficit stems from a computational impairment had been suggested by previous models.

Bradley, Garrett & Zurif (1980) explored whether the distinction between the closed and open class vocabulary groups is present in agrammatics.

Their found that closed-class words are dismissed in comprehension, whilst open-class words are substituted in oral production. These results can therefore reveal a parallel deficit in the comprehension. Starting from the assumption that the lexicon would be normally divided into a frequency-sensitive box (which includes the open-class words) and a frequency-insensitive one (containing just the closed-class words), open class words is therefore influenced by frequency in normal subjects, whereas the closed class is clearly insensitive to that (Grodzinsky 1990: 64). Differently from normal subjects, even the close-class word would be sensitive to frequency in agrammatism (1990: 64).

Although Bradley, Garrett & Zurif’s study is important in showing that agrammatic linguistic system is seriously impaired, their theory makes correct predictions only to a certain extent.

Kolk et al. (1985) had hypothesized that the agrammatic receptive deficit mirrored a limitation in the phonological memory. According to these authors, the phrasal comprehension requires the maintaining of different constituents in working phonological memory, from which the syntactic parser gets useful information for the following stages of the interpretation process. However, the agrammatic syntactic parser would be constrained to work with a particularly brief
phonological input due to the reduced capacity of phonological memory, then preventing the normal comprehension of sentences.

2.2.1 HICKOCK & AVRUTIN (1995): the contribute of the reference

Other authors have interpreted agrammatic receptive deficit as the incapacity to implement the information expressed by grammatical morphemes, whose comprehension may appear selectively compromised.

One hypothesis about agrammatic procedural limitations (which would determine a difficulty of implementation at the discourse level) has been represented in the study of HICKOK & AVRUTIN (1995). They noted that agrammatics show more difficulty in the interpretation of the sentences in (1) from in the sentences in (2): (HICKOK & AVRUTIN 1995:19-20)

(1)
   a. Which psychologist attacked the linguist?
   a. Is Mama Bear touching her?

With respect to sentences as:

(2)
   b. Who attacked the linguist?
   b. Is every bear touching her?

HICKOK & AVRUTIN explained these outcomes by considering the semantic property of reference. They found that the referential comprehension would determine a greater computational effort, as demonstrated by the greater difficulty found in the interpretation of the referential interrogative pronoun which with respect to its not-referential correspondent who (HICKOK & AVRUTIN 1995:19-20). The weakening of the computational resources in agrammatism would allow them only the interpretation of not referential linguistic units, whereas elements requiring the implementation of a contextual discursive information would be misunderstood.

2.2.2 AVRUTIN et al. (1999): the interpretation of contrastive stress

Further support to this hypothesis is offered by the experiments of AVRUTIN et al. (1999) on the interpretation of contrastive stress.

The study, realized on eight Broca’s aphasics and five normal subjects, consisted in two experiments: the interpretation of stress represents a decisive factor for the assignment of the pronominal character in the first one. In the
second one, the interpretation of stress provides the distinction between compound words and homophone modified phrases (composed instead by a name and an adjective).

In the first experiment the *stressed condition* has the following structure:

(3) “First John (verb)s Bill and then Mary (verb)s HIM”,

and the *unstressed condition* as in:

(4) First John (verb)s Bill and then MARY (verb)s him.

Sentences of the two conditions are minimal pairs, in which stress is the distinctive indication for the assignment of the correct character. In the sentences of the first type (*stressed condition*), the pronoun *him* refers to the subject NP (John) of the first sentence, whereas in the second type (*unstressed condition*) the pronoun *him* is tied to the NP object (*Bill*):

(5)  
First John hits Bill and then Mary hits HIM. (SC).
First John hits Bill and then MARY hits him (UC).

The comprehension of the sentences was tested by a picture-selection task, and the performance of agrammatics was weaker in either conditions, confirming the general difficulty of these subjects with the interpretation of pronouns. Results showed that the first condition (*stressed condition*) was more difficult than the second one (*unstressed condition*).

Although agrammatics are stress-sensible in normal conditions, they lost the ability to assign pronominal reference in the presence of a contrastive stress.

The second experiment wanted to establish whether the agrammatics’ difficulties in the implementation of stress have to be attributed to a more general interpretative problem, bound to the computation of information at *discourse-level processing*.

Hence, the experiment was composed by sentences as *Show me an X*, in which *X* can be recognized only by the indication of stress. According to data, agrammatics would manifest more sensibility to stress whenever it is the only way to recognize *X* as a compound name, whereas it would not receive enough attention during the recognizing of a modified NP.
To the authors, these outcomes would confirm the processing account proposed by Zurif (1995), in which agrammatics’ deficits were conceived to lie in a reduced processing capacity. The interpretation of unstressed condition would involve the application of a strategy at the discourse level in normal subjects, namely a “parallel function strategy”, which permits the association of the object pronoun with the object NP of the first sentence (Bill).

(6) First John hits Bill; and then MARY hits him.

Conversely, in contrastive stress condition, the pronoun him should be linked to the first NP of the main sentence:

(7) First John hits Bill and then Mary hits HIM.

However, the resolution of pronominal references would be accidental both in stressed and in unstressed conditions in agrammatism. The application of the parallel function strategy needs effectively the assignment of syntactic roles to the elements of the sentence and their maintenance in the working memory, clearly impossible operations in agrammatism.

Indeed, Kolk (1987) explained that syntactic roles would hastily decay in agrammatic linguistic representation. Being prevented from relying on any kind of parallelism in pronominal assignment, they finally would act randomly.

The indication (carried by stress) of a change of reference, would not be decisive for these subjects, since the interpretation of unstressed/stressed condition would be totally arbitrary.

The comprehension of sentences in the second experiment, on the contrary, does not require any synchrony between syntactic and discourse modules, being the indication of stress in the morpho-syntactic level.

Agrammatics would be able to distinguish the passage to another prosodic context, as was found in the interpretation of compound nouns. The worse performance with modified NPs would be due to difficulties with accessing to the lexicon: the necessity to process two memorized lexical units (e.g. hot and dog), instead of only one (hot-dog) would determine a computational increment, which actually does prevent any improvement in the perception of stress. The additional computational cost should explain even the greater difficulty in the
comprehension of pronominal dependences rather than in the processing of reflexive pronouns.

As explained by AVRUTIN et al. (1999), and according to the chomskyan Binding Theory, the antecedent of reflexive pronouns (e.g. as in Is the girl\_i hugging herself\_i?) can be identified only by syntactic criteria, applying the A Principle: *An anaphor is bound in its governing category* (AVRUTIN 1999:12).

Conversely, the interpretation of non-reflexive personal pronouns (e.g. as in Is the girl\_i hugging her\_i?) requires the application of extra-syntactic aspects. However, principle B (*A pronoun is free in its governing category*) does not define which element the pronoun must be attributed to, only stating in which syntactic context the referent of the pronoun cannot be found (AVRUTIN 1999:12). Since the establishment of pronominal reference requires one more general interpretative principle, the consequent computational increment would cause a syntactic deficit.

**2.3 Agrammatic deficit as a delay in building the structure of the sentence**

Many authors have interpreted the deficit in comprehension as the outcome of a delay in building syntactic structure, which would prevent the execution of the linguistic operations in adequate temporal limits to linguistic comprehension.

The reason of this delay has received different explanations. According to SWINNEY et al. (1989) and ZURIF (2003), it would be the outcome of a slowness in the lexical access, causing a delay in the syntactic building.

HAARMANN & KOLK (1991) revealed that a greater slowness in the activation corresponds a high-speed decay. Hence, the agrammatic disorder would depend not only on a delayed activation of lexical units and phrases which constitute the syntactic structure, but also on their rapid decay from the linguistic representation.

PRATHER et al. (1997) (basing on KOLK 1985, 1987 who stated that agrammatic deficit would be determined by a rapid decrement of the syntactic tags from the phonological working memory) claimed that a lexical priming effect would be present only when agrammatics have an extended interval of time for the comprehension process.

More recent theories have attributed this delay to a specific weakness of the syntactic module. One of these hypotheses, known as *Weak syntax* or *Slow-syntax model*, was generated by the observation of comprehension errors in structures
derived by syntactic movement and in the interpretation of pronominal dependencies:

(8)

In light of [these] observations, [...] a generalization suggests itself: agrammatic comprehension fails whenever the underlying syntactic representation is unable to properly constrain the possible interpretations that comprehension system can contemplate for a sentence. In fact, it is only in those cases where correct interpretation depends exclusively on the proper implementation of syntactic structure that agrammatic system predictably fails”.

(BURKHARDT, AVRUTIN, PIÑANGO, RUIGENDJIK 2008:121)

The Slow-syntax model was formulated by PIÑANGO (1999), and has been sustained, among others, by AVRUTIN (2006) and BURKHARDT (2008). The term weak syntax is due to AVRUTIN (2006), whilst slower-than-normal syntax is used by BURKHARDT et. al (2008). The purpose of these hypotheses is to explain the extreme variety of the agrammatic deficits, since all the typologies of sentences are not affected in the same manner.

According to these theories, agrammatics would lose none of the abilities necessary to build the syntactic structure (as hypothesized by models of structural deficit), nor would they suffer from a resource reduction (as models of working memory reduction and hypotheses of slow lexical access proposed). Agrammatic impairment would depend on delayed syntactic operations, preventing the formation of any syntactic structure, which would not be completed in time.

Consequently, they would be forced to choose extra-syntactic principles in the interpretation of the sentence. Thus, their deficit would be observable only when the interpretation of the sentences requires syntactic operations and when the interpretation obtained through extra-linguistic principle does not correspond to the syntactic one.

The majority of experimental evidence which confirms the Slow-syntax model derives from researches on the interpretation of pronominal dependencies.

The Economical Hierarchy of REULAND (2001) states that syntactic operations represent, in normal interpretation, the fastest and the most automatic way to establish pronominal references; on the contrary, agrammatics’ weak syntax would manifest a different economical hierarchy of the interpretative resources:
now the syntactic operations are become the most expensive way to recognize pronominal dependences.

The slowdown of syntactic operations would cause even the forced access to other interpretational levels (e.g. discourse and extra-linguistic steps), normally blocked by the faster activation of syntax, then leading to a different thematic assignment.

Analogously, the agrammatic failure in the interpretation of structures originated from syntactic movement would be explainable as a delayed syntactic process.

Thus, their impairment would not compromise the ability to establish the syntactic chain (as GRODZINSKY predicted), rather it delays the process of sentence construction, which would become excessively slow for linguistic comprehension.

Prevented from using syntactic information, agrammatics would be forced to rely on extra-linguistic principles. The interpretation of moved elements would be therefore affected particularly by competition between the syntactic module and the interpretative rules of discourse, as can be noted in passive sentences: the NP which moves to the first position does not receive a thematic role since its building is particular slow in agrammatics. For that reason, the thematic role would be interpreted with the rule of *topic-preference*, an interpretative principle at the level of the discourse: in the presence of two NPs, the subject would receive the role of theme. However, this assignment would contrast with the role assigned by finally available syntactic process:

(9)

(Theme) *for the application of the topic-preference principle*

The *boy* was pushed by the *girl* (Agent).

(Patient) *for the assignment of the syntactic chain.*

Similar errors have been found in the execution of the same task in pre-scholar children. This convergence has been considered a confirmation that agrammatic impairment cannot be attributed to a structural loss, but to a reduced capacity of processing: otherwise the resemblance with children’s performance cannot be explainable, whose difficulty cannot be certainly attributed to a loss in linguistic
system, but rather to an incomplete development of the procedural capacities which provide the implementation of syntactic information.

2.3.1 The slower-than-normal syntax: linguistic and experimental evidence

This hypothesis predicts that agrammatic deficit in comprehension stems from a specific weakening of the syntactic module, rather than from a loss in the procedural or linguistic system. The model of the slow-syntax assumes that the agrammatic procedural deficit mainly entails a delay of the syntactic processing.

The particular slowness in the execution of the syntactic operations would determine a delay in the construction of the sentence structure, which would prevent agrammatics from utilizing syntactic information in the first phases of the interpretation process.

Contrarily to what happens in normal interpretation, where syntax represents the cheapest and the most economical way, the agrammatic unavailability of syntactic structure causes the use of other linguistic levels (as semantic and discourse level), normally blocked by the syntactic resolution.

The economical hierarchy of agrammatic interpretative resources would be different from that formulated by Reuland for normal subjects, since syntax represents now the most expensive way rather than the most economical. If it were not so, the recourse to extra-syntactic interpretative levels would represent a violation of the economical hierarchy, given that linguistic interpretation has to rely on the most economical ways, which correspond in normal situation to syntactic operations. The computational cost would instead remain unvaried in the following stages of comprehension process.

Although agreeing with this general planning, the formulation of the slow-syntax model diverged in explaining the origin of agrammatic errors. To Burkhardt et al. (2008), agrammatic comprehension would be characterized by a competition between the syntactic and extra-syntactic interpretative routes; thus, interpretation would be determined by which of the two routes prevails on.

Despite the fact that agrammatics could succeed in completing the syntactic construction, this never happens on time to block the activation of extra-syntactic interpretative principles. Once available, the syntactic interpretation would be in contrast with the meaning supplied by the extra-syntactic strategy. The chance-level performance would depend therefore on the outcomes of this competition:
good comprehension would be achieved whenever syntactic operations are applied, otherwise it will result extremely erroneous.

According to Burkhardt et al. (2008), the weakening of the syntactic module does not entail a generic delay, but it would compromise the Merge operation, preventing the formation of the syntactic structure on time. In this view, well comprehended constructions (active sentences and subject relatives) represent cases of structures in which the lack of syntactic information does not constitute an obstacle, since the interpretation suggested by semantic or discourse principles corresponds to the syntactic one.

The hypothesis of the slower-than normal syntax has been confirmed also by experiments on pronominal dependences. Ruigendijk & Avrutin (2003) revealed that in transitive sentences, the minor difficulty in interpreting personal pronouns could be attributed to the lexical properties of the verb, sufficient to exclude any co-referential interpretation.

On-line studies (e.g. Love et al. 1998) has verified the hypothesis of a delayed agrammatic processing, showing their inability to establish syntactic dependences rapidly, even in case of personal pronouns, as occurred with the wrong re-activation of the antecedent.

The hypothesis of an agrammatic deficit in comprehension determined by a delay in the construction of the syntactic structure is adopted also for explaining the failure in the interpretation of sentences not derived by syntactic movement. The hierarchy of economy formulated by Reuland is assumed as an evaluation criterion for the computational cost.

The model of slower-than-normal syntax claims that, in the absence of the syntactic information about thematic roles, agrammatics are constrained rely only on semantic principles and extra-syntactic strategies. Although the recognition of a delay in the syntactic operations could explain several phenomena, how agrammatics may use other interpretative systems to supply the syntactic loss remains unexplored.

The wrong interpretation has been often attributed to the application of extra-syntactic principles. At the same time, in some contexts, it would be impossible to apply interpretative strategies at the discourse level, for the lack of a syntactic structure to which to refer.
Conversely, the hypothesis of slow-syntax predicts that agrammatic procedural deficit is not restricted to the syntactic module, since it would compromise, although secondarily and occasionally, even further interpretative levels.

Concluding, the delay of the syntactic system could provide even the explanation for the agrammatic failure in the comprehension of different structures.

2.4 Conclusions about procedural deficits

The idea that the agrammatic disorder stems from a loss of processing, rather than from the loss of some linguistic knowledge, is the core hypothesis of several linguistic models about the aphasic deficits. This theoretical implant provides the explanation of intra-subjective/extra-subjective variability emerged in the accomplishment of different tasks. Moreover, this model does not imply excessively restricted predictions about patterns of agrammatic failure, as occurred with the grodzinskian theory about the loss of knowledge.

It provides the description and the unitary explanation for observable phenomena in agrammatic comprehension, without suggesting the existence of different damages which would determine difficulties in one or in another syntactic structure.

The agrammatic failure in interpretative tasks would depend on a computational increment which determines an excessive working load for agrammatic procedural capacities; then, the accomplishment of some linguistic operations would result significantly slowed down.

However, models differ in the identification of the slowdown causes. Hypotheses about the slow-lexical access (Swinney & Zurif, 1989) and the rapid decline of the linguistic tags (Kolk, 1987), have the limit to predict wider patterns of failure than those effectively found.

In addition to that, they explained the difficulty neither in comprehension of passives and object relatives, nor in active sentences and in subject relatives clauses. The unavailability of syntactic structure predicted by slow-syntax model offers a more adequate explanation for the fact that the receptive deficit does not arise in all types of sentences, but only in particular structures; in some cases, only determinate specific instances of a construction would be impaired (see the
difference between subject and object relatives). Finally, it is worth to consider agrammatic deficit as a delay in syntactic construction.

2.5 A mapping theory of agrammatic comprehension deficits

The Isomorphic Mapping Hypothesis predicts agrammatic difficulty with not linear ordered sentences (O’GRADY, LEE 2005:91).

It differs from ‘‘canonical order models,’’ elaborated by SCHWARTZ, SAFFRAN, & MARIN (1980), which stated that agrammatics would have difficulty in structures with not linear order, and diverges even from ‘‘trace-based’’ theories by GRODZINSKY (1995, 2000) and from the Double Dependency Hypothesis (DDH) of MAUNER, FROMKIN, & CORNELL (1993), in which traces are preserved, in spite of the disruption of the syntactic chain (O’GRADY, LEE 2005:91).

Sentences with only one dependency would be interpretable unambiguously, whereas two antecedent-trace dependencies would make the representation semantically ambiguous, consequently generating more difficulties (BERETTA, SCHMITT, HALLIWELL, MUNN, CUETOS, KIM 2001:410).

The Isomorphic Mapping Hypothesis (henceforth IMH) states that

(10) “a non-isomorphic mapping between syntactic representations and the corresponding event increases processing difficulty”.

(O’GRADY, LEE 2005:92)

Active clauses present the canonical agent-theme order, being isomorphic with the event, in which an agent makes an action toward the theme:

(11) The child threw the ball  \[ \text{sentence} \]

\[ \text{X acts on Y \ [ \text{event} ]} \]

\[ \text{Agent Theme} \]

whereas passive sentences are non-isomorphic with the event, since the sentence order is not linear (O’GRADY, LEE 2005:92).

(12) The ball was thrown by the child  \[ \text{sentence} \]

\[ \text{X acts on Y \ [ \text{event} ]} \]

\[ \text{Agent Theme} \]
Consequently, the computational cost would increase whenever a non-isomorphic relationship between the surface order and the sequence of the event takes place, leading to an impairment in the process of comprehension. Thus, the IMH conceives agrammatic comprehension disorders as processing deficits that affect syntactic representations.

In the sentence *John threw a ball to Mary* the final argument (the goal Mary) does not cause additional difficulties (O’GRADY, LEE 2005:92):

(13)

```
NP
John
```

```
V
Threw
```

```
NP
a ball
```

X (John) acts on Y (a ball) causing it to go to Z (to Mary)

On the contrary, in a double object dative, such as *John threw Mary a ball*, several problems in the comprehension arise. This sentence has not a linear order, since the second NP is the goal and not the theme; after the agreement between the subject and the verb, the association between the latter and the second argument overwhelms the available resources (O’GRADY, LEE 2005:93).

(14)

```
NP
John
```

```
V
Threw
```

```
NP
Mary
```

X (John) acts on Y (??) causing it to go to Z (to Mary)

The assumption that double object constructions should be more difficult to comprehend than dative sentences is shared with canonical order models, trace-based theories. Regarding passive constructions, the three theories make the same predictions, that is passives would be more difficult than active sentences because of the non-isomorphic mapping in IMH, for non-basic theme-agent order in canonical order theories, for NP-trace relations to traces-based accounts (O’GRADY, LEE 2005:93).
**IMH theory** ascribes the greater difficulty in relative clauses and cleft sentences to the non-canonical word order, in addition to the presence of two trace-antecedent dependencies (O’GRADY, LEE 2005:93).

Finally the following table reassumes the different sentence’s patterns:

(15)

<table>
<thead>
<tr>
<th>Subject relative:</th>
<th>Isomorphic sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>the boy, [that [IP t₁ [VP t₂ pushed the girl]]] Agent theme</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direct object relative:</th>
<th>Non-Isomorphic sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>The boy, [that [IP the girl, [VP t₂ pushed t₁]]] Theme Agent</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subject cleft:</th>
<th>Isomorphic sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>It was the boy, [that [IP t₁ [VP t₂ pushed the girl]]] Agent Theme</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direct object cleft:</th>
<th>Non-Isomorphic sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>It was the boy, [ that [IP the girl, [VP t₂ pushed t₁]]] Theme Agent</td>
<td></td>
</tr>
</tbody>
</table>

Concluding, IHM claims that agrammatic comprehension is affected whenever a NP cannot be associated with the corresponding slot in the event representation. In this view, agrammatic computational system would be intact, but it would suffer from a reduction of resources, being impaired in case of a divergence between a sentence’s structure and the linearity of event (O’GRADY, LEE 2005:99).

**2.6 CAPLAN (2006) and aphasic deficits in syntactic processing**

Performance and reaction time in syntactic comprehension of forty-two aphasic patients has been tested in off-line modality and in end-of-sentence, sentence-picture matching, grammaticality judgment tasks. Agrammatic ability to compute syntactic process in active and passive sentences, in subject and object relatives, in matched sentences with and without reflexives pronouns was investigated. Data clearly showed that agrammatics have several problems in complex sentences, demonstrating an intermittent reduction of their processing resources (CAPLAN 2006:800).

Hence, agrammatic subjects cannot be influenced by a single syntactic operation, otherwise they would perform in a similar way. To verify this pattern (namely whether agrammatics have deficits in specific operations) two
comprehension tasks were used (sentence picture matching and object manipulation) (CAPLAN 2006:801).

Agrammatic performance has been evaluated at poor level if their accuracy was lower with respect to the control group, if their time of reaction was longer with respect to the control group, if they presented a below chance performance. Two subjects showed an independent deficit from the task used, localized in passives (one subject) and in object extracted structures (the other patient), with an additional deficit in another task. Thirty-one presented a single structural deficit on one task only. Outcomes show that the presence of an agrammatic deficit affecting only one structure is very rare, if not absent at all. Specific syntactic deficits are not confirmed either (CAPLAN 2006:801).

In this account, resource reduction can be one possible source of agrammatic deficit, as demonstrated by the fact that patients with lower performance are more impaired in sentences which generally are more difficult. Specifically, the capacity of compute featural aspects of the cognitive architecture would be reduced, affecting further stages of the interpretative process.

Data evidence an individual deficit, but not a specific syntactic one, since patients showed good performances with the same structure in another task, and display the capacity to understand the same meaning in different structures.

There are two potential explanations: there can be a specific impairment in structures in which syntactic operations are needed to accomplish the sentence meaning and succeed the required task (CAPLAN 2006:802). CAPLAN affirms that “Deficits may arise in the ability to accomplish the combination of the demands of parsing, interpretation and task performance” (2006:802). A structure-specific deficit would be conceived syntactically as an impairment in several structures and psycho-linguistically as a reduction in parsing and interpretation capacities (2006:803).

Moreover, CAPLAN claims that “Task-specific construction-specific deficits might be “explained” as deficits in structures and operations identified in theories of syntactic structure, parsing and interpretation, and task performance”.

The other explanation argues that no specific deficit exists. In this view, performance is due to 1) the level of demand exerted by different sentence types in different tasks; 2) the degree of resource reduction in each patient; and 3) random noise (CAPLAN 2006:803).
Several data show that the agrammatic performance may depend on the task used. In this view, resource reduction is the responsible for structure-specific and task-specific deficits. Caplan concludes by saying that “Various ways of analyzing the data lead to the conclusion that resource reduction is the major – perhaps the only – determinant of performance” (2006:803).

2.7 Caplan et al. (2007) and the syntactic processing in aphasia

This study takes into exam the two most important explanations for agrammatic deficit in semantically reversible sentences and in syntactically complex sentences. The first one argues that agrammatic subjects have lost or cannot use the ability to compute more complex sentences; among other the studies of Grodzinsky and the formulation of the TDH have to be signaled (1986, 1989, 1990, 1995, 2000) (Caplan et al. 2007:104). Other theories regarding agrammatic impairment have been proposed by Beretta (2001); Beretta, Harford, Patterson & Piñango, (1996, 1999); Mauner (1995); Mauner, Fromkin & Cornell (1993) (Caplan et al. 2007:106).

Briefly, the TDH assumes that agrammatics have difficulty with the computation of traces, in sentences as object relativized structures, passives and “raising” sentences (Drai & Grodzinsky, 1999; Drai, Grodzinsky & Zurif, 2001; Grodzinsky, 2000; Grodzinsky & Finkel, 1998), and their deficit is exclusively syntactic. However, as it has been pointed out, this hypothesis has not been completely confirmed by experimental data (Caplan et al. 2007:105).

Moreover, several studies do not validate the assumption that syntactic deficits in computing traces are limited to sentences that contain them.

In effect, agrammatic poor performance in sentences with traces could be due to a resource reduction (Caplan & Hildebrandt 1988; Hildebrandt et al. 1987). Finally, TDH has been re-formulated by saying that it is limited to a subset of agrammatic patients, being valid exclusively for Broca’s aphasics (Caplan et al. 2007:105).

Conversely, the second type of theories sustains that these subjects are not able to accomplish computational operations required in the assignment of structure and meaning, for the reduction of available resources (2007:104).

There are several arguments which may confirm that agrammatic deficit stems from resource reduction.
CAPLAN & HILDEBRANDT (1988), HILDEBRANDT et al. (1987) found that comprehension is good in simpler sentences, whereas it rapidly declines in more complex structures. In addition to that, JUST & CARPENTER (1992) revealed that patients’ performance is more affected in complex than in computational simple sentences (2007:106).

Several experimental manipulations (concurrent load, increased speed of stimulus presentation, perceptual degradation or masking of input) may influence the performance of normal subjects, then resembling a reduction of available resources (2007:106).

CAPLAN & HILDEBRANDT (1988) claims that agrammatics would be affected by an association of specific deficit and resource reduction impairment. According to the mapping hypothesis formulated by LINEBARGER et al. (1983), patients would succeed in grammaticality judgments but not in sentence-picture matching, being affected by a deficit in assigning syntactic thematic roles.

The mapping hypothesis conceives a deficit in several syntactic aspects rather than in a single one (CAPLAN et al. 2007:107).

In later work, they affirmed that “the asyntactic comprehension pattern [may] simply [be] the result of selectively weakening syntactic input to a dynamic system in which other components continue to operate much as they normally do” (SAFFRAN et al., 1998), then agreeing with resources limitations.

In addition to that, there are other accounts that conceive resource reduction as an impairment in cognitive processes, for example stemming from reductions in verbal working memory (CAPLAN et al. 2007:108). Although it has not been confirmed that working memory is directly involved in syntactic processing, reductions in this mechanism (also in phonological store/rehearsal and short-term semantic systems) could generate comprehension disorders (difficulties with the re-assigning of meanings and with the elaboration of meanings derived from the comprehension process have been found) (CAPLAN et al. 2007:108).

These deficits may influence aphasic performance, since they combine with other specific impairments, for example a delayed processing (caused by slowed activation or fast decay of syntactic representations) (CAPLAN et al. 2007:108).

Hence, agrammatic impairment has been attributed to a specifically syntactic deficit or a reduced processing capacities which would impede the computation of all the operations required by more complex structures. The only certain result is
that agrammatic performance in one and the same sentence depends on the test typology that has been used (CAPLAN et al. 2007:108).

Accuracy, reaction time, and other task variables mirrored the increment of psycholinguistic load contained in more complex sentences, corroborating the assumption that object relatives are more difficult to compute than subject relatives.

The higher computational cost would stem from the verb of the object relative, analogously to the verb of passive sentences which requires more resources with respect to that of active sentences. Another complex operation would be the inferring of the agent in a truncated passive (CAPLAN et al 2007:145).

Interestingly, patients who performed very poorly on off-line accuracy measures (with longer reaction times), showed the opposite result in on-line tasks, demonstrating that syntactic structures can occasionally be built on-line.

Hence, the origin of their deficit would lie in on-line operations, in an intermittent functioning of the parsing/interpretive mechanism because of resource reduction (CAPLAN et al. 2007:145). This mechanism seems to fails more frequently in sentences which require an higher computational cost (CAPLAN et al. 2007:146). This study evidences that:

(16)

“...when performance is measured on several instances of particular constructions in each of several tasks using different performance measures, deficits affecting the ability to perform particular operations appear to be rare, leaving the level of overall proficiency as the major determinant of performance”. (CAPLAN et al 2007:147)

Being the agrammatic comprehension’s level generally lower than in normal subjects, even this can be attributed to resource reduction.

However, the notion of processing resources is not completely explainable. Problems rise from the fact that several theoretical models of resources exist, in which the operations and the typology of reduction are conceived differently (CAPLAN et al 2007:147).

Moreover, CAPLAN argues:

(17)

“we can ask whether it is possible to ascribe an overall reduction in the ability to process sentences to abnormalities in particular processes. One possibility is that [...] variability in resource availability is in reality
variability in the number and type of specific deficits in different patients

[…] the analyses of deficits in single cases presented here make this possibility unlikely; there is evidence that specific deficits are extremely rare”. (2007:147)

Hence, the slower speed of activation or the rapid decay of syntactic representations may lead to a reduction in processing resources, deeply influencing the construction of more complex structures (CAPLAN 2007:148).

Two facts have to be noted: first, the concept of processing resources refers to various cognitive levels (operational, formal computational, and neurological).

Second, on-line data indicate that there is an intermittent functioning of available resources, causing errors in the comprehension process; that is when the computational cost overpass a certain limit, the entire system collapses (CAPLAN et al. 2007:148). Concluding, we can say that agrammatic performance is deeply characterized by this variability.

Patients suffer from an intermittent resources reductions, being occasionally prevented from assigning roles and interpreting sentences on-line. More interestingly, these reductions are predicted to vary in severity and frequency of occurrence from one subject to another (CAPLAN et al. 2007:148).

Conclusions

In this chapter we have seen most of theories and hypotheses regarding agrammatic comprehension, showing that they are divided into two main lines of researches: those which conceive agrammatic impairment as a total deletion of computational abilities and those which predict a partial reduction of their processing capacities. Nevertheless, the nature of agrammatic difficulties in comprehension has to be understood yet.

Indeed, several studies do not validate the hypotheses of an exclusive syntactic deficit in computing traces, since agrammatic poor performance could be due to a processing resource reduction.

Resource reduction can be one possible source of the agrammatic deficit, as demonstrated by the fact that patients with lower performance are more impaired in sentence types which generally are more difficult. It can be said that the typology of the reduced resources belongs to the featural aspects of the cognitive architecture, which provide/affect further phases and interpretative levels.
In this account, although agrammatics would succeed in completing the syntactic construction, this never happens on time, and extra-syntactic interpretative principles occurred in the process of comprehension, finally interfering with syntactic interpretation.

As to resource reduction, Caplan (2006, 2007) offered an interesting explanation of agrammatic performance, by arguing that patients would suffer from an intermittent resource reductions. Hence, being occasionally prevented, these reductions might vary in severity and frequency from one subject to another, leading to an unpredictable performance.

Indeed, data evidence individual deficits, but not a specific syntactic one, since patients showed good performance with the same structure in another task, and display the capacity to understand the same meaning in different structures.
CHAPTER 3  
*Theoretical Framework*

**PART 1**  
*Number features in agrammatism and in other language disorders*

**Introduction**  
This chapter has been divided into three parts, in order to exemplify the structure of the arguments examined.

This first part will present the most important studies regarding the number feature, the discussion about its status and position, and the differences with the gender feature. In addition to that, I will report the influence of number features in other language impaired populations, namely in SLI and hearing-impaired children.

The second part of the chapter will deal with relative clauses, their properties and theories about their formation. Moreover, some linguistic and psycholinguistic studies will be briefly described, regarding the comprehension of this typology of sentences in agrammatism and in other language disorders.

In the third part, the principle of object attraction over the subject-verb agreement will be described and discussed, useful for the interpretation of agrammatic performance.

**3.1 The Number Phrase**  
The status of Gender and Number has been widely discussed in recent years. It is still debated whether only Number projects its own syntactic head (Ritter, 1995; Di Domenico, 1997; De Vincenzi & Di Domenico, 1999) or even Gender owns a specific syntactic projection (Piccallo, 1991, 2001, 2007; Ferrari, 2005; Lampitelli, 2008).

Given that NPs are complements to the head of a Determiner Phrase, and hypothesizing a subject-noun-object order for DPs in Hebrew, Ritter (1991:38-39) elaborates a N to D movement to account for the different order of construct-state genitives, as in:

(1) ahavat dan et ijt-o  
*Hebrew*  
love Dan ACC wife-his  
‘Dan’s love of his wife’
In Hebrew, deverbal nouns show a non-canonical NSO order (instead of SNO). This structure would originate from the head movement of the object *ahavat* “love” to the left of the subject *dan* ‘Dan’ in order to receive case (Ritter 1991:39). The head movement is required since in the construct state a definite determiner cannot be placed at the beginning of the sentence (there is a D assigning GEN (D_{GEN}) not visible overtly). In addition to that, the head noun would undergo a morphological change in order to make this D_{GEN} visible:

\[
\begin{align*}
\text{(2)} & \quad \text{DP} \\
& \quad \text{DET} \quad \text{NP} \\
& \quad \text{ahavat} \quad \text{‘love’} \\
& \quad \text{DP} \quad \text{Dan} \\
& \quad \text{DP} \quad \text{et jft-o} \\
& \quad \text{‘Acc wife-his’}
\end{align*}
\]

Despite the fact that the free genitive has the same NSO order of construct-state, it actually allows a definite determiner in initial position. Hence, it would show an overt case marker of genitive which would be introduced by *ʃel* ‘of’. However, even in this case the head noun precedes the genitive, forcing us to hypothesize an additional projection to account for this position, as in (3) (Ritter 1992:197-218):

\[
\begin{align*}
\text{(3) ha-axila} & \quad \text{ha-menumeset} \quad \text{ʃel dan} & \quad \text{et} & \quad \text{ha-uga} & \quad \text{Hebrew} \\
& \quad \text{the-eating} & \quad \text{the-polite} & \quad \text{of Dan} & \quad \text{ACC} & \quad \text{the-cake} \\
& \quad \text{“Dan’s polite eating of the cake”}
\end{align*}
\]

In this sentence, the free genitive *axila*, with the definite determiner *ha-*, is located at the beginning, while the genitive marker *ʃel* ‘of’ is overtly present in the construction and is close to the subject *dan* ‘Dan’, and the adjective *menumeset* ‘polite’ is dislocated to the left of the subject. However, in the case of free genitives, the NP *axila* cannot be assumed to move to D, since this position (specDP) is already occupied by the definite article *ha*. Hence, it has to move to a somewhat lower projection. The assumed structure is the following:
The projection between NP and DP is claimed to be the Number phrase. Being Number inflectional on nouns, it requires head movement; conversely, being Gender derivational, it is affixed in the lexicon. The different status of Number and Gender will be discussed in the next section.

3.2 Number and Gender

Ritter (1995) suggested that the number projection merges differently from gender. Starting from the assumption that Number is a syntactic suffix and Gender suffixes belong to the lexicon (Ritter 1995: 409), she predicts that, not only NumP would be placed higher than NP, but also it would carry the semantic gender, whereas grammatical gender would be hosted in N, as part of the lexical entry (Ritter 1995: 409-413).

Hence, Gender has to be hosted in a lexical suffix merged on the lexical head to be represented in Hebrew, whereas the noun phrase bears the plural denotation only when the number suffix heads a distinct functional head (Ritter 1995:418).

More specifically, Gender appears only on suffixes merged on the lexical head during the sentence implementation, whereas Number is encoded on suffixes attached to the noun after the head movement.

Hence, in Hebrew the gender affixes would be located in the head of NP, whereas the number affixes are placed in the head of NumP (1995:417-418).
Differently from DPs, pronouns lack the NP projection, thus Gender and Number are merged together in unique projection (Ritter 1995:418):

(5)

a. Pronouns

\[
\begin{array}{c}
\text{NP} \\
\text{[gender]}
\end{array}
\]

b. Noun phrases

\[
\begin{array}{c}
\text{DP} \\
\text{[definiteness]}
\end{array}
\]

In this account, Number is represented as a syntactic projection, separated from the lexicon, which can sometimes host semantic gender. Conversely, Gender is not autonomous and it is encoded either with the noun (grammatical gender) or with number (semantic gender) (Ritter 1995:422).

Di Domenico (1997) agrees with Ritter (1991,1993) claiming that Number heads its own functional projection. Analogously, she differentiates two kinds of gender: semantic and grammatical gender. The former would be placed in the Num head, whereas the latter would merge in the lexical head N (Adani et al. 2010:2154). If gender has semantic value, as in *ragazza “girl”* (which has the masculine counterpart *ragazzo “boy”*), the feature is represented in the lexicon (2010:2154).

On the contrary, when gender belongs to the lexicon (grammatical gender), as in *sedia “chair.FEM”*, it does not bear semantic content, and has no masculine form (*sedio*).

The following table sums up what was said above:

(6) NOUN Semantic Content Productively(masculine form)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>ragazza “girl”</td>
<td>+</td>
</tr>
<tr>
<td>b</td>
<td>donna “woman”</td>
<td>+</td>
</tr>
<tr>
<td>c</td>
<td>sedia “chair”</td>
<td>_</td>
</tr>
</tbody>
</table>
Although being all singular and feminine nouns, only *ragazza* has a masculine counterpart *ragazzo* “boy”, since *ragazza* bears semantic gender.

Despite that, all of these nouns have a plural form; it follows that Number has to own a specific projection.

Conversely, Gender is not a syntactic head and it has to be located in other projections. For that reason, RITTER (1995) suggested that Gender is always projected with Number in Romance languages, whereas in Hebrew, Gender is hosted in N.

Summing up, DI DOMENICO argues that semantic gender is analyzed via a syntactic operation, as happens for Number, whereas grammatical gender belongs to the lexicon, compulsorily placed in the lexical entry (ADANI et al. 2010:2154).

Similarly, Gender and Number are claimed to have different properties in CHOMSKY (1995); whereas gender would be an intrinsic feature of the noun, Number would be derived and selected by the operation of Numeration (ADANI 2010:2151).

Number and Gender would differ even semantically, since they contribute in a different way to the interpretation of the noun (2010:2152).

(7) “Whereas Number signals that a set of entities has cardinality, Gender is largely arbitrary. In turn, Gender values are not always predictable on the basis of some semantic feature property of the noun” (ADANI 2010:2154).

### 3.3 Gender and Number in FERRARI (2005)

In FERRARI’s (2005) account, not only Number, but also Gender is a syntactic phenomenon, since gender can label a lexical item as a noun (FERRARI 2005:126).

First of all, is it shown how a root can be recognized as a noun, thanks to the feature [n], originated by the union of Gender and N. Since Gender requires agreement, it is an inflectional feature, hence it must project a syntactic head.

A masculine noun would be marked only by the feature [n], whereas feminine nouns would be further signaled by another feature, labeled as [f], projected under fP. Since the feminine nouns’ resulting structure is more complex, feminine nouns are the marked case (2005:127). She wrote: “*marked nouns have more layers of structure than unmarked ones*” (2005:230).
Note that this hypothesis has already appeared in HARRIS (1999) as well as in HARLEY & RITTER (2002), who claimed that feminine gender is the marked feature whereas masculine is the unmarked one.

Hence, masculine and feminine nouns would be represented as follows (FERRARI 2005:230):

(8)

a. /√+n/= [stem (n)] libr- ø fior-e
   b. /√+n/+f/= [stem (n f)] cas-ø

Masculine is characterized only by [n], and <ø> and <e> are cases of morphological and phono-logical epenthesis, respectively, and are possible expression of unmarkedness (FERRARI 2005:230).

Feminine is marked by [[n]+f], in which the ending vowel [a] is the morpheme of the feminine singular, representing the feature [f].

Finally, Move would participate in the derivation, since the left position of the gender feature does not correspond to that of the output (2005:231).

The derivation of a feminine noun endings in /a/, such as casa “house” is the following (2005:231):

(9)

Lexical representation  [√cas+n]f
Merger of [√cas (n)]P with n > [nP [n [cas (n)P]]]
Merger of f with [nP [n [casa (n)P]]] > [fP [f-a [nP [n [cas(n)P]]]]]
Move of L(n)P to spec of fP > [fP ![cas(n)P]][f-a[nP[n [t_i]]]]
Spell-out [fP [cas(n)P][f-a [nP]]]

Hence, if no additional n-features are merged in the construction, the outcome will be a simple masculine stem. On the contrary, if the morpheme /a/ (carrying the feature [f]) will merge, the result is a feminine/marked noun (FERRARI 2005:232).

The plural of masculine nouns is formed by a merge of the feature Number, which is realized as the plural morpheme [i] (2005:226).

Thus masculine plural nouns are formed by:

(10a)

[[n]+Num], (/√+n/+p[l][i]/ = libr-i).
The plural derivation is the following (2005:227):

(10b)

[XP… [nP [n [tavol (n)P)]]]

Merge of NUM
[NumP[ Num –i [XP… [nP [n [tavol (n)P)]]]]

Move of nP
[NumP [nP [n [tavol (n)P), Num – i [XP [ti]]]]]

The merge of the Num projection makes the appearance of the singular morpheme impossible; in nouns ending in -e, the merge of the Num projection blocks even the lowering of the morpheme of the plural [-i]:

(11)

[XP… [nP [n [sapon+/i/ (n)P)]]]

Merge of NUM
[NumP[ Num –i [XP… [nP [n [sapon+i (n)P)]]]]

Move of nP
[NumP [nP [n [sapon+i (n)P), Num – i [XP [ti]]]]]

In masculine nouns ending in [a], the plural is not formed by simply adding the Num projection, but it pluralizes as poet-i “poets”, since the vowel /a/ is part of the n-stem (FERRARI 2005:228).

Feminine plural nouns are characterized by [[[n]+f]+Num], and the feminine morpheme for the plural [e] (the morpheme[i] is for feminine nouns ending in /e/) stems from the union of [a] and [i]:

An example of plural feminine noun endings in [a] (2005:233):

(12)

[Num i […]XP [fP [[cas(n)P],[f-a [nP[n [ti]]]]
[NumP [fP [[cas(n)P],[f-a [nP[n [ti]]]]][Num i […]XP [ti]]

PF Fusion of a and i > [e]

Concluding, in Ferrari’s account the Number projection is argued to merge only in the plural features, not in the singular.

Similar assumptions regarding the role of Gender are made by Picallo (2005). She argues that Gender hosts a syntactic projection, naming ClassP.

However the independent projections of ClassP and Number are strictly interconnected, since they depend on each other. Indeed, the number feature cannot be realized if the gender of the lexical item has not been classified.
3.4 Gender status

The relationship between Number and Gender has been underlined since the considerations of GREENBERG (1967) about the linguistic universals regarding number and gender features (ADANI et al. 2010:2151):

(13)

Universal 32: Whenever the verb agrees with a nominal subject or object in gender it also agrees in number.

Universal 36: If a language has the category of gender, it always has the category of number.

Universal 37: A language never has more gender categories in non-singular numbers than in the singular.

Universal 45: If there are any gender distinctions in the plural of the pronoun, there are some gender distinctions in the singular also.

The role of Number and Gender has been investigated by Nicol (1988). This study revealed a priming effect for the number feature with respect to the gender track in paired sentences differing only for the gender or number features of personal pronoun. The lexical referents of the pronoun can be recognized thanks to the differences in number and gender. The following sentences show the experimental condition (VOLPATO 2010:29-30):

(14) The landlord told the janitors that the fireman with the gas-mask would protect him if it became necessary.

The landlord told the janitors that the fireman with the gas-mask would protect them if it became necessary.

The ballerina told the skier that the doctor would blame him for the injury.

The ballerina told the skier that the doctor would blame her for the injury.

Outcomes revealed that the recovery of the appropriate antecedent takes place earlier when subjects can use the number feature as a morphosyntactic cue.

Instead of that, the status and the role of Gender has not been identified definitively. Indeed, some authors (such as PICALLO, 1991, 2008) theorize the
existence of a functional projection also for Gender, whereas Bernstein (2001), Diodomenico (1997) and Ritter (1993) contrasted this hypothesis.

Ritter (1993) claims that Gender is realized directly on one functional head of the NP structure and that it does not have its own projection. In this view, the typology of the head that hosts gender would vary from one language to another: Gender is hosted in Num in Romance language, whereas it would be placed in N in Hebrew (Adani 2010:2153). Indeed, in Hebrew, neologisms can be coined by gender switching and several nouns can be formed simply by adding feminine suffixes to the same stem (2010:2153-2154):

(15)

<table>
<thead>
<tr>
<th>Masculine nouns</th>
<th>Feminine nouns</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxsan</td>
<td>maxsan-it</td>
</tr>
<tr>
<td>warehouse-M</td>
<td>magazine-F</td>
</tr>
<tr>
<td>amud</td>
<td>amud-a</td>
</tr>
<tr>
<td>page-M</td>
<td>column-F</td>
</tr>
</tbody>
</table>

(16)

<table>
<thead>
<tr>
<th>Masculine</th>
<th>Feminine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muchacho Boy-M</td>
<td>Muchacha Girl-F</td>
</tr>
<tr>
<td>Jefe Chief-M</td>
<td>Jefa Chief-F</td>
</tr>
<tr>
<td>Cerezo Cherry tree-M</td>
<td>Cereza Cherry-F</td>
</tr>
<tr>
<td>Manzano Apple tree-M</td>
<td>Manzana Apple-F</td>
</tr>
<tr>
<td>Paso Step-M</td>
<td>Pasa Raisin-F</td>
</tr>
</tbody>
</table>

On the contrary, gender switching in Spanish is active only with nouns having human or animate reference:
All these studies share the prediction that Number has its own functional projection and that it has a higher position that gender in the syntactic tree:

(17) \[ [_{\text{Num}} D [_{\text{Num}} \text{NumP} [_{\text{Num}} \text{NP} [_{\text{Num}} N]]]] \] (ADANI et al. 2010:2152)

In PICALLO (2008) Gender is thought as a syntactic operation, consequently having an influence on the interpretative process.

If it were not so, clitics (such as the Catalan clitic *la “the.F”) would be interpreted as free morphemes (like determiners), instead of being considered bound to the context (ADANI et al. 2010:2153):

(18)

Quan un venedor te´ una calaixera, *la /el*-i /ho-en ven.
When a seller-M has a drawer chest-F it-F,SG /it-M,SG /it-Neut sells.
When a seller has a drawer chest, he sells it.

To PICALLO (2008), the correct interpretation of the clitic would constitute evidence of the gender’s function and relevance. Hence, this feature is called [Class] since it defines the class of the noun, and it would belong to a syntactic projection (c) above N:

(19) \[ [c [\text{Class}] N] \] (PICALLO 2008:50)

ADANI et al. wrote: “c merges with a lexical N complement that enters the numeration fully inflected. At the syntactic component, the feature [class] selects and probes N” (2010:2153). Gender has a projection placed lower than number in the syntactic tree. Indeed, gender cues are less important in the processing of a sentence (2010:2162), as DE VINCENZI & DI DOMENICO (1999), CARMINATI (2005) have already found.

Three factors are claimed to be responsible for that asymmetry: Gender is lower than number in the syntactic tree; Number is an independent syntactical node, whereas Gender is not autonomous and it is accessed later in the comprehension process; Gender is semantically more salient than Number (ADANI et al. 2010:2162).
3.5 Number in Italian and the differences with Gender

In Italian the number feature allows to distinguish ambiguous sentences, since it merges on verbal morphology. Moreover, the verb and the subject share the same number features, thus in the presence of transitive verbs this morphological cue simplifies the distinction between the DP which agrees with the verb (the subject) and the DP which does not share the same number feature (the object). This feature allows therefore the correct computation of sentences that can be either subject or object relatives (VOLPATO 2010:27):

(20)
Il bambinoᵢ [che <il bambino> baciaᵢ i nonni]
The childᵢ [that <the child> kissesᵢ the grandfathers]

I bambiniᵢ [che <i bambini> bacianoᵢ il nonno]
The childrenᵢ [that <the children> kissᵢ3 PLᵢ the grandfather]

Il bambino [che bacianoᵢ i nonniᵢ <il bambino>]
The child [that kissᵢ3PLᵢ the grandfathersᵢ <the child>]
The child that the grandfathers kiss

I bambini [che baciaᵢ il nonnoᵢ <i bambini>]
The children [that kissᵢ3SGᵢ the grandfatherᵢ <the children>]
The children that the grandfather kisses (VOLPATO 2010:28)

For Italian DE VINCENZI & DI DOMENICO (1999) replicated NICOL’s experiment, investigating the reaction to number feature with respect to Gender (VOLPATO 2010:30). Given the following experimental sentences:

(21)
Lo sposo disse agli alunni che il vecchio generale in pensione voleva salutare lui quanto prima.
“The bridegroom told the pupils that the old retired general wanted to greet him as soon as possible”.

Lo sposo disse agli alunni che il vecchio generale in pensione voleva salutare loro quanto prima.
“The bridegroom told the pupils that the old retired general wanted to greet them as soon as possible”.

69
The uncle told the doctorand(F) that the engineer known during vacation could receive her in the afternoon".

Outcomes confirmed NICOL’s findings that Number is an essential feature for the comprehension of the ambiguous reference, since only Number makes the interpretative process faster. On the contrary, Gender is not accessed from the beginning of the interpretative process.

Again, the importance of the number feature would originate from its own syntactic head, whilst gender would be devoid thereof (VOLPATO 2010:32).

CARMINATI (2005) follows the line of DE VINCENZI & DI DOMENICO (1999), and investigates the effect of Number and Gender features in the interpretative process of the null subject pronoun in Italian sentences (ADANI et al. 2010:2155):

(22)
Quando Maria lo cerca, diventa ansioso.
When Maria-F him-M-looks for, pro becomes anxious-M
‘When Maria looks for him, he becomes anxious’

Quando i Rossi lo cercano, diventa ansioso.
When the Rossis-PL him(SG)-look for, pro becomes anxious (SG).
‘When the Rossis look for him, he becomes anxious’.

Outcomes revealed that the interpretative process of pro and the recovery of its correct referent is faster when “the pronoun is disambiguated by Number rather than when it is disambiguated by Gender” (ADANI 2010:2155).

Concluding, DE VINCENZI & DI DOMENICO 1999 and CARMINATI 2005 proposed that Number has its own functional head, placed higher than Gender, and that for this reason Number feature is accessed faster by the human parser in the comprehension process.
3.6 Number in language impaired populations

Following the proposal of Friedmann, Belletti, Rizzi (2009), Adani et al. (2010) claimed that Relativized Minimality is a consequence of the lexical restriction. They tested whether the comprehension of center-embedded object relatives in Italian typically-developing (henceforth, TD) children is influenced by the manipulation of number features. Results show that even the performance of normal subjects can be conditioned by inflectional features.

Specifically, they found that the mismatch condition of number features facilitates the comprehension of object relative clauses.

Thus, the projection of Number, realized only in condition of plural features (following Ferrari 2005), would exert its influence even in normal subjects. Conversely, intervention would increase its effects in sentences displaying match number features.

Although NumP is important in normal subjects (in whom the mismatch configurations improve the comprehension of thematic roles), hearing impaired (henceforth, HI) children do not seem sensible to this syntactic feature. Several studies (see Volpato 2010) showed that the mismatched Number (especially SING-PLUR condition with plural agreement on the embedded clause) is more complex to process for HI children. Hence, marked number features could be inaccessible or underspecified in these subjects.

Following Chesi (2006) and Chinellato (2004), Volpato (2010) hypothesized that in a SING-PLUR sentence, such as:

(23)
La gallina che i pulcini beccano
the hen that the chicks peck
DP_o[-pl] DP_s[+pl] V[+pl]

Plural features are not computed, causing the deletion of the plural morpheme -no:

(24)
La gallina che i pulcini beccano
the hen that the chicks peck
DP_o[-pl] DP_s[+pl] V[-pl]

In addition to the underspecification of the plural morpheme, Kayne (1989) claimed that a unmarked head [-pl] can attract a verb bearing unmarked features:
(25)  
La gallina che i pulcini becca(no)  
DPO[-pl]  DPS[+pl]  V[-pl]  
SG  PL  SG  

In this account, the object *la gallina* “the hen” would agree with the verb, which actually carries the same unmarked number feature (due to the underspecification of the plural morpheme –no), regardless of the thematic roles. Consequently, the embedded subject would be computed as the DP object of the sentence.

Hence, a wrong agreement between the object and the verb occurred, leading to the selection of the incorrect agent of the action (Volpato 2010:139).

An analogous attraction effect would occur in SING-SING condition, since the unmarked DP object enters in an erroneous agreement with the verb (which carries the same number features). In this case, the DP subject is interpreted as the topicalized object of the sentence (2010:140):

(26)  
La gallina che il pulcino becca  

The situation radically changes in sentences with marked object (PLUR-SING, PLUR-PLUR), since it cannot attract the embedded verb (Kayne 1989). In PLUR-PLUR condition, the underspecified plural feature of the verb is deleted from the representation and does not enter in agreement with the marked object:

(27)  
Le galline che i pulcini becca(no)  

Since the object-verb agreement cannot be established, hearing-impaired children have to rely on the further subject-verb relation (the Spec-Head configuration) to compute the thematic roles of the sentence, regardless of the mismatch number features between the subject and the verb (Volpato 2010:141):

(28)  
Le galline che i pulcini becca(no)  
Spec/head  

A similar strategy is applied in the PLUR-SING sentences:
(29)
Le galline che il pulcino becca
The hens that the chick pecks
DPO[+pl] DPS[-pl] V[-pl]

Even in this case, the agreement between the object and the verb cannot take place, since the verb carries singular features.

(30)
Le galline che il pulcino becca

Hence, hearing impaired children have to rely on the spec-head agreement, in this case even stronger, since the subject and the verb share the same number features (VOLPATO 2010:141).

(31)
Le galline che il pulcino becca

Conversely, hearing participants better performed in sentences with mismatch number features (SING-PLUR; PLUR-SING), with the best performance in the SING-PLUR condition, demonstrating that marked number features are important in the comprehension of thematic roles, as RITTER (1995), DI DOMENICO (1997), DE VINCENZI & DI DOMENICO (1999), CARMINATI (2005), ADANI (2008), VOLPATO (2008) found.

In SING-PLUR condition, the disjointness given by the presence of two close plurals and by the Number projection (in the plural embedded subject), best facilitates the identification of the thematic roles with respect to PLUR-SING sentences, in which only one element carries plural features (VOLPATO 2010:143-144). VOLPATO wrote: “In a disjunction situation, the rich configuration of agreement and the salience of Number features favor the correct interpretation of thematic roles”. (2010:144)

(32)
là gallina che i pulcini beccano <la gallina>

[-pl] [+pl] [+pl] [-pl]
le galline che il pulcino becca <le galline>

[+pl] [-pl] [-pl] [+pl]
Conversely, normal hearing children could not rely on syntactic cues in matched number features (VOLPATO 2010:145), then guessing the agent and the patient of the action. Indeed, carrying an identical set of number features, the two DPs of the sentence would be harder to distinguish.

(33a)
La gallina che il pulcino becca <la gallina>
The hen that the chick pecks <the hen>

(33b)
Le galline che i pulcini beccano <le galline>
The hens that the chicks peck <the hens>

Undoubtedly, the mismatch conditions, especially SING-PLUR sentences (for the closeness of the plurals and for the markdness given by NumP), seem to increase the level of normal hearing subjects’ performance, whereas these conditions would represent the most difficult situations for hearing impaired children.

CHINELLATO (2004) found similar results in agrammatic patients, in whom the condition of marked number would be the most expensive in computational terms. The substitution in a patient (in most cases, 57%) of the (marked) sixth person with the (unmarked) third one, led CHINELLATO to hypothesize that the plural can be underspecified even in agrammatism for an excessive processing cost (VOLPATO 2010:137).

The study of ADANI et al. (2013) confirmed the presence of an asymmetry between the subject and object-extracted centre-embedded relative clauses in 12 children (aged 9;5-16) with Grammatical Specific Language Impairment (henceforth G-SLI).

The greater difficulty of the object relatives would be due to the RM effects. Conversely, the performance of SLI children resulted systematically lower both in
subject and in object relatives. Nevertheless, even in SLI children the discrepancy between the match and the mismatch number features is present.

Again, the mismatch condition seems to improve their performance, confirming the findings that the checking of agreement features is not impaired in SLI (Pawlowska, Leonard, Camarata, Brown & Camarata 2008; Jakubowicz 2003; Van der Lely 1998).

**Conclusions**

I have introduced some of the most important studies regarding the assumption of NumP, underlining the different positions about the role of Number (whose projection is assumed only in the plural condition in Ferrari 2005) and Gender (whose existence as an autonomous projection has not been completely proved).

Indeed, several studies conceive that Gender and Number would merge in different ways on the syntactic tree.

Ritter (1995) and Di Domenico (1997) claim that gender affixes would be located in the head of NP, whereas the number affixes are placed in the head of NumP, thus Number heads its own functional projection. Analogously, they differentiate two kinds of gender: semantic gender would be placed in the Num head, whereas the grammatical gender would merge in the lexical head N.

In other words, these studies share the hypothesis that Number has its own functional projection and that it has a higher position that gender in the syntactic tree.

Conversely, Ferrari (2005) and Picallo (2008) argue that not only Number, but also Gender is a syntactic phenomenon, since gender can label a lexical item as a noun, then having an influence on the interpretative process. To Picallo (2008) this would constitute evidence of the gender’s function and relevance. The Gender feature is called [Class] since it defines the class of the noun, and it is claimed to belong to a syntactic projection (c) above N.

Interestingly, the Number projection is argued to merge only in the plural features in Ferrari’s account, not in the singular.

The number features permit to distinguish ambiguous sentences in languages such as Italian, since they merge on verbal morphology. Moreover, the verb and the subject share the same number features, thus this morphological cue simplifies the distinction between the DP subject (which agrees with the verb) and the DP
object, which does not compulsorily agree with the verb. In addition to that, this feature allows the correct computation between subject and object relative/cleft sentences.

Indeed, outcomes confirmed NICOL’s findings that Number is an essential feature for the comprehension of ambiguous reference, since only Number makes the interpretative process faster. On the contrary, Gender is not accessed from the beginning of the interpretative process.

Again, the importance of the number feature would originate from its own syntactic head, whilst gender would be devoid thereof.

Furthermore, the interpretative process of pro and the recovery of its correct referent is faster when “the pronoun is disambiguated by Number rather than when it is disambiguated by Gender”, since Number feature is accessed faster by the human parser in the comprehension process. Specifically, the mismatch condition of number features facilitates the comprehension of object relative clauses.

Indeed, the projection of Number, realized only in condition of plural feature (following FERRARI 2005), would exert its influence even in normal hearing subjects. Conversely, intervention would increase its effects in sentences displaying match number features.

Although NumP is claimed to be important in normal subjects, hearing impaired (henceforth, HI) children do not seem sensible to this syntactic feature, since the mismatched Number (especially SING-PLUR condition with plural agreement on the embedded clause) is more complex to process for these subjects. Hence, marked number features could be inaccessible or underspecified in HI children.

ADANI et al. (2013) found the asymmetry between match and the mismatch number features is present even in SLI children. Although they performed worse with respect to the control group because of the RM effects, the mismatch condition seems to improve their performance both in subject and in object relatives, confirming the findings that the checking of agreement features is not impaired in SLI.

Number feature seems to be relevant in language impaired populations, since it can either improve (SLI) or worsen (HI children) their performance.
**PART 2**

*Relative clauses in agrammatism and in other language disorders*

**Introduction**

This second part of the chapter will deal with relative clauses, their properties and theories about their formation. In addition to that, I will report some of the linguistic and psycholinguistic studies regarding the comprehension of subject and object relative sentences in agrammatism, in typically developed and language impaired populations (SLI, HI children).

**3.7 Relative clauses in Italian**

Relatives clauses can be divided in center-embedded and right-branching on the base of the position of the subordinate clause. The relative clause is placed in the centre of the matrix sentence in the former, like in “the girl who the aunt hugs is blonde”, whereas it is placed on the right of the main clause in the latter, like “in the boy who the grandmother greets”. All the sentences used in our test were right-branching:

(34)

Tocca la farfalla che la bambina disegna.

Touch the butterfly which the baby draws

These typologies of relative clauses are also named restrictive relatives, since their goal is to specify the nature of the head by the identification of its possible referents. In Italian they are introduced by “che” *that*, a complementizer, whereas the subordinate clause hosts the trace of the moved element (either the subject or the object):

(35)

La mela, *che* la bambina mangia tᵢ

The apple, *that* the child eats tᵢ

Fotografando la bambina, *che* tᵢ mangia la mela

Photographing the child, *that* tᵢ eats the apple
In Cinque (1978, 1982) these sentences are predicted to be originated by wh-movement of the relative operator, which moves from the embedded position to the left periphery of the sentence to specCP position, where it is linked with the relative head (Volpato 2010:24). In this view, a subject relative is derived as follows (Volpato 2010:24):

(36) a. La tigre che <la tigre> colpisce gli elefanti.
   b. [DP la [NP tigre, [CP OP, che [IP t, colpisce gli elefanti ]]]]

An object relative is instead derived as in:

(37) a. Il cane che la tigre bacia <il cane>
   b. [DP Il [NP cane, [CP OP, che [IP la tigre bacia t]]]

Conversely, other authors (Vergnaud 1985, Kayne 1994, Guasti & Shlonsky 1995, Bianchi 1999, Cinque in preparation) claim the subject/object would move to the CP node, establishing a link with a head external to the relative clause. In subject relatives, it is the subject which moves from its embedded position (Volpato 2010:24-25).

(38) a. La tigre che <la tigre > colpisce gli elefanti.
   b. [DP la [CP [NP tigre,] che [IP [NP t, ] colpisce gli elefanti ]]]
In object relatives, the object moves from its initial position.

(39) a. Il cane che la tigre bacia <il cane>
    b. $[\text{DP} \ 	ext{II} \ [\text{CP} \ [\text{NP cane}] \ che \ [\text{IP} \ la \ tigre \ bacia \ [\text{NP} \ t_i] ] ] ]$

In this approach, the head of the relative is involved in A’-movement and moves to the position of specCP (Volpato 2010:26). Since it crosses over the DP subject, it would determine RM effects in the case of language impairment:

Differently from these, center embedded relative clauses are more difficulty to process for adults and children (Volpato 2010:51). For that reason, this typology of relative clauses was not used in this task, since their greater complexity would have influenced the computation of the syntactic structure.

### 3.8 Relative clauses in agrammatism

In this section, I will review some of the most important studies regarding the agrammatic performance in the comprehension of object relative clauses.

According to the TDH, which predicts the deletion of traces, the moved NP cannot receive any thematic role causing the complete misunderstanding of sentences such as subject and object relative clauses, wh-questions.

Hence, agrammatics would elaborate an extra-linguistic principle, assigning a default agent role to the first NP of the sentence (see Chapter 1, section 1.3).
Better performance should therefore be found in subject relative clauses, subject clefts and adjectival passives, in which the first NP is the effective agent of the action. Contrarily to that, object relative clauses, object clefts, passives would be more complex since the first NP is the object/theme/patient.

\[ \text{(40)} \]

<table>
<thead>
<tr>
<th>Normal Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
</tr>
<tr>
<td>Theme</td>
</tr>
</tbody>
</table>

Subject relative clause \[ [\text{CP the girl that } [\text{VP t pushed [the boy]]}] \]

<table>
<thead>
<tr>
<th>Agrammatic assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
</tr>
<tr>
<td>Theme</td>
</tr>
</tbody>
</table>

\[ \text{(41)} \]

<table>
<thead>
<tr>
<th>Normal Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theme</td>
</tr>
<tr>
<td>Agent</td>
</tr>
</tbody>
</table>

Object relative clauses \[ [\text{CP the boy that } [\text{VP the girl pushed t}]] \]

<table>
<thead>
<tr>
<th>Agrammatic Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
</tr>
<tr>
<td>Theme</td>
</tr>
</tbody>
</table>

Regarding the syntactic movement as the source of agrammatic deficits in comprehension of certain typologies of sentence, FRIEDMANN & SHAPIRO (2003) tested agrammatic comprehension of SVO and OSV-OVS active sentences in Hebrew (see Chapter 1, section 1.5).

Data revealed lower levels of performance in OSV-OVS active sentences with respect to SVO, in which agrammatics performed at above chance. This fact is a further proof that agrammatic impairment stems from NP movements since SVO sentences (which showed higher percentages of accuracy) differ from OVS, OSV only for the absence of this typology of movement.

As has been claimed previously, GRILLO (2005) interpreted subject/object asymmetries in agrammatic comprehension of relative clauses in terms of Relativized Minimality (see Chapter 1, section 1.4).
This theory claims that RM effects cannot take place in subject relatives, since no NP intervenes between the moved constituent and its trace. Conversely, in object relatives, the object crosses over the DP subject during its movement, leading to minimality effects.

In addition to that, RM effects are claimed to occur more frequently whenever feature sets of the elements cannot be completely computed, as happens in agrammatic sentences. Hence, the moved element and the subject would actually belong to the same class because of the impoverishment of feature sets, causing interference during the process of comprehension.

FRIEDMANN, GVION, NOVOGRODSKY (2006) recalled the hypothesis that agrammatic difficulties with non-canonical ordered sentences stem from a deficit in movement, investigating the nature of this impairment in relative clauses in SLI and agrammatic subjects. Since the assignment of thematic roles to a moved element is composed of two steps (the creation of traces in the element’s initial position and the transmission of the thematic role through a chain between the trace and its antecedent, that is, the moved constituent), agrammatic deficit in NP movement has therefore to lie in one of these two stages (FRIEDMANN, GVION, NOVOGRODSKY 2006:198).

In order to achieve this goal, they used a task containing heterophonic homographs, that is, words written in the same way but sounding differently (e.g. lives, tears, wind, dove), as it occurs in the following sentences (FRIEDMANN, GVION, NOVOGRODSKY 2006:198):

(42a) Lifeguards save lives
(42b) The woman lives in Italy.

In the former sentence (42a), the homograph is the object of the action and it is a noun, whereas it is a verb in the latter (42b). Hence, the correct reading of these words requires the correct assignment of thematic roles to the moved elements.

Language impaired subjects’ performance was tested in reading and paraphrasing tasks of object relative clauses containing these noun-verb heterophonic homographs placed after the trace position. Thus, the correct reading of these words requires the correct construction of the syntactic structure, giving the element the object role and computing the trace. Instead of that, the correct paraphrase requires the correct transmission of thematic role to the moved element.
(FRIEDMANN, GVION, NOVOGRODSKY 2006:200). If the trace cannot be constructed, difficulties are expected in the reading of object relatives, since they would interpret the verb as an object noun. If the impairment lies in thematic roles assignment, lower percentages of accuracy are expected in the paraphrasing task; indeed, although the homographs are correctly read, subjects’ would encounter problems in paraphrasing, in giving sense to the object relative (FRIEDMANN, GVION, NOVOGRODSKY 2006:200). Agrammatics were presented three sentences for each homograph: a target centre-embedded relative clause with a homograph after the trace, and two control simple sentences without movement, one containing a homograph as a verb and one as a noun (FRIEDMANN, GVION, NOVOGRODSKY 2006:201).

Outcomes showed that agrammatics have several problems in reading and paraphrasing the homographs (FRIEDMANN, GVION, NOVOGRODSKY 2006:202). In addition to that, results revealed that patients’ performance is influenced by the syntactic structure and not by the homograph, since control simple sentences were easily understood (FRIEDMANN, GVION, NOVOGRODSKY 2006:203). Since the syntactic structure cannot be built up, traces cannot be identified, leading to an incorrect assignment of thematic roles to the moved element, actually failing in the sentence’ interpretation (FRIEDMANN, GVION, NOVOGRODSKY 2006:205).

Remarkably, authors found that the agrammatic deficit differs from SLI impairment. In the former the syntactic structure is impaired and traces cannot therefore be computed in the comprehension of the sentence, whereas SLI would succeed in the construction of the syntactic structure, and traces would be correctly computed. Despite that, the assignment of thematic roles to the moved element is claimed to be impaired (FRIEDMANN, GVION, NOVOGRODSKY 2006:208).

Regarding agrammatic aphasia, this pattern seems to mirror the proposal of GRODZINSKY (1990, 2000), who claimed that traces are deleted in this language impairment (see Chapter 1, section 1.3). A possible explanation of this fact is that the incorrect construction of the syntactic tree actually causes the extreme precariousness of traces in agrammatism.

In this account, FRIEDMANN, GVION, NOVOGRODSKY (2006) argue that the incorrect computation of the CP node lead agrammatics to an absent representation of traces, given that patients would not know to which element the
trace has to be tied. Indeed, in the absence of this node, the object cannot move to the specifier of CP and the creation of the trace is not compulsory, given that there is no antecedent with which it is possible to create a link (FRIEDMANN, GVION, NOVOGRODSKY 2006:208).

Hence, the agrammatic deficit in comprehension of sentences derived by movements would lie in the incorrect construction of the syntactic structure, which would prevent the creation of traces. In these conditions, the assignment of thematic roles occurs randomly.

In contrast with the assumptions of the study above, FRIEDMANN & GVION (2012) argued that the type of sentence does not have any role, whereas comprehension is influenced by the presence of an NP intervener. However, these results could be a proof that syntax is not totally absent in agrammatism: indeed, if we assume that patients cannot construct traces, it remains not totally explained how the NP intervener can obstacle chain formation (see Chapter 1, section 1.7).

Concluding, it is clear enough that the agrammatic deficit still has to be investigated, in order to fully understand this language impairment.

3.9 Relative clauses in other language impaired populations


As has been said previously, the asymmetry between subject and object relatives would stem from the violation of the locality syntactic principle (the Relativized Minimality). FRIEDMANN et al. (2009) proposed that RM would be caused by the intervention of the lexical restriction [+NP], realized both in the head of the relative and in the intervenient.

ADANI et al. (2010) revised the definition of lexical restriction, arguing that is the internal structure of the DP which causes minimality effects.

For instance, the performance in object relatives has been demonstrated to be influenced by the nature and the properties of the DPs (which can be undefined, proper nouns, personal pronouns, quantifiers or expressions of animacy).
Hence, object relatives with two full DPs would be computationally more expensive to process with respect to those with only a full DP (GORDON et al., 2001; ARNON, 2009; FRIEDMANN et al., 2009).

ADANI et al. (2010) showed that even the number features influence the performance in relative clauses.


GUASTI & CARDINALETTI (2003) found that the asymmetry between RS and RO is present in normally developing children (age-range 5;1- 10;0).

An analogous gradient of difficulty was found by AROSIO et al. (2005) in TD children (age range 5-11), that is RS are better performed than RO with preverbal subject, with the latter processed better with respect to RO with postverbal subject. Moreover, TD children are shown to reach the ceiling level in object relatives with postverbal subject only by the age of 11. Although ADANI et al. (2010) did find the same gradient of difficulty, children in that study seemed to reach the ceiling level more prematurely (RS at ceiling from age 3; RO with preverbal subject are 83% correct at age 4; RO with postverbal subject are 70% correct at age 7).

Regarding SLI children, several studies showed that relative clauses would be learned later (CIPRIANI, BOTTAI, CHILOSI & PFANNER, 1998) and that the linguistic impairment will last even in elder children relative clauses (STAVRAKAKI, 2001). However, not only object relatives would be particularly problematic for SLI children (FRIEDMANN & NOVOGRODZSKY, 2004), but also the comprehension and the production of some typology of subject relatives would be impaired (STAVRAKAKI, 2002, HÅKANSSON & HANSSON, 2000, SCHUELE & NICHOLLS, 2000) (FRIEDMANN et al. 2004:664).

FRIEDMANN et al. (2004) investigated relative clauses in Hebrew in SLI and typically developing children by using a binary sentence-picture matching task.
TD children showed to understand object relative clauses around the age of 6;0, whereas the elder SLI children were still at a chance level of performance, like normal developing children of 4;0 years old. Conversely, subject relatives were comprehended at ceiling by the age of 6;0.

Structures with not-canonical order of elements, that is being derived by movement, are problematic for SLI (FRIEDMANN et al. 2004: 663).

FRIEDMANN & NOVOGRODSKY (2007) investigated the SLI deficit in the syntactic movement, revealing that it is the transfer of the thematic roles which is impaired, and not the construction of the syntactic structure.

To prove that, they tested Hebrew SLI children (9;3-14;6) in reading and paragraphing tasks of object relatives containing a “noun-verb heterophonic omographs”, placed after the position of the trace. Since the correct reading of these homographs (as a noun or a verb) requires the identification of their syntactic role and position, those who are not able to construct trace should read them incorrectly. Remarkably, SLI children read homographs correctly, but failed in the paragraphing of the object relatives, making several errors in the identification of thematic roles (FRIEDMANN & SZTERMAN 2007:57).

Hence, the syntactic structure would be built up, whereas the assignment of the thematic role, via the link between the moved elements and its trace, would be seriously impaired (2007:58). Therefore, the trace would be implemented (as shows their correctly reading of the homographs), whereas the capacity to process the syntactic movement would be seriously damaged (2007:59). Despite the fact that the empty position is correctly computed as the object of the embedded verb, the arguments of the verbs would not be processed at all, with several errors in the thematic roles assigning; then, several problems in connecting thematic roles to their antecedents would occur (2007:59).

Finally, the syntactic structure and the empty category are spared in G-SLI, whereas the movement of the thematic role from the trace to the moved element (2007:61) is seriously impaired.

In this view, the empty category would be implemented, without knowing to which NP it refers. In effect, all the possible combinations of the two arguments and the thematic roles were mirrored in their errors:

(43) 1) the theme of the embedded verb received an interpretation of the agent of the embedded verb; 2) the agent of the embedded verb received the role of
In addition to that, they sometimes interpreted the object relative clauses as a simple SVO sentences, then deleting the *che* “that”, being prevented from the assigning of the thematic role to the subject.

Analogously to other language impaired populations (TD children, SLI children, agrammatics), even HI children show a gradient of difficulty, in which RS are better comprehended than RO with preverbal and postverbal subject (RS>RO<sub>pre</sub> RO<sub>post</sub>). Again, this asymmetry has been explained as a consequence of the relativized minimality (RIZZI 1990, 2000, 2004a; STARKE, 2001).

FRIEDMANN & SZTERMAN (2006) found that Hebrew HI children (age range: 7;7-11;3) performed worse in RO with respect to TD children, whereas they were close to the ceiling in RS. Again, the asymmetry would stem from the longer distance of the dependencies in RO. Interestingly, they found a correlation between the level of performance and the age of implantation: those who were implanted within the first year of life performed significantly better than later implanted children.

Regarding hearing impairment, FRIEDMANN et al. (2010) tested the comprehension of relative clauses in Hebrew and Palestinian Arabic HI children, using a sentence-picture matching task. Showing greater problems in object relative clauses and in object (which) questions, difficulties should arise from the wh-movement rather than from the presence of an embedded clause (FRIEDMANN et al. 2010:167).

VOLPATO & ADANI (2009) examined the comprehension of subject and object relative clauses in cochlear implanted children by using an agent selection task.

Not only HI children showed lower levels of comprehension with respect to TD subjects, but also they reported the expected asymmetry between subject (more easily to process) and object relative clauses (more difficult).

Object relatives with preverbal subject were easier to process than object relatives with postverbal subject, confirming that the difficulty of object relative clauses depends on the nature of the DPs.

The greater difficulty of object relatives with postverbal subject stems from the fragility of the subject-verb agreement, which in these sentences are checked only
by AGREE, not being further controlled by Spec-Head, given that the subject remains in its initial position within the VP node.

In addition to that, RO with postverbal subject are computationally more expensive, since the plural morphology has to be memorized for a long time, given that the subject does not move. Hence, HI children would interpret the sentence as a RS (Volpato & Adani 2009:10).

Conclusions
In this chapter I have introduced some of the most important studies regarding relative clauses, their nature and syntactic structure.

Following the most recent theories, relative clauses originate from the movement of the subject/object to the CP node, establishing a link with a head external to the relative clause. In subject relatives, it is the subject which moves from its embedded position, whereas it is the object which move in object relatives. Since it crosses over the DP subject during its movement, this can determine RM effects in the case of language impairment.

Several theories have tried to explain this discrepancy between subject and object relative clauses. Starting from the assumptions of the Trace Deletion Hypothesis and the default linear strategy, agrammatics would assign the role of the agent to the first DP of the sentence. Hence, the above chance performance in actives, subject relatives, subject cleft is due to an accidental correspondence between the role assigned by the default principle and the role that the moved element would have had.

Differently from that, Grillo (2005) proposes that the responsibility for asymmetries in agrammatic comprehension has to be attributed to Relativized Minimality. This account predicts that subject relatives should be correctly interpreted by agrammatics, since no NP intervenes between the moved constituent and its trace, and no RM effects can take place.

The same clearly does not happen in object relatives, in which the subject NP intervenes between the moved object and its trace. Indeed, agrammatic impoverished representation does not permit to link the moved phrases to their traces, causing the impossibility to assign the correct theta role to each argument.

Garaffa & Grillo (2007) hypothesized that structures characterized by a movement through an intervening NP (such as object relative clauses) are more complex to process and thus more likely to be compromised.
Following this line of study, Friedmann-Belletti-Rizzi (2009) predict that the type of object relative may influence children’s performance. According to the RM, an impaired comprehension would be sensible to the “similarity” between the moved element and the NP intervenient, whereas dissimilarity improves their performance. Indeed, it has been demonstrated that the difficulty in object relatives can be increased/decreased by manipulating the nature of nominal elements.

In the last paragraph of this section, I have described the performance in relative clauses of typically developed and language impaired subjects, and all show an asymmetry between SR (higher performance) and OR (lower performance).

Regarding SLI children, several studies showed that relative clauses would be learned later and that the linguistic impairment lasts even in elder children relative clauses, leading to the assumption that structures with a non-canonical order of elements are problematic for SLI.

Analogously, even HI children show a gradient of difficulty, in which SR are better comprehended than OR with preverbal and postverbal subject (RS > RO_pre > RO_post). Again, this asymmetry has been explained as a consequence of relativized minimality.

Interestingly, Friedmann & Szterman (2006) found a correlation between the level of performance and the age of implantation: those children who were implanted within the first year of life performed significantly better than later implanted individuals.

PART 3
Theoretical Framework

Introduction
The theoretical framework is based on the principle of attraction formulated by Franck et al. (2006). The following paragraphs have the purpose to illustrate the principle of attraction, the establishment of the subject-verb agreement by the operation of AGREE and Spec-Head and how they can be influenced by the attraction phenomenon.
### 3.10 Agreement in linguistic theory

In this section, I will describe the relation of agreement.

A syntactic structure is built up by several operations, namely MERGE, AGREE, and MOVE. Establishing relations through MERGE, elements first form an elemental phrase \([A \, B]\), then the relations between verb and its arguments and subsequently a primitive sentence structure (with the appearance of the inflectional features of the verb: tense, aspect, mood...), which can be modified by MERGE or by MOVE. Hence, before reaching the final structure (the surface order of the elements), there are several intermediate states, all having the following basic structure (Franck et al. 2006:178):

(44)

![Diagram of Specifier, head, complement, K]

A head is merged with a complement, and the resulting constituent is then merged with a specifier. For instance, every transitive clause has the following tree at the beginning of the derivation:

(45)

![Diagram of Subject, Verb, Object]

These nodes correspond with words or phrases, each in vertical (dominance) and horizontal (precedence) hierarchical relation (Franck et al. 2006:179). Subject-verb agreement would be realized in a specific node, that is, AgrS (whose specifier hosts the subject), which contains the morphology required for the establishing of the subject-verb agreement.

(46)

![Diagram showing Functional and Thematic structures with AGREE, VP, AgrS, Subject, Verb, Object]
The subject first merges in SpecVP in order to receive its theta role, and subsequently the functional and the thematic structure are built. At this point of the derivation, the underspecified head of AgrSP enters in a relation of AGREE with the subject in specVP in order to build a copy of its number and gender features, and after that the verb moves from V to AgrS to get morphological specification.

Then, the subject moves out of the VP node to specAgrS, leaving a trace in its original position. Hence, a spec-head relationship between the subject in specAgrS and the verb in Agr is formed. This relation enforces and further checks the features shared by subject and verb (FRANCK et al. 2006:180-181).

(47)

Spec-head

Functional structure

subject

V + AgrS

Thematic structure

VP

However, as we have seen previously, agreement is checked only by AGREE in OVS ordered sentences, and in this condition agreement is more fragile. Consider sentences such as:

(48a) Many books are/*is on the table

(48b) There are/’s many books on the table

Agreement is stronger in the first sentence than in the second one, since in the former the subject moves to specAgrS, establishing a Spec-Head relation, whereas in the latter the subject does not move, and its position is occupied by the expletive (FRANCK et al. 2006:181).

It has been reported that agreement is not compulsory in VS sentences, whereas it is necessary and obligatory in SV ordered clauses. Moreover, the weakness of agreement in VS sentences does not consist in guessing between the
plural and the singular features, since a singular verb always precedes a plural subject, the contrary never occurs (FRANCK et al. 2006:181). GRILLO sums up:

(49) ...if a language has the agreement morphology, it does require the morphological manifestation of agreement when the subject is in a Spec-head relation to the Agr$ node... whereas in VS configurations the morphological realisation of agreement is more fragile... (FRANCK et al. 2006:182).

On the contrary, the agreement would be preserved in SV structures, since it is checked twice: by AGREE and Spec-Head relations.

3.11 The attraction principle

Attraction is claimed to occur when a phrase noun, placed close to the subject and the verb, is able to exert its influence on the subject-verb agreement relation. In this account, the verb would actually assume the number features of the local noun rather than those of the subject. In the following sentence, the subject and the verb do not share the same number features (FRANCK et al. 2006:175):

(50) *The son of the neighbours always come back late.

BOCK & CUTTING (1992) first investigated the influence of proximity in the phenomenon of attraction, claiming that even the belonging to “the same unit of syntactic encoding” is a factor of interference with the establishment of agreement (FRANCK et al. 2006:175). In the examples (FRANCK et al. 2006:176):

(51a)*The editor of the history books were (.)
(51b)*The editor who rejected the books were (.)

The local noun “books” exerts a bigger attraction in 51a rather than in 51b, since it is located in the embedded clause in the latter (FRANCK et al. 2006:176). These findings have been confirmed by NICOL (1995), who found that attraction has minor strength when the similar nouns are located in different clauses.

VIGLIOCCO & NICOL (1998) proved that the responsible for the attraction is the hierarchical position of the local noun, not the surface order of the elements. Indeed, English speakers made the same percentage of errors both in interrogative
and in declarative sentences, even if they have a different surface order (Franck et al. 2006:176-177):

(52a) *ARE the helicopter for the flights safe?
(52b) *The helicopter for the flights ARE safe

Indeed, the formation of the interrogative sentence occurs after the subject-verb agreement, namely after the attraction influence.

In the same line, Franck, Vigliocco & Nicol (2002) hypothesized that the aforesaid attraction effects can depend on the depth of the node in which the local noun merges rather than on the fact of belonging to the same clause of the subject. In their experiment, two local nouns were added to the main clause:

(53a) *The computer with the programs of the experiment are broken.
(53b) *The computer with the program of the experiments are broken.

Although they predicted a similar attraction strength (given that the local nouns are in the same syntactic unit of encoding of the subject-verb relation), the first sentence was found to be complex to compute.

Hence, the higher a local noun is placed in the syntactic tree, the higher is its attraction power, the lower a local noun is placed in the syntactic tree, the lower is its attraction power. The local noun with more attractive power is located farther from the verb.

(54) Hence, the critical factor triggering attraction is not the position of the local noun with respect to the assumed units of encoding, nor its position in the final word string, but rather its position in the syntactic hierarchy, and more precisely the syntactic distance that separates it from the verb in the hierarchy.

(Franck et al. 2006:176).

The role of the local noun’s hierarchical position is underlined also by Solomon & Pearlmutter (2004), who claimed that the attractive strength can depend on the structure of the subject phrase. Indeed, the performance in “The drawing of the flowers” is more influenced by attraction than in “The drawing
with the flowers”. Hence, the final position of the local noun does not cause attraction, since:

(55)  “Attraction errors occur in the grammatical encoding process before words are linearised in their left-to-right order, at a stage when words are organized hierarchically, and the declarative and interrogative structures are identical”.

(FRANCK et al. 2006:177)

In any case, attraction has been found to be more powerful especially when the local noun is closer to the head-subject, e.g. when it is located within the subject-phrase. HARTSUIKER et al. (2001) confirmed the hypothesis by saying that a local noun can best influence the establishing of agreement when it is closer to the subject (subject modifier) than the verb (direct object) (FRANCK et al. 2006:178).

Hence, a previous intermediate state in which words are analyzed hierarchically has to be hypothesized. Attraction would be sensible to this hierarchical order: the higher the local noun is, the more attraction it will have on the subject-verb agreement. Consequently, a local noun would best interfere whenever it is subject-phrase internal rather than when it belongs to the verbal-phrase.

### 3.12 The attraction occurrences

FRANCK et al. (2006) claim that the moved object in the left periphery of the sentence can interfere in the subject-verb agreement. They tested OSV and OVS ordered cleft sentences, whose formation involves the movement of the object to the left periphery of the sentence, to prove that assumption (FRANCK et al. 2006:195):

(56a) C’est les négociations que le ministre suspend

It’s the negotiations that the minister stop

(56b) C’est les négociations que suspend le ministre

It’s the negotiations that stop the minister

Although attraction effect were found, it emerged that the object final position does not interfere with the subject-verb agreement. Therefore, the object must occupy an intermediate position during its movement, and this intermediate position must be located within the relation of subject-verb agreement (FRANCK et al. 2006:195). The object, during its step-by-step movement toward the left periphery, would pass through an intermediate position called AgrO, which is
adjacent to the VP node. Specifically, the object would first move to specAgrO, and then to the complementizer node.

(57)

Hence, the relation of AGREE (between the subject and AgrS) can be influenced by this intermediate position of the object. As a result, SpecAgrO intervenes both linearly and hierarchically on AGREE (Franck et al. 2006:195).

Remind that agreement is established only under AGREE in OVS cleft sentences, since the relation of Spec-Head does not take place, given that the subject does not move, and it remains within the VP. Since this second relation is absent, a weakening in the subject-verb agreement would occur, leading to a greater number of attraction errors. Conversely, OSV sentences have a stronger subject-verb agreement, because they are characterized by both AGREE and spec-head checking, and attraction errors occur less frequently (Franck et al. 2006:196).

Results showed that the object in the left periphery of the sentence can clearly influence the establishment of the subject-verb agreement. Moreover, the weaker a subject-verb agreement relation is, the greater will be the number of attraction errors (Franck et al. 2006:199).

Hence, specAgrO may intervene and prevent the establishment of AGREE, especially in OVS sentences, given that subject-verb agreement is not checked by the spec-head relation (Franck et al. 2006:200).
Conversely, the subject moves to specAgrS and enters in Spec-Head relation with the verb in AgrS in OSV sentences, establishing a further control for the agreement (Franck et al. 2006:200).

Summing up, being the subject still within the VP node, AGREE would copy the subject’s feature in AgrS. Then, moving the verb and the subject respectively to the head and to the specifier of AgrS, the relation of Spec-Head would take place. In this account, Spec-Head could be seen as a sort of checking of the values contained in AgrS, controlling whether the subject and verb share the same agreement values (Franck et al. 2006:203).

In this view, AGREE ensures copy and Spec head ensures verification where verification is not rewriting, but a comparison of the two specifications.

(Franck et al. 2006:203).

An indirect proof of Spec-Head checking role stems from the different performance in OSV and OVS cleft sentences. Indeed, OVS clauses, which lacks spec-head relation, are more subject to attraction errors.

Hence, the object would interfere both in OVS and in OSV sentences, even though the spec-head relation checks and corrects contingent agreement errors in OSV, whereas the same does not occur in OVS, lacking this further agreement check (Franck et al. 2006:203-204).
Remarkably, Franck et al. (2006) predicted that other factors could be responsible for agreement errors, such as the word order and the number mismatch (Franck et al. 2006:201).

Indeed, the dissimilarity between the moved element and the NP intervener could prevent RM/attraction effects.

3.13 Kayne (1989) and the attraction principle

As mentioned above, the subject’s features (Number, Gender and Person) are transferred to the verb through the operation of agreement. Subject-verb agreement is the relevant cue for the comprehension of the sentence in Italian, since it allows the distinction between the agent and the patient, whilst English speakers have to rely on the sentence order, given that the English verb does not express the number features overtly (Vigliocco, Semenza et al. 1995:192).

Interestingly, Vigliocco, Semenza et al. (1995) found that agreement errors are more frequent when the head is singular and the subject has a preferred multiple token interpretation, whereas in the case of plural head a greater number of agreement was found when the subject lacked morphological marking of number (Vigliocco, Semenza et al. 1995:202).

Hence, agreement would depend on three fundamental factors: the grammatical features of the subject, the relation between the subject and the verb (tense, mood, aspect, contingent presence of a modifier) and the status of the object/referent (Vigliocco, Semenza et al. 1995: 210).

Thornton (1999) and Salvi & Vanelli (2004) examined the plural verbal features, especially the status of the sixth person in Italian, which is different from the fourth and the fifth. Indeed, it can be said that the sixth person is the only true person of the plural in Italian, being built by adding the plural morpheme -no to the bare form of the third person singular (Volpato 2010:134-135):

(60) [[pettina]+no] [[comb.3.SG]+PL]

The third person of the singular does not bear any agreement morpheme, since the final vowel of the root is the thematic vowel, not the marker of the singular feature. (Volpato 2010:135).

In this account, Italian is opposite to the English agreement system, in which the third singular person bears the marked features (being composed of the bare
form of the verb + the singular marker –s), whereas the sixth person of the plural is the unmarked form (VOLPATO 2010:136).

As KAYNE (1989) predicted, it is possible that a singular (marked) subject can agree with an unmarked (plural) verb, when the head of the relative/wh-phrase is unmarked (plural).

(61) the people who Clark think are in the garden

   PL   SG   PL

Remarkably, the attraction phenomenon does not occur in the opposite situation: a unmarked subject cannot agree with the marked form of the verb, when the relative head is in the singular (VOLPATO 2010:136):

(62) *the man who the girls likes

   SG   PL SG

Hence, attraction is only possible when the verb is unmarked, since it is bare and not specified for agreeing with the DP subject. Conversely, the verb cannot be attracted when it bears marked (singular) features, since it already agrees with the DP subject. Being opposite to the English system, in Italian it is possible that a plural (marked) subject can co-occur with an unmarked (singular) verb, when the head of the relative/wh-phrase is unmarked (singular).

Conclusions

In this chapter I have introduced the concept of attraction. This phenomenon is claimed to occur when a local noun, placed close to the subject-verb agreement, is able to exert its influence on this relation. Hence, the verb would actually assume the number features of the local noun rather than those of the subject. Several studies proved that responsible for the attraction is the hierarchical position of the local noun, not the surface order of the elements involved.

In this view, FRANCK, VIGLIOCCO & NICOL (2002) hypothesized that the aforesaid attraction effects can depend on the depth of the node in which the local noun merges rather than on the fact of belonging to the same clause of the subject.

Hence, the higher a local noun is placed in the syntactic tree, the higher is its attraction power, the lower a local noun is placed in the syntactic tree, the lower is its attraction power. Although attraction effect were found, it emerged that the object final position does not interfere with the subject-verb agreement. Therefore, the object must occupy an intermediate position located within the relation of
subject-verb agreement. Moreover, the weaker a subject-verb agreement relation is, the greater will be the number of attraction errors.

It has been claimed that an agreement without the relation of Spec-Head is weaker, thus OVS sentences are subject to a greater number of attraction errors. Conversely, being characterized by both AGREE and spec-head checking, and having a stronger subject-verb agreement, attraction errors occurs less frequently in OSV sentences.

Hence, the position of specAgrO somewhat intervenes in the establishment of AGREE, especially in OVS sentences, whose subject-verb agreement is not further checked by the spec-head checking.

In the last paragraph it has been shown that attraction errors occur only when the head of the relative is unmarked. Indeed, as KAYNE (1989) predicted, in a variety of English, it is possible that a singular (marked) subject agrees with an unmarked (plural) verb, only with a unmarked head(plural).

Indeed, an unmarked verb is bare and not specified for agreeing with the DP subject. Conversely, attraction effects cannot take place when the verb bears marked (singular) features, since it already agrees with the DP subject. Being opposite to the English system, in Italian a plural (marked) subject can co-occur with an unmarked (singular) verb, being the head unmarked (singular).
CHAPTER 4

*The test assessing the comprehension of relatives clauses*

PART 1

*The test*

**Introduction**

This study wants to investigate whether the agrammatic comprehension of object relative clauses with embedded preverbal subjects is influenced by marked number features. A sentence-picture matching task was used to assess their performance and results showed that the mismatch condition of number features (namely the subject singular/plural and the object plural/singular) is computationally the most complex. This would be caused by the presence of an additional syntactic projection, named NumP, which exists only when the number feature is plural. Agrammatic patients would have great difficulty in establishing the right set of syntactic relations, nevertheless the wide variability found.

To reach this objective, a particular protocol for the sentence-picture matching task has been constructed. A detailed description of all experimental conditions and variables adopted will be given. In the second section of the chapter, agrammatic performance will be analyzed and investigated.

**4.1 The sentences**

This test is composed of 96 object relative clauses with embedded preverbal subject, divided into 48 reversible (in which both the DPs are possible agents for the verb, thus the comprehension of the sentence is achieved only by syntactic principles) and 48 irreversible sentences. All the agents/patients of reversible clauses were humans, no animals were included in the task (the same experimental manipulation in the irreversible sentences).

This is the preliminary scheme of the test:

(1) 96 object relative clauses with embedded preverbal subject

48 reversible object relative clauses  48 irreversible object relative clauses
Successively, sentences have been manipulated for the number feature and matched with an appropriate picture, in order to form four groups of sentences carrying the following set of number features:

1) SING-SING (object and subject are singular)

(2) Irr. Tocca il cucchiaio che l’uomo lava.

Irr. Touch the spoon that the man wash.

(3) Rev. Tocca la modella che la bambina fotografa.

Rev. Touch the model (F) that the girl photographs.
2) SING-PLUR (object is singular, subject is plural)

(4) Irr. Tocca il lampione che gli uomini riparano.

Irr. Touch the lamppost that the men repay.

(5) Rev. Tocca il bambino che i pagliacci divertono.

Rev. Touch the baby that the clowns entertain.
3) PLUR-SING (object is singular, subject is singular)

(6) Irr. Tocca le rondini che la bambina dipinge
   Irr. Touch the swallows that the girl paints

(7) Rev. Tocca le bambine che la donna chiama.
   Rev. Touch the girls that the woman calls.
4) PLUR-PLUR (object and singular are both plural)

(8) Irr. Tocca le rose che le ragazze piantano
   Irr. Touch the roses that the girls plant

(9) Rev. Tocca i ragazzi che i pirati rapiscono
   Rev. Touch the boys that the pirates kidnap
Thus, we have 12 SING-SING reversible relative clauses, 12 SING-PLUR reversible relative clauses, 12 PLUR-SING reversible relative clauses and 12 PLUR-PLUR reversible relative clauses; the same happens for the irreversible relatives.

The final scheme of the task is the following:

(10)

96 object relative clauses with embedded preverbal subject

48 reversible relative clauses

48 irreversible relative clauses

To avoid that any verbal complexity effect may influence their performance, the selection of verbs used in the sentences depended on the frequency of use; therefore only verbs with fundamental frequency or with an extensive use were chosen. Verbs belong mainly to the first Italian conjugation –are, however several verbal forms belong to the second and third conjugation. Verbs were used mainly in only one occasion, except for some predicate which has been used from two to six times.

Moreover, all the verbal forms were transitive and they were conjugated in the present tense, since in language-impaired subjects compound verbal forms (verbal tenses including auxiliaries) can be problematic (CHINELLATO 2004).

The verbs, the times of use and their frequency are listed in the following table:\(^2\):

\(^2\) Frequency is taken from DE MAURO T. 1999, *Grande dizionario italiano dell’uso*, Utet, Torino. Verbs are listed in decreasing order for frequency: FO fundamental frequency; AU extensive use; AD huge disponibility; CO common.
<table>
<thead>
<tr>
<th>Verb</th>
<th>conjugation</th>
<th>Using frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lavare/ to wash (four times)</td>
<td>I -are</td>
<td>FO</td>
</tr>
<tr>
<td>Mangiare/ to eat (three times)</td>
<td>I -are</td>
<td>FO</td>
</tr>
<tr>
<td>Tagliare/ to cut (six times)</td>
<td>I -are</td>
<td>FO</td>
</tr>
<tr>
<td>Scuotere/ to shake</td>
<td>II -ere</td>
<td>AU</td>
</tr>
<tr>
<td>Cucire/ to sew</td>
<td>IV -ire</td>
<td>AU</td>
</tr>
<tr>
<td>Annaffiare/ to hose down</td>
<td>I -are</td>
<td>AD</td>
</tr>
<tr>
<td>Disegnare/ to draw (twice)</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Pitturare/ to paint</td>
<td>I-are</td>
<td>CO</td>
</tr>
<tr>
<td>Tirare/ to kick (twice)</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Guardare/to look (five times)</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Imbucare/to mail</td>
<td>I-are</td>
<td>CO</td>
</tr>
<tr>
<td>Pettinare/ to comb (twice)</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Rincorrere/to chase</td>
<td>II-ere</td>
<td>AU</td>
</tr>
<tr>
<td>Visitare/to see (twice)</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Imboccare/to feed</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Salutare/ to greet (three times)</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Spiare/ to spy on (twice)</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Accarezzare/ to caress</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Fotografare/ to take a picture (twice)</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Bagnare/ to drench</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Coprire/ to cover (twice)</td>
<td>IV-ire</td>
<td>FO</td>
</tr>
<tr>
<td>Saltare/ to jump over</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Portare/ to wear/ to carry (four times)</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Riparare/ to repair (three times)</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Colorare/ to paint</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Dipingere/ To paint (twice)</td>
<td>II-are</td>
<td>FO</td>
</tr>
<tr>
<td>Stirare/ to iron (twice)</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Battere/ to defeat</td>
<td>II-ere</td>
<td>FO</td>
</tr>
<tr>
<td>Divertire/ to entertain</td>
<td>IV-ire</td>
<td>FO</td>
</tr>
<tr>
<td>Baciare/ to kiss</td>
<td>I-ire</td>
<td>FO</td>
</tr>
<tr>
<td>Accompagnare/ to accompany (twice)</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Italian Verb</td>
<td>Tense</td>
<td>Part of Speech</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------</td>
<td>---------------</td>
</tr>
<tr>
<td>Minacciare/ to threaten</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Mordere/ to bite</td>
<td>II-ere</td>
<td>AU</td>
</tr>
<tr>
<td>Asciugare/ to dry</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Rimproverare/ to scold (twice)</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Ascoltare/ to hear</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Indossare/ to wear (twice)</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Comprare/ to buy</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Strappare/ to tear</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Spolverare/ to dust</td>
<td>I-are</td>
<td>AD</td>
</tr>
<tr>
<td>Raccogliere/ to harvest (twice)</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Spingere/ to push (twice)</td>
<td>II-ere</td>
<td>FO</td>
</tr>
<tr>
<td>Premiare/ to reward</td>
<td>I-are</td>
<td>AU</td>
</tr>
<tr>
<td>Votare/ to vote</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Sporcare/ to dirty</td>
<td>I-are</td>
<td>AD</td>
</tr>
<tr>
<td>Inseguire/ to chase</td>
<td>IV-ire</td>
<td>AU</td>
</tr>
<tr>
<td>Chiamare/ to call</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Abbracciare/ to hug</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Truccare/ to make up</td>
<td>I-are</td>
<td>AD</td>
</tr>
<tr>
<td>Consigliare/ to advice</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Massaggiare/ to massage</td>
<td>I-are</td>
<td>CO</td>
</tr>
<tr>
<td>Confessare/ to confess</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Salvare/ to save</td>
<td>I-are</td>
<td>CO</td>
</tr>
<tr>
<td>Arrestare/ to arrest</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Vestire/ to clothe (twice)</td>
<td>IV-ire</td>
<td>FO</td>
</tr>
<tr>
<td>Cacciare/ to expel</td>
<td>I-are</td>
<td>FO</td>
</tr>
<tr>
<td>Rapire/ to kidnap</td>
<td>IV-ire</td>
<td>AU</td>
</tr>
<tr>
<td>Allacciare/ to tie</td>
<td>I-are</td>
<td>AD</td>
</tr>
<tr>
<td>Leggere/ to read</td>
<td>II-ere</td>
<td>FO</td>
</tr>
<tr>
<td>Prenderere/ to take</td>
<td>II-ere</td>
<td>FO</td>
</tr>
<tr>
<td>Piantare/ to plant</td>
<td>I-are</td>
<td>FO</td>
</tr>
</tbody>
</table>
Another variable taken into consideration is the gender feature of the NPs. To avoid any possible influence on subjects’ performance, the object and the embedded subject always show the match condition of gender; thus, if the subject is female/male the object carries the same gender feature:

(12)
Tocca la bambina che disegna la farfalla
Touch the baby who draws the butterfly

(13)
Tocca l’albero che il contadino taglia
Touch the tree which the farmer cut/hack.

4.2 Embeddedness

All the sentences used in this task were right-branching relatives, in which the relative clause is placed on the right:

(14)
Tocca la farfalla che la bambina disegna.
Touch the butterfly which the baby draws

Differently from these, the center embedded relative clauses (that is they are embedded in the center of the matrix clause) like “the girl who the aunt hugs is blonde” are more difficulty to process for adults and children (VOLPATO 2010:51).

For this reason, center-embedded relative clauses were not used in this task, since their greater complexity would have influenced the computation of the syntactic structure.

4.3 The filler sentences

32 experimental filler sentences were spaced out with relative clauses. They were irreversible subject relative clauses, characterized by transitive verbs and inanimate objects. Since fillers are simpler to process and comprehend, they were added with the purpose to lighten the computational cost of the task.

Examples:
Tocca la ragazza che guarda le stelle.
Touch the girl who looks at the stars.

4.4 The pictures

In the picture matching tasks used by Friedmann & Novogrodzsky 2004, Friedmann & Sztermann 2006 children had to choose the correct answer between two/three pictures, which might lead to a chance performance (indeed subject had the 50% of possibilities to guess the correct answer). In addition to that, the choice between only two pictures does not require an excessive amount of processing capacities, facilitating their succeeding in the trial (Volpato 2010:46). On the contrary, the presentation of four pictures reduces the probability of a performance obtained by guessing (only the 25% of possibility to guess right) (2010:47).

In this test, for each sentence a paper was presented with four images: only one image corresponds to the sentence heard, the other three present erroneous number features. Images are colored and placed symmetrically in the paper to avoid any effect of prominence.
An example of an experimental sentence:
(16) Tocca le rondini che la bambina disegna
    Touch the swallows that the kid(F) draws.

In this case the correct image corresponding to the sentence is the one in the bottom left corner. The remaining three pictures are wrong, given that they present different number features for one or both the DPs:

The first image, at the top left corner, represents the sentence
Tocca la rondine che la bambina disegna (SING-SING)
Touch the swallow that the girl draws

The second image, at the top right corner, represents the sentence
Tocca la rondine che le bambine disegnano (SING-PLUR)
Touch the swallow that the girls draw

The third image, at the bottom right corner, represents the hypothetical sentence
Tocca le rondini che le ragazze disegnano
Touch the swallows that the girls draw (PLUR-PLUR)
Analogously in reversible object relative clauses:

(17) Tocca i ladri che l’uomo insegu.

Touch the thieves that the man chases.

In this case the correct answer is the one in the top right corner, whilst the remaining three are mistaken.

We understand that the distinction among the images is possible only analyzing correctly the number features merged on the DPs and the embedded verb.

The images correctly matching the sentence were placed in random sequence, in order to avoid any effect of repetition.

4.5 Procedure

Patients were tested in two sessions, were firstly administered the irreversible sentences, secondly the reversible sentences. Patients were tested in a silent room at the IRCSS San Camillo, the structure in which they were hospitalized.

At the beginning of the task, the examiner explains the procedure and what the subject has to do: after having showed the paper with the four images, the examiner pronounces the target sentence and the patient has to indicate the picture that he considers correct.
Reaction times have not taken into consideration, given that the purpose of the experiment is to investigate whether the number feature influences the agrammatic performance.

For every correct answer 1 point has been assigned, 0 points if the subject indicates the wrong image. Repetitions of the target sentence requested by the patients has not been taken into consideration in the final score.

4.6 Participants

Three different populations participated in this task.

4.6.1 The first group: Agrammatic subjects

The first group was composed by two individuals with agrammatism, named A1 and A2. They are Italian native speakers. A1 was 56 years old at the time of the experiment and had 17 years of education. A2 was 49 years old at the time of the experiment and had 8 years of education.

4.6.1.1 A1 status

Although he partially healed, A1 is still affected by hemiparesis and motor aphasia, the consequences of a cerebral hemorrhage in the left hemisphere in the frontal-parietal lobe. At the moment of the test, he was in a stable condition, 1;2 years post-onset.

The last linguistic examination with the AAT (Aachener Aphasie test) shows unvaried scores in the repetition tasks and in the TOKEN test, they are compromised by a mild deficit; however imprecisions and substitutions in the phonetic-phonologic planning in reading aloud tasks are still present. A more considerable improvement has been registered in the denomination and comprehension tasks. In conclusion, the deficit of a mild Broca’s aphasia endures. In the following table, A1’s scores in AAT examinations are reported:

(18)

<table>
<thead>
<tr>
<th></th>
<th>26/03/2012</th>
<th>19/06/2012</th>
<th>19/09/2012</th>
<th>27/12/2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Token test</td>
<td>48</td>
<td>54</td>
<td>57</td>
<td>56</td>
</tr>
<tr>
<td>Repetition</td>
<td>39</td>
<td>48</td>
<td>56</td>
<td>55</td>
</tr>
<tr>
<td>Written</td>
<td>48</td>
<td>57</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>Denomination</td>
<td>40</td>
<td>60</td>
<td>57</td>
<td>71</td>
</tr>
<tr>
<td>Comprehension</td>
<td>52</td>
<td>58</td>
<td>63</td>
<td>80</td>
</tr>
</tbody>
</table>
4.6.1.2 A2 status

A2 has been affected since the last year by the effects of a cerebral hemorrhage located in the thalamic-capsular zone. In the acute phase, his status was characterized by not fluent-aphasia with repetition and denomination abilities preserved. However he reflects a progressive recovery. The AAT shows a mild deficit in the repetition task, whilst he shows a better performance in the written part; minimum deficit in morphosyntactic comprehension (Token test). Oral and written production shows similar performances. Overall, A2 was in a context of mild aphasia at the time of the experiment. The following table shows his outcomes at the AAT on 11/02/2013:

<table>
<thead>
<tr>
<th>Test</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Token test:</td>
<td>63</td>
</tr>
<tr>
<td>Repetition:</td>
<td>58</td>
</tr>
<tr>
<td>Written:</td>
<td>63</td>
</tr>
<tr>
<td>Denomination:</td>
<td>77</td>
</tr>
<tr>
<td>Comprehension:</td>
<td>60</td>
</tr>
</tbody>
</table>

4.6.2 The second group: fluent patients

Two other hospitalized subjects were tested. This group is composed by two individuals suffering from fluent aphasia, named F1 and F2. They were native speakers of Italian. F1 was 38 years old at the time of the experiment and had 10 years of education. F2 was 56 years old at the time of the experiment and had 8 years of education.

4.6.2.1 F1 status

He was affected by a severe subarachnoid hemorrhage causing a fluent aphasia with preserved oral comprehension. The fluent oral production is characterized by anomic deficits, semantic, verbal and formal paraphasia and production of neologisms. In the AAT a mild deficit in the denomination task emerged. More severe deficit is shown in written language, while his performance increases in the token test. Finally he suffers from a severe-mild aphasia. The outcomes to the AAT on 18/01/2013 are the following:

<table>
<thead>
<tr>
<th>Test</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Token test:</td>
<td>56</td>
</tr>
<tr>
<td>Repetition:</td>
<td>63</td>
</tr>
<tr>
<td>Written:</td>
<td>61</td>
</tr>
<tr>
<td>Denomination:</td>
<td>55</td>
</tr>
<tr>
<td>Comprehension:</td>
<td>51</td>
</tr>
</tbody>
</table>
4.6.2.2 F2 status

She was affected by the outcomes of a ischemic cerebral stroke located in the left temporal-medial and neural-capsular homolateral, in association with permeability of the patent foramen ovale, a ventricular septal defect. Although she partially healed, F2 is still affected by right hemiparesis, aphasia, and anosognosia, in which a patient with a deficit does not seem aware of his/her condition.

4.6.3 Summary of language impaired subjects

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Gender</th>
<th>Education</th>
<th>Etiology</th>
<th>Lesion</th>
<th>Aphasia</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>55;3</td>
<td>M</td>
<td>18 years</td>
<td>cerebral hemorrhage</td>
<td>Left hemisphere of frontal-parietal lobe</td>
<td>Not fluent</td>
</tr>
<tr>
<td>A2</td>
<td>51;8</td>
<td>M</td>
<td>13 years</td>
<td>cerebral hemorrhage</td>
<td>Thalamic-capsular zone</td>
<td>Not fluent</td>
</tr>
<tr>
<td>F1</td>
<td>51;7</td>
<td>M</td>
<td>13 years</td>
<td>Intracranial hemorrhage</td>
<td>subarachnoid</td>
<td>Fluent</td>
</tr>
<tr>
<td>F2</td>
<td>49;1</td>
<td>F</td>
<td>5 years</td>
<td>cerebral stroke</td>
<td>Left temporal-medial and neural-capsular homolateral</td>
<td>Fluent</td>
</tr>
</tbody>
</table>

4.6.4 The third group: the control group

To assess the validity of the sentence-picture matching task, the control group is composed of five native Italian speakers without language impairment (named C1, C2, C3, C4, C5), who matched in age, gender, and education the individuals of the agrammatic group. They were 44-55 years old (mean age 50;4). They had 5-18 years of education G1 ($M=13.4$).

<table>
<thead>
<tr>
<th></th>
<th>age</th>
<th>gender</th>
<th>education</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>55;3</td>
<td>M</td>
<td>18 years</td>
</tr>
<tr>
<td>C2</td>
<td>51;8</td>
<td>F</td>
<td>13 years</td>
</tr>
<tr>
<td>C3</td>
<td>51;7</td>
<td>M</td>
<td>13 years</td>
</tr>
<tr>
<td>C4</td>
<td>49;1</td>
<td>F</td>
<td>5 years</td>
</tr>
<tr>
<td>C5</td>
<td>44;5</td>
<td>F</td>
<td>18 years</td>
</tr>
</tbody>
</table>
Introduction
In this section of the chapter, agrammatic performance will be analyzed and investigated. First, their quantitative result, the percentages of correctness in reversible and irreversible object relative clauses will be discussed. Second, the influence of number manipulation on their comprehension will be reported and commented. Third, their errors in the picture-sentence matching test will be coded and listed.

4.7 Quantitative results in reversible and irreversible sentences
Subjects’ general performances in reversible and irreversible object relative with embedded preverbal subject are listed. The percentages of correct responses are shown in the following table:

(23)

<table>
<thead>
<tr>
<th></th>
<th>Reversible sentences</th>
<th>Irreversible sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CORRECT</td>
<td>CORRECT</td>
</tr>
<tr>
<td>A1</td>
<td>44/48 91.66 %</td>
<td>48/48 100 %</td>
</tr>
<tr>
<td>A2</td>
<td>38/48 79.16 %</td>
<td>47/48 97.91 %</td>
</tr>
<tr>
<td>F1</td>
<td>45/48 93.75 %</td>
<td>48/48 100 %</td>
</tr>
<tr>
<td>F2</td>
<td>40/48 83.33 %</td>
<td>42/48 87.5 %</td>
</tr>
<tr>
<td>C1</td>
<td>48/48 100 %</td>
<td>48/48 100 %</td>
</tr>
<tr>
<td>C2</td>
<td>48/48 100 %</td>
<td>48/48 100 %</td>
</tr>
<tr>
<td>C3</td>
<td>48/48 100 %</td>
<td>48/48 100 %</td>
</tr>
<tr>
<td>C4</td>
<td>48/48 100 %</td>
<td>48/48 100 %</td>
</tr>
<tr>
<td>C5</td>
<td>48/48 100 %</td>
<td>48/48 100 %</td>
</tr>
</tbody>
</table>

Both irreversible and reversible object relatives show very high percentages of accuracy for all groups. Normal subjects (C1,C2,C3,C4,C5) performed at ceiling (100%) both in irreversible and reversible clauses. A1 (agrammatic subject) and F1 were very close to the ceiling level in reversible clauses.

A1 correct responses were 44/48, equal to the 91.66%, whereas F1 reached the 93.75% of accuracy (correct responses 45/48). Both the subjects performed at ceiling in irreversible sentences.
Although A2 and F2 performed abundantly above chance, lower performances occurred in reversible relatives. A2 failed in 10/48 reversible sentence, which means 79.16% of accuracy, whereas F2 in 8/48, equal to the 83.33% of accuracy.

Note that these last two subjects encountered difficulties even in the irreversible sentences. A2 got wrong one irreversible sentence, whereas F2 registered a lower performance, with 6/48 errors, equal to the 12.5%.

The following bar graph represents the performance of language impaired subjects.

(24)

4.8 Quantitative results in matched/mismatched number features.

In the following table, subjects’ performance in every possible manipulation of the number features is represented. Note that the reversible sentences were divided into 12 SING-SING (both object and subject singular) relative clauses, 12 SING-PLUR (object singular and subject plural) relative clauses, 12 PLUR-SING (object plural and subject singular) relative clauses and 12 PLUR-PLUR (both object and subject plural) relative clauses; the same occurs for the irreversible sentences. The percentages of correct responses (divided for number features) observed in reversible sentences are shown in following table:

(25) Correct answers in Reversible Clauses
A1 made errors only in mismatched features (2 SING-PLUR and 2 PLUR-SING), whereas matched features registered a ceiling performance. He did not make any error in the irreversible sentences.

A2 made several errors in reversible sentences, both in matched (3 SING-SING, 2 PLUR-PLUR) and in mismatched number features (3 PLUR-SING, 2 SING-PLUR). In addition to that, one irreversible sentence with PLUR-SING number features resulted erroneous.

F1 made errors only in mismatched features in reversible sentences (3 SING-PLUR), whereas he reached the ceiling level in the irreversible sentences.

F2 made several errors, not only in reversible sentences (both in the matched features 1 SING-SING, 1 PLUR-PLUR, and in the mismatch features 2 PLUR-SING, 4 SING-PLUR), but also in irreversible relative clauses (3 SING-PLUR and 3 PLUR-PLUR).

(26) The table shows the percentages of correct responses in irreversible sentences:
4.9 Statistical evaluations

Statistical significance was evaluated following the Pearson’s chi-squared test, specifically realizing a chi-squared test on the contingency table, which contains different variables: correct and incorrect responses in reversible sentences and irreversible sentences, correct and incorrect responses in match and mismatch number features.

Regarding the performance of A1, it was statistically significant only for the different behavior in match features (none error) with respect to mismatch number features (4 errors) \([\chi^2 = 4.36, p > 0.03]\). On the contrary, no significant difference was found in the analysis of the correct and incorrect responses in reversible clauses \([\chi^2 = 4.36, p = 0.22]\).

The performance of A2 was not statistically significant. The analysis of correct and incorrect reversible sentences was not significant \([\chi^2 = 0.50, p = 0.91]\), neither was the analysis of the performance in sentences with match and mismatch feature of number \([\chi^2 = 0.50, p = 0.47]\), nor was the analysis of correct and incorrect responses in irreversible sentences \([\chi^2 = 3.06, p = 0.38]\).

F1 performed differently in match (none error) and mismatch features (three errors), showing a tendency for significance \([\chi^2 = 3.2, p > 0.07]\); in addition to that, the analysis of the correct and incorrect responses in reversible clauses resulted significant (F1 made three errors, all in SING-PLUR mismatch condition) \([\chi^2 = 9.6, p > 0.02]\).

F2 made several errors in reversible sentences (1 SING-SING, 2 PLUR-SING, 4 SING-PLUR, 1 PLUR-PLUR), but the analysis of correct and incorrect sentences was not statistically significant \([\chi^2 = 5.88, p = 0.11]\), neither was the analysis of the performance in match and mismatch conditions \([\chi^2 = 1.23, p = 0.26]\), whereas the analysis of correct and incorrect irreversible (3 SING-PLUR and 3 PLUR-PLUR errors) showed a certain tendency for significance \([\chi^2 = 6.85, p > 0.07]\).

(27) The following bar graph represents the patients’ performance in the various constructions of number features in reversible sentences.
4.10 Response analysis

4.10.1 Errors Coding

Participants’ errors were classified into three categories: 1) reversed number features errors; 2) head’s number change errors; 3) Subject-verb agreement errors.

1) Reversed number features errors occurred whenever the indicated picture represents the sentence with reversed number features. Instead of the target (28a), the patient indicated the picture which represents the sentence with the reversed number features, as in (28b):

(28a) Target: tocca l’uomo che i bambini mordono.

Target: Touch the man that the children bite.

(28b) Tocca gli uomini che il bambino morde.

Touch the men that the child bites.

This typology of error occurs in all the impaired language subjects.

2) Head’s number change errors occurred whenever the picture indicated by the subjects represents the sentence with reversed number features only in the head of the relative clause. Instead of the target (29a), the patient indicated the picture which represents the sentence with the head of the relative characterized by reversed number features, as in (29b):

(29a) Target: Tocca il bambino che il papà pettina.

Target: Touch the baby that the father combs.

(29b) Tocca i bambini che il papa pettina.

Touch the babies that the father combs.
This typology of error occurs only in two impaired language subject (A2;F2). In A2 it origins in a match number features condition, whereas in F2 it stems from mismatch features. These subject made the same error in the irreversible sentences as well: A2 in a PLUR-SING relative clause, F2 in 3 SING-PLUR and in 3 PLUR-PLUR features.

3) **Reversed subject-verb agreement errors** occurred when the picture indicated represents the sentence with reversed number features in the subject-verb agreement. Instead of the picture corresponding to (30a), the patient indicated the picture which represents the sentence with reversed number features in the subject-verb agreement, as in (30b):

(30a) Target: Tocca la bambina che la donna saluta.

Target: Touch the baby that the woman greets.

(30b) Tocca la bambina che le donne salutano.

Touch the baby that the women greet.

This typology of error occurs only in one impaired language subject (F2) and it stemmed from the match number features.

**4.10.2 A1 performance**

His errors consisted in choosing the reversed features of number in 2 SING-PLUR and in 2 PLUR-SING reversible clauses.

Instead of the target (31a), the patient indicated the picture which represents the sentence with the reversed number features, as in (31b), in the sentence number 23 (SING-PLUR) of the test:

(31a) Target: tocca l'uomo che i bambini mordono.

Touch the man that the children bite.

(31b) Tocca gli uomini che il bambino morde.

Touch the men that the child bites.

Instead of the target (32a), the patient indicated the picture which represents the sentence with the reversed number features, as in (32b), in the sentence number 29 (PLUR-SING) of the test:
(32a) Tocca le bambine che la ragazza chiama.
    Touch the girls that the woman calls.

(32b) Tocca la bambina che le ragazze chiamano.
    Touch the girl that the women call.

Instead of the target (33a), the patient indicated the picture which represents the sentence with the reversed number features, as in (33b), in the sentence number 39 (SING-PLUR) of the test:

(33a) Tocca l’avversario che i ragazzi battono.
    Touch the adversary that the boys defeat.

(33b) Tocca gli avversari che il ragazzo batte.
    Touch the adversaries that the boy defeats.

Instead of the target (34a), the patient indicated the picture which represents the sentence with the reversed number features, as in (34b), in the sentence number 42 (PLUR-SING) of the test:

(34a) Tocca gli uomini che il prete confessa.
    Touch the men that the priest confesses.

(34b) Tocca l’uomo che i preti confessano.
    Touch the man that the priests confess.

4.10.3 A2 performance

His errors consisted in choosing the reversed features of number in 2 SING-PLUR and in 3 PLUR-SING reversible clauses.

Instead of the target (35a), the patient indicated the picture which represents the sentence with the reversed number features, as in (35b), in the sentence number 4 (PLUR-SING) of the test:

(35a) Tocca le ragazze che la donna trucca.
    Touch the girls that the woman makes up.
(35b) Tocca la ragazza che le donne truccano.
   Touch the girl that the women make up.

Instead of the target (36a), the patient indicated the picture which represents the sentence with the reversed number features, as in (36b), in the sentence number 21 (PLUR-SING) of the test:

   (36a) Tocca i ragazzi che il bambino sporca.
   Touch the boys that the child dirties.

   (36b) Tocca il ragazzo che i bambini sporcano.
   Touch the boy that the children dirty.

Instead of the target (37a), the patient indicated the picture which represents the sentence with the reversed number features, as in (37b), in the sentence number 42 (PLUR-SING) of the test:

   (37a) Tocca gli uomini che il prete confessa.
   Touch the men that the priest confesses.

   (37b) Tocca l’uomo che i preti confessano.
   Touch the man that the priests confess.

Instead of the target (38a), the patient indicated the picture which represents the sentence with the reversed number features, as in (38b), in the sentence number 14 (SING-PLUR) of the test:

   (38a) Tocca l’uomo che i ragazzi minacciano.
   Touch the man that the boys threaten.

   (38b) Tocca gli uomini che il ragazzo minaccia.
   Touch the men that the boy threatens.

Instead of the target (39a), the patient indicated the picture which represents the sentence with the reversed number features, as in (39b), in the sentence number 39 (SING-PLUR) of the test:
(39a) Tocca l’avversario che i ragazzi battono.
   Touch the adversary that the boys defeat.

(39b) Tocca gli avversari che il ragazzo batte.
   Touch the adversaries that the boy defeats.

In addition to that, he made errors in 3 SING-SING and 2 PLUR-PLUR match condition of reversible clauses as well, indicating a plural object in SING-SING sentences and a singular object in spite of the PLUR-PLUR condition.

Instead of the target (40a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from SING to PLUR), as in (40b), in the sentence number 12 (SING-SING) of the test:

(40a) Tocca il bambino che il papà pettina.
   Touch the baby that the father combs.

(40b) Tocca i bambini che il papa pettina.
   Touch the babies that the father combs.

Instead of the target (41a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from SING to PLUR), as in (41b), in the sentence number 26 (SING-SING) of the test:

(41a) Tocca il bambino che il papà lava.
   Touch the baby that the father washes.

(41b) Tocca i bambini che il papà lava.
   Touch the babies that the father washes.

Instead of the target (42a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from SING to PLUR), as in (42b), in the sentence number 43 (SING-SING) of the test:

(42a) Tocca l’uomo che il bambino spia.
   Touch the man that the child spies.
(42b) Tocca gli uomini che il bambino spia.
   Touch the men that the child spies.

Instead of the target (43a), the patient indicated the picture which represents
the sentence with the changed number feature in the head of the relative (from
PLUR to SING), as in (43b), in the sentence number 7 (PLUR-PLUR) of the test:

(43a) Tocca le nonne che le bambine spingono.
   Touch the grandmothers that the children push.

(43b) Tocca la nonna che le ragazze spingono.
   Touch the grandmothers that the girls push.

Instead of the target (44a), the patient indicated the picture which represents
the sentence with the changed number feature in the head of the relative (from
PLUR to SING), as in (44b), in the sentence number 20 (PLUR-PLUR) of the
test:

(44a) Tocca le bambine che le commesse consigliano.
   Touch the babies that the customer assistant suggest.

(44b) Tocca la bambina che le commesse consigliano.
   Touch the baby that the customer assistant suggest.

Finally, he made an error even in irreversible clauses, indicating for the sentence
91 (PLUR-SING) the picture representing SING-SING features. Instead of the
target (45a), the patient indicated the picture which represents the sentence with
the changed number feature in the head of the relative (from PLUR to SING), as
in (45b), in the sentence number 91 (PLUR-SING) of the test:

(45a) Target: gli alberi che il contadino taglia.
   Target: the trees that the farmer cuts.

(45b) L’albero che il contadino taglia.
   The tree that the farmer cuts
4.10.4 F1 performance

His errors consisted in choosing the reversed features of number in 3 SING-PLUR reversible clauses.

Instead of the target (46a), the patient indicated the picture which represents the sentence with the reversed number features, as in (46b), in the sentence number 14 (SING-PLUR) of the test:

(46a) Tocca l’uomo che i ragazzi minacciano.
      Touch the man that the boys threaten.

(46b) Tocca gli uomini che il ragazzo minaccia.
      Touch the men that the boy threatens.

Instead of the target (47a), the patient indicated the picture which represents the sentence with the reversed number features, as in (47b), in the sentence number 23 (SING-PLUR) of the test:

(47a) Target: tocca l’uomo che i bambini mordono.
      Touch the man that the children bite.

(47b) Tocca gli uomini che il bambino morde.
      Touch the men that the child bites.

Instead of the target (48a), the patient indicated the picture which represents the sentence with the reversed number features, as in (48b), in the sentence number 45 (SING-PLUR) of the test:

(48a) Tocca la suora che le ragazze guardano.
      Touch the nun that the girls look at.

(48b) Tocca le suore che la ragazza guarda.
      Touch the nuns that the girl looks at.
4.10.5 F2 performance

Her errors consisted in choosing the reversed features of number in 2 SING-PLUR, in choosing the PLUR-PLUR condition instead of the correct SING-PLUR in two occasions, and in choosing the reversed features of number in 2 PLUR-SING reversible clauses.

Instead of the target (49a), the patient indicated the picture which represents the sentence with the reversed number features, as in (49b), in the sentence number 5 (SING-PLUR) of the test:

(49a) Tocca la cantante che le ragazze ascoltano.
   Touch the singer that the girls listen to.

(49b) Tocca le cantanti che la ragazza ascolta.
   Touch the singers that the girl listens to.

Instead of the target (50a), the patient indicated the picture which represents the sentence with the reversed number features, as in (50b), in the sentence number 14 (SING-PLUR) of the test:

(50a) Tocca l’uomo che i ragazzi minacciano.
   Touch the man that the boys threaten.

(50b) Tocca gli uomini che il ragazzo minaccia.
   Touch the men that the boy threatens.

Instead of the target (51a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from SING to PLUR), as in (51b), in the sentence number 9 (SING-PLUR) of the test:

(51a) Tocca il ragazzo che i professori rimproverano.
   Touch the boy that the professors scold.

(51b) Tocca i ragazzi che i professori rimproverano.
   Touch the boys that the professors scold.
Instead of the target (52a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from SING to PLUR), as in (52b), in the sentence number 45 (SING-PLUR) of the test:

(52a) Tocca la suora che le ragazze guardano.
Touch the nun that the girls look at.

(52b) Tocca le suore che le ragazze guardano.
Touch the nuns that the girls look at.

Instead of the target (53a), the patient indicated the picture which represents the sentence with the reversed number features, as in (53b), in the sentence number 13 (PLUR-SING) of the test:

(53a) Tocca le bambine che la ragazza copre.
Touch the babies that the girl covers.

(53b) Tocca la bambina che le ragazze coprono
Touch the baby that the girls cover.

Instead of the target (54a), the patient indicated the picture which represents the sentence with the reversed number features, as in (54b), in the sentence number 33 (PLUR-SING) of the test:

(54a) Tocca i bambini che il papà rimprovera.
Touch the children that the father scolds.

(54b) Tocca il bambino che i papà rimproverano.
Touch the child that the fathers scold.

In addition to that, she made errors in 1 SING-SING and 1 PLUR-PLUR match condition of reversible clauses as well, indicating a plural subject in SING-SING sentence and indicating a singular subject in spite of the PLUR-PLUR condition. Instead of the target (55a), the patient indicated the picture which represents the sentence with the change in the subject-verb agreement number, as in (55b), in the sentence number 1 (SING-SING) of the test:
Instead of the target (56a), the patient indicated the picture which represents the sentence with the change in the subject-verb agreement number, as in (56b), in the sentence number 20 (PLUR-PLUR) of the test:

(56a) Tocca le bambine che le commesse consigliano.
    Touch the babies that the customer assistants advice.

(56b) Tocca le bambine che la commessa consiglia.
    Touch the babies that the customer assistant advices.

Finally, she made errors even in irreversible clauses; specifically in 3 SING-PLUR (she indicated PLUR-PLUR) and in 3 PLUR-PLUR (she indicated SING-PLUR).

Instead of the target (57a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from SING to PLUR), as in (57b), in the sentence number 52 (SING-PLUR) of the test:

(57a) Tocca l’ostacolo che gli uomini saltano.
    Touch the obstacle that the men jump.

(57b) Tocca gli ostacoli che gli uomini saltano.
    Touch the obstacles that the men jump.

Instead of the target (58a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from PLUR to SING), as in (58b), in the sentence number 54 (PLUR-PLUR) of the test:

(58a) Tocca le scarpe che le bambine allacciano.
    Touch the shoes that the babies tie.
(58b) Tocca la scarpa che le bambine allacciano.
    Touch the shoe that the babies tie.

Instead of the target (59a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from PLUR to SING), as in (59b), in the sentence number 58 (PLUR-PLUR) of the test:

(59a) Tocca i limoni che gli uomini raccogliono.
    Touch the lemons that the men harvest.

(59b) Tocca il limone che gli uomini raccogliono.
    Touch the lemon that the men harvest.

Instead of the target (60a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from SING to PLUR), as in (60b), in the sentence number 74 (SING-PLUR) of the test:

(60a) Tocca il regalo che i ragazzi portano.
    Touch the present that the boys carry.

(60b) Tocca i regali che i ragazzi portano.
    Touch the presents that the boys carry.

Instead of the target (61a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from PLUR to SING), as in (61b), in the sentence number 84 (PLUR-PLUR) of the test:

(61a) Tocca i rami che gli uomini prendono.
    Touch the branches that the men take.

(61b) Tocca il ramo che gli uomini prendono.
    Touch the branch that the men take.
Instead of the target (62a), the patient indicated the picture which represents the sentence with the changed number feature in the head of the relative (from SING to PLUR), as in (62b), in the sentence number 94 (SING-PLUR) of the test:

(62a) Tocca il cancello che i bambini pitturano.
   Touch the gate that the babies paint.

(62b) Tocca i cancelli che i bambini pitturano.
   Touch the gates that the babies paint.

4.11 Errors analysis

In this section, I sum up the errors that occurred in the performance of the language impaired subjects. Errors were classified in: 1) reversed number features errors; 2) head’s number change errors; 3) Reversed Subject-verb agreement errors.

➢ A1 made only reversed number features errors:

2 SING-PLUR ➔ PLUR-SING
2 PLUR-SING ➔ SING-PLUR

➢ A2 made reversed number features errors:

2 SING-PLUR ➔ PLUR-SING
3 PLUR-SING ➔ SING-PLUR

and head’s number change errors:

3 SING-SING ➔ PLUR-SING
2 PLUR-PLUR ➔ SING-PLUR
1 PLUR-SING (Irreversible sentence) ➔ SING-SING

➢ F1 made only reversed number features errors:

3 SING-PLUR ➔ PLUR-SING
F2 made reversed number features errors:

2 SING-PLUR ➔ PLUR-SING
2 PLUR-SING ➔ SING-PLUR

and head’s number change errors:

2 SING-PLUR ➔ PLUR-PLUR
3 SING-PLUR (Irreversible sentences) ➔ PLUR-PLUR
3 PLUR-PLUR (Irreversible sentences) ➔ PLUR-PLUR

and Reversed subject-verb agreement errors:

1 SING-SING ➔ SING-PLUR
1 PLUR-PLUR ➔ PLUR-SING

Conclusions

This chapter dealt with the description of the test and the performance of impaired language subjects. We have seen that the test was composed of reversible and irreversible object relative clauses with embedded preverbal subject. Number features were manipulated in order to verify whether they influence subjects comprehension of these sentences. Hence, for each sentence a paper with four images was presented: only one picture corresponds to the sentence heard, the other three present erroneous number features. Images are colored and placed symmetrically in the paper to avoid any effect of prominence.

Three different populations participated in this task: the first group was composed by two individuals with agrammatism. The second group was composed of two individuals suffering from fluent aphasia. To assess the validity of the sentence-picture matching task, the control group is composed of five native Italian speakers without language impairment, who matched in age, gender, and education the aphasic individuals.

Results were clear enough: both irreversible and reversible object relatives show very high percentages of accuracy for all groups. Normal subjects performed at ceiling (100%) both in irreversible and reversible clauses. A1 and F1 were very close to the ceiling level in reversible clauses (100% of accuracy in irreversible clauses).
Although A2 and F2 performed abundantly above chance, they registered lower performances in reversible relatives and encountered difficulties even in the irreversible sentences.

Importantly, mismatch features (SING-PLUR and PLUR-SING) resulted the most complex conditions for all experimental subjects, who made several errors in computing mismatched number.

Participants’ errors were classified into three categories: reversed number features errors (made by A1, A2, F1, F2); head’s number change errors (made by A2, F2); Subject-verb agreement errors (only made by F2).

Outcomes revealed an implicational relationship of number features’ errors in the patients (subject-verb agreement’s Number change > head’s Number change > reversed Number). Given that the Number of subject-verb agreement is the most stable feature and checked twice, if it is subject to modification, the other two typologies of errors will also occur. Indeed, if a patient changes the number of subject-verb agreement, he will also make the other two typologies of errors, as occurred in F2.
CHAPTER 5
Discussion

Introduction
In this chapter I will attempt to give some explanations regarding the errors occurred in subjects’ performance.

To sum up, we have classified the errors into three categories:

1) *Reversed number features errors* occurred whenever the picture chosen by the patients represents the sentence with reversed number features, instead of the target:

   (1a) Target: tocca l’uomo che i bambini mordono.
       Touch the man that the children bite.

   (1b) Tocca gli uomini che il bambino morde.
       Touch the men that the child bites.

   This typology of error occurs in all impaired language subjects.

2) *Head’s number change errors* occurred whenever the picture pointed to by the subjects represents the sentence with reversed number features only in the head of the relative clause.

   (2a) Target: Tocca il bambino che il papà pettina.
       Touch the baby that the father combs.

   (2b) Tocca i bambini che il papà pettina.
       Touch the babies that the father combs.

   This typology of error occurs only in two impaired language subject (A2;F2). In A2 it is found in the match number features condition, whereas in F2 it occurred in mismatch features. These subjects made the same error in the irreversible sentences as well: A2 in a PLUR-SING relative clauses, F2 in 3 SING-PLUR and in 3 PLUR-PLUR relative sentences.

3) *Reversed subject-verb agreement errors* occurred when the picture indicated represents the sentence with reversed number features in the subject-verb agreement:
(3a) Target: Tocca la bambina che la donna saluta.
   Target: Touch the baby that the woman greets.

(3b) Tocca la bambina che le donne salutano.
   Touch the baby that the women greet.

This typology of error occurs only in one impaired language subject (F2) and it stemmed from the match number features.

5.1 First typology: Reversed number features errors

5.1.1 First typology: Reversed number features errors (SING-PLUR)

In this section I will interpret the error in the following sentence:

(4) Tocca l’uomo che i bambini mordono → gli uomini che il bambino morde.
   Touch the man that the children bite → the men that the child bites.

Some preliminary considerations:

This typology of error has been made by all the impaired language subjects. It can be hypothesized that the SING-PLUR mismatch is the most expensive one in terms of computational cost.

Following Ferrari’s proposal, which stated that the projection of number is realized only in the plural, sentences such as the following would be computationally expensive to process, and subject to errors.

(5) [+Num] [+Num]
   SING-PLUR: Object….. Subject….. verb…..
   [+Num]
   PLUR-SING: Object….. Subject….. verb…..

Similar difficulties have been encountered by cochlear implanted children (see Volpato 2008, 2010), whereas this mismatch number feature condition represents the “simplest” to process in normal subjects: the strength of the subject-verb agreement and the marked plural encoded on the subject and verb of the relative clause help them to recognize the correct thematic roles.

This error could be interpreted as a direct influence of the object’s number features over the subject-verb agreement. Indeed, Vigliocco & Nicol (1998) proved that it is the hierarchical position to be responsible for attraction, not the surface order. In line with this study, Franck, Vigliocco & Nicol (2002) found
that the higher a local noun is placed in the syntactic tree, the higher is its power of attraction; the lower it is located, the lower is its attractive force; namely, the local noun with the greatest attractive power is the farthest from the verb.

In the following sentences, three nouns are inserted: a head noun (computer), an intermediate (program) and a local noun (experiment) (FRANCK, VIGLIOCO & NICOL, 2002:381).

(6a) L’ordinateur avec le programme des expériences  
The computer with the program of the experiments
(6b) L’ordinateur avec les programmes de l’expérience  
The computer with the programs of the experiment

Remarkably, they found that the establishment of subject–verb agreement was not influenced by the local noun (experiment), but rather by the intermediate noun (program), placed farther from the verb.

Similarly, FRANCK et al. (2006) have shown that the object in cleft sentences can interfere with subject-verb agreement. In OSV (7a) and OVS (7b) sentences attraction effect were found, although it emerged that the object final position could not interfere with the subject-verb agreement (FRANCK et al. 2006:195):

(7a) C’est les négociations que le ministre suspend  
It’s the negotiations that the minister stop
(7b) C’est les négociations que suspend le ministre  
It’s the negotiations that stop the minister

To explain this pattern, the object is claimed to occupy an intermediate position (AgrO) during its step-by-step movement, located within the relation of the subject-verb agreement. Being placed between AgrS and the merge position of the subject (specVP), this object intermediate position can influence the relation of AGREE between the subject and AgrS. Hence, SpecAgrO intervenes both linearly and hierarchically on AGREE (FRANCK et al. 2006:195) (see Chapter 3, section 3.12).

This position conditions the establishment of AGREE especially in OVS sentences, whose subject-verb agreement is not further checked by the spec-head relation. Fewer attraction effects were found in OSV sentences, in which the spec-
head relation takes place (since the subject moves to specAgrS), and further checks the subject-verb agreement (see Chapter 3, section 3.12).

Hence, the object would interfere both in OVS and in OSV sentences. Nevertheless, if the spec-head relation also takes place (in OSV), it checks and corrects contingent agreement errors, whereas where it does not occur (in OVS), the influence of the object’s features is even stronger.

In addition to that, KAYNE (1989) argued that an unmarked head (plural in English; singular in Italian) can attract a verb bearing unmarked features (plural in English; singular in Italian), as in the case in question (Tocca l’uomo che il bambino morde “Touch the man that the children bites”) (see Chapter 3, section 3.13).

Thus, the singular object l’uomo “the man” can attract the verb. For Italian, It has been found that even a marked verb can be attracted by a unmarked head in the case of language impairment (CHINELLATO 2004; VOLPATO 2010), since the verb can be underspecified for plural morphology.

(8) unmarked head (singular in Italian; plural in English)
    ↓ ATTRACTION ↓
unmarked verb (singular in Italian; plural in English)   marked verb (plural in Italian; singular in English) in case of language impairment

However, language impaired subjects (A1, A2, F2) failed also in PLUR-SING sentences, leading us to hypothesize that even a marked (plural) head could attract a unmarked (singular) verb (see below section 5.1.2)

Either for reduced processing capacities or for an intermittent ability, agrammatics would rely on the linear order of the sentence, interpreting the object/patient as the subject/agent of the action and a wrong object-verb agreement would occur.
The agrammatic process of comprehension

At the beginning of the derivation, AgrS is still underspecified for number and gender. Its features are valued by the subject, placed in specVP, through the relation of AGREE (9).

(9)  
\[
\begin{array}{c}
\text{CP} \\
C' \\
C \\
\text{AgrSP} \\
\text{AgrS'} \\
\text{AgrS} \\
\text{[+p]} \\
\text{[+Num]} \\
\text{AGREE} \\
\text{I bambini} \\
\text{mordono} \\
\text{l'uomo} \\
\text{V'} \\
\text{VP} \\
\text{AgrO'} \\
\text{AgrO} \\
\text{V'} \\
\text{I uomo} \\
\text{t_i} \\
\text{AgrS} \\
\text{AgrS'} \\
\text{AgrS} \\
\text{AgrOP} \\
\text{[+Num]} \\
\end{array}
\]

However, the movement of the object to the intermediate position specAgrOP interferes with the establishing of AGREE, since this position is located between AgrS and specVP (10).

(10)  
\[
\begin{array}{c}
\text{CP} \\
C' \\
C \\
\text{AgrSP} \\
\text{AgrS'} \\
\text{AgrS} \\
\text{[+Num]} \\
\text{I uomo} \\
\text{mordono} \\
\text{l'uomo} \\
\text{V'} \\
\text{VP} \\
\text{AgrO'} \\
\text{AgrO} \\
\text{V'} \\
\text{I bambini} \\
\end{array}
\]

As consequence of this interference, AGREE does not bear the features of the subject. Hence, after having been moved to AgrS, the verb checks the object’s features, instead of receiving the canonical inflectional specification.
In this account, the relation of spec-head between the moved subject in specAgrSP and the verb in AgrS assumes the function of a further checking of the subject-verb agreement, given that they carry different features (11).

During the establishment of the Spec-Head relation, the extra feature of marked number is removed from the subject-verb agreement, and it merges with the object, the only element that can receive it. Finally, the object moves to specCP, its final position, whereas the complementizer merges as the head of this projection (12).

However, after the establishment of the spec-head relation, the projection of number could be simply deleted. Hence, the object would incur in RM effects during its final movement to specCP, as it occurs in the following typologies of
GRILLO (2005) argued that impoverished syntactic abilities leads to an underspecification of the morphosyntactic features, causing minimality effects.

GARRAFFA & GRILLO (2007) hypothesized that structures characterized by a movement through an intervening NP are more complex to process and thus more likely to be compromised. Structures derived by movement over an intervening NP will be performed at chance level, while structures which do not involve any intervening NP will be correctly comprehended (GARRAFFA & GRILLO 2007:7).

In the case in question, not being completely computed, the subject and the object would share the same values and minimality effects would occur:

(13)
+ [Num]
NP NP NP
[< the men> that [the baby bites <the man>]]

To avoid any interference, agrammatics would differentiate the two DPs by adding a number projection on the object, given that subject-verb agreement should not be modified, being strictly preserved by the spec-head relation.

Hence, agrammatic syntactic capacities cannot be claimed to be definitively compromised, otherwise it should not be possible to add or to delete number features. I hypothesize that number features would be computed in the sentence derivation, but they would be characterized by an extreme precarious status and subject to modifications due to attraction.

5.1.2 First typology: Reversed number features errors (PLUR-SING)

In this section, reversed number features errors in the other mismatch number condition will be explained:

(14) tocca le bambine che la ragazza chiama → la bambina che le ragazze chiamano

This error has also been interpreted as the interference of object’s features over the subject-verb agreement.

Contrarily to what KAYNE suggests (1989), attraction seems to arise even from a marked object. However, note that this phenomenon is not canonical, and it
never occurs in subjects without language impairment. Syntactically, it could be a consequence of agrammatic linear interpretation, which assigns the function of subject to the first DP, regardless of the thematic roles.

Several psycholinguistic theories do attribute agrammatic delay to a specific weakness of the syntactic module. The *Weak syntax* (Avrutin, 2006) or *Slow-syntax model* (Burkhardt, 2008) predicts that agrammatics neither lose the necessary abilities to build the syntactic structure nor do they suffer from a reduction of resources.

Hence, agrammatic impairment would depend on delayed syntactic operations; that is, the formation of syntactic structure would not be completed in time. Consequently, they would be forced to choose extra-syntactic principles in the interpretation of the sentence, relying on the linear order of the sentence to assign roles.

In addition to that, there are accounts that conceive resource reduction as an impairment in cognitive processes, stemming from reductions in verbal working memory (Caplan 2007:108). Although it has not been confirmed that working memory is directly involved in syntactic processing, reductions in this mechanism could generate comprehension disorders (difficulties with the re-assigning of meanings and with the elaboration of meanings derived from the comprehension process have been found) (Caplan 2007:108).

These deficits may influence aphasic performance, since they combine with other specific impairments, for example a delayed processing (caused by slowed activation or fast decay of syntactic representation) (Caplan 2007:108).

Accuracy, reaction time, and other tasks variables mirrored the increment of psycholinguistic load contained in more complex sentences, corroborating the assumption that object relatives are more difficult to compute than subject relatives. The higher computational cost would stem from the verb of the embedded clause, which requires more resources with respect to that of active sentences, analogously to the verb of passive sentences.

Hence, because of the linear interpretation of the thematic roles and because of an intermittent or delayed computation of number features, the DP object would interfere with the establishment of AGREE even in this case.
In addition to that, agrammatic subjects could be more sensible to interference exerted by the object intermediate position (specAgrOP), given that it is located within the subject-AgrS relation (15).

(15)

As consequence of this interference, AGREE is again established under the features of the object. After the movement to the head of AgrSP, the verb checks these features and again the relation of spec-head assumes the function of a further checking of the subject-verb agreement, given that these elements carry different features (16).

(16)
During the formation of Spec-Head between the subject and the verb, a feature of marked number is merged on the former to restore agreement. Note that this is not the most economical strategy, since the creation of another number projection should overcome the patients’ computational abilities. It follows that number features cannot be underspecified, otherwise they would have been deleted from the representation.

I argue that agrammatic subjects would be affected by an intermittent access to syntactic abilities, as CAPLAN (2007) predicted. Suffering from an intermittent resources reduction (caused by the slower speed of activation or the rapid decay of syntactic representations), they would be occasionally prevented from assigning roles and interpreting sentences on-line. Remarkably, these reductions would vary in severity and frequency of occurrence from one subject to another. Hence, the origin of their deficit lies in an intermittent functioning of the parsing/interpretive mechanism because of resource reduction; this mechanism seems to fails more frequently in sentences which require a higher computational cost (CAPLAN 2007:145).

However, after the establishing of the spec-head relation a overabundance of NumP occurs:

\[
\text{This overabundance of number projections could overwhelm the patients’ processing ability, and relativized minimality effects can be expected, given that the DP object has to cross over the subject to reach the CP node.}
\]

Indeed, GRILLO (2005) argued that an impoverished ability to process syntactic information leads to underspecify the morphosyntactic features; minimality effects would be consequent to that deficit, depending on whether the intervening element belongs to the same class (with the same features set) as the other NPs.
Agrammatics could have difficulties whenever a sentence contains a NP crossing over a similar one (GRILLO 2005:115).

Hence, minimality effects occurs since the subject and the object share the same features:

\[
\begin{array}{ccc}
\text{[NumP]} & \text{[NumP]} & \text{[NumP]} \\
\text{NP} & \text{NP} & \text{NP} \\
\langle \text{the children} \rangle & \langle \text{the girls call } \langle \text{the children} \rangle \rangle & \end{array}
\]

To avoid RM effect, agrammatic subjects would differentiate the two DPs, deleting the weaker number projection (encoded on the object), whereas the [NumP] associated with the subject cannot be eliminated, being strictly preserved by the spec-head relation.

\[
\begin{array}{c}
\text{CP} \\
\text{La bambina} \\
\text{che} \\
\text{AgrSP} \\
\text{spec-head} \\
\text{le ragazze} \\
\text{AgrS'} \\
\text{AgrS} \\
\text{AgrOP} \\
\text{chiamano} \\
\text{le bambine} \\
\text{AgrO'} \\
\text{AgrO} \\
\text{VP} \\
\text{t_1} \\
\text{t_2} \\
\text{t_o} \\
\text{V'} \\
\end{array}
\]

Finally, the object would reach its final position, specCP, whose head is occupied by the complementizer.

5.2 Second typology: head’s number change errors

5.2.1 Second typology: head’s number change errors (SING-SING)

I will examine the second typology of errors noticed in our test. Differently from the first typology, the head’s number change error was made only by the most seriously injured subjects (A2 and F2), and it occurs in all the possible manipulations of number features.

Regarding reversible sentences, A2 made this kind of errors in both the matched number feature (SING-SING and PLUR-PLUR), whereas F2 only in one
mismatched condition (SING-PLUR). A glance at irreversible sentences reveals that the former made one error in PLUR-SING condition, the latter got wrong in PLUR-PLUR and SING-PLUR number features.

In this section I will analyze the head’s number change errors in the first match condition of number (SING-SING):

\[(20) \quad \text{SING} \quad \text{SING} \quad \text{PLUR} \quad \text{SING} \]

Tocca il bambino che il papà pettina → Tocca i bambini che il papà pettina.

Touch the baby that the father combs → Touch the babies that the father combs

Note that this error was made only by one subject (A2) characterized by a lower level of comprehension ability than A1 and F1.

This error has two possible interpretations: 1) the influence of the object’s features on the subject-verb agreement; 2) a consequence of RM effects.

Thus, the singular DP object *il bambino* “the man” can attract the verb which carries the same number feature. Indeed, a unmarked head can attract a verb bearing unmarked features (KAYNE 1989).

Nevertheless, differently from the errors of the first typology, the attraction of the object does not cause any change of number features, since both DPs share the same Number. Hence, even if AGREE is established under the interference of the object, it still mirrors the values of the subject.
Despite the fact that the verb carries the object’s features, to establish the spec-head relation does not require any deletion or addition of number features.

\[
\text{CP} \\
\downarrow \\
\text{C'} \\
\downarrow \\
\text{AgrSP} \quad \text{spec-head} \\
\downarrow \\
\text{Il papà} \\
\downarrow \\
\text{AgrS'} \\
\downarrow \\
\text{AgrS} \\
\downarrow \\
\text{AgrOP} \\
\downarrow \\
\text{pettina} \\
\downarrow \\
\text{il bambino} \\
\downarrow \\
\text{AgrO'} \\
\downarrow \\
\text{AgrO} \\
\downarrow \\
\text{VP} \\
\downarrow \\
\text{t}_s \\
\downarrow \\
\text{t}_v \\
\downarrow \\
\text{V'} \\
\downarrow \\
\text{t}_o
\]

(22)

However, during its movement to specCP the object crosses over the subject, then causing RM effects, given that the two elements actually share the same number features:

\[
\text{NP} \quad \text{NP} \quad \text{NP} \\
\text{[< the child> that < the father combs < the child> ]}
\]

(23)

To avoid any interference, the agrammatic subject would differentiate the two DPs by adding a Num projection on the object, which carries the “weaker” number projection. Whereas in the previous strategy, agrammatic subjects deleted the number feature from the object, in this case we deal with the addition of the number projection, indeed a not economical operation.

\[
\text{CP} \\
\downarrow \\
\text{I bambini} \\
\downarrow \\
\text{Che} \\
\downarrow \\
\text{Il papà} \\
\downarrow \\
\text{AgrS'} \\
\downarrow \\
\text{AgrS} \\
\downarrow \\
\text{AgrOP} \\
\downarrow \\
\text{pettina} \\
\downarrow \\
\text{il bambino} \\
\downarrow \\
\text{AgrO'} \\
\downarrow \\
\text{AgrO} \\
\downarrow \\
\text{VP} \\
\downarrow \\
\text{ts} \\
\downarrow \\
\text{t}_s \\
\downarrow \\
\text{t}_v \\
\downarrow \\
\text{V'} \\
\downarrow \\
\text{t}_o
\]

(24)
Again, agrammatic syntactic capacities cannot be claimed to be definitively compromised, otherwise the addition or deletion of number features could not be possible.

Hence, number features would be computed in the sentence derivation but they would be characterized by an extreme precariousness and subject to modifications.

5.2.2 Second typology: head’s number change errors (PLUR-PLUR)

In this section I will interpret the head’s number change errors in the second match condition of number (PLUR-PLUR):

(25)                 PLUR     PLUR
                        Tocca le nonne che le bambine spingono
                        Touch the grandmothers that the children push

                        SING  \rightarrow  PLUR
                        Tocca la nonna che le bambine spingono
                        Touch the grandmother that the children push.

Note that this error was made only by the most impaired subjects, A2 (in reversible sentence) and F2 (in irreversible sentence). Again, this error can occur either for the influence of the object’s features on the subject-verb agreement or it can be as a consequence of relativized minimality.

However, remind that the attraction that arises from a marked object is a not canonical phenomenon, and it never occurs in subjects without language impairment.

In any case, as in the previous typology of error, the object’s attraction (if it occurs) does not cause any change of number features, since both DPs share the same Number.

Hence, even if AGREE is established under the interference of the object, it checks the values of the subject.
Despite the fact that the verb carries the object’s features, the establishment of the spec-head relation does not require any deletion or addition of number features.

After establishing the spec-head relation, the overabundance of NumP causes problem of relativized minimality, since the object during its movement to specCP has to cross the DP subject:
To avoid any RM effects, agrammatics would differentiate the two DPs, deleting the weaker Num projection, which is encoded on the object. Finally, the object would reach its final position, specCP, whose head is occupied by the complementizer.

A similar pattern is assumed to occur in F2 erroneous irreversible sentences. However, note that an error in irreversible sentences is a more serious symptom of a cognitive deficit, since the dissociation between animacy/object should constitute an essential syntactic cue for the correct interpretation of the sentence.

5.2.3 Second typology: head’s number change errors (SING-PLUR)

In this section I will interpret the head’s number change errors in the first mismatch condition of number (SING-PLUR):

(30)  SING       PLUR       PLUR       PLUR
      la cantante che le ragazze ascoltano → le cantanti che le ragazze ascoltano
      the singer  that   the girls   listen to → the singers that the girls   listen to

Remarkably, this error was made only by the most impaired subject (F2), both in reversible and irreversible sentences. Differently to previous errors, this one has not been interpreted as a direct influence of the object’s features on the subject-verb agreement. Indeed, it is the subject’s features that exercise their influence on the object during its final movement to specCP, not the contrary.

Attraction would not occur in this case, and F2 would correctly compute the sentence as normal subjects do.
Note that this pattern is not expected, since in other occasions (with the same SING-PLUR mismatch condition) the establishment of AGREE was influenced by the intervention of the object. Indeed, in 2 SING-PLUR sentences the number feature was inverted.

Nevertheless, after the establishment of the Spec-Head relation, the movement of the object across the subject causes RM effects, even in condition of mismatched number features between the two DPs:

\[
\text{NP} \quad \text{NumP, NP} \quad \text{NP} \quad \text{[< the singer> that <the girls listen to <the singer>]} \quad (33)
\]
Clearly, this behavior cannot be completely explained; given that the two NPs differ in terms of number features, they should be easily differentiated.

On the contrary, the RM effect occurs even in this case, with the number of the subject encoded on the object. This pattern can be partially explained by assuming that the language-impaired subject has consumed all his computational resources in the establishment of AGREE and spec-head agreement. Hence, when the object crosses the other DP, the computational cost to maintain the two NPs differentiated overwhelms his resources, and the number features of subject-verb agreement would be merged on the values of the DP object.

Remarkably, only F2 made the same errors even in irreversible sentences. Hence, a similar explanation is assumed to comment this pattern. However, note that an error in irreversible sentences is a serious symptom of a cognitive deficit, since the dissociation between animacy/object should constitute an essential syntactic cue for the correct sentence interpretation.

5.2.4 Second typology: head’s number change errors (PLUR-SING)

Agrammatic subject A2 made one similar error in irreversible sentences, changing the number of the head, and passing from a mismatch condition (PLUR-SING) to matched number features (SING-SING). Again, once processing capacities have been consumed, the mismatch condition between the subject and the object would be not sufficient to differentiate these DPs and the number of the latter would be influenced by the values of the former.
5.3 Third typology: reversed subject-verb agreement errors (SING-SING; PLUR-PLUR)

In this section I will interpret the change of subject-verb number agreement in both the matched conditions of number (SING-SING and PLUR-PLUR). Remarkably, these errors occurred only in F2, the most impaired subject. In effect, the change of number in the subject-verb agreement was totally unexpected.

(35a)  

SING    SING    SING    PLUR

Tocca la bambina che la donna saluta → tocca la bambina che le donne salutano

Touch the baby that the woman greets → Touch the baby that the women greet

(35b)  

PLUR    PLUR

Tocca le bambine che le commesse consigliano.

Touch the babies that the customer assistants advise.

PLUR    SING

Tocca le bambine che la commessa consiglia.

Touch the babies that the costumer assistant advises.

These errors can be explained as a consequence of RM effects:

(36a)  

NP  NP  NP

[<the baby> that [the woman greets <the baby>]]

(36b)  

NP  NP  NP

[<the babies> that [the customer assistants advice <the babies>]]

As has been said previously, GRILLO (2005) claimed that an impoverished ability to process syntactic information can cause the underspecification of the morphosyntactic features; as a consequence of this deficit, minimality effects would arise, since the intervening element would actually belong to the same morphological class of the other NPs.
It follows that language impaired subjects could have difficulties whenever a sentence contains a NP crossing another similar one (GRILLO 2005:115).

In addition to that, GARRAFFA & GRILLO (2007) hypothesized that structures characterized by a movement through an intervening NP are more complex to process and thus more likely to be compromised.

In this case, F2 would even change the number of the subject-verb agreement just to avoid the match of number feature. Clearly not economical, this strategy has been used only twice and only by this patient. This non canonical strategy could be explained as a temporary computational black-out which would prevent the comprehension of the sentence, forcing to assign the thematic roles randomly. In this case, the Weak syntax model cannot account for this not-expected pattern, which definitely stems from reduced processing capacities.

5.4 General discussion

The following discussion has the purpose to explain the performance of language impaired subjects in the light of the most recent syntactic and psycholinguistic theories. Syntactically, this discussion is based on the assumptions of FERRARI (2005), FRANCK et al. (2006), GRILLO (2005).

In her study, FERRARI stated that Number projection is realized only in the presence of plural features, leading to the hypothesis that mismatched number feature could be more complex to process in case of language impairment (as indeed found by CHINELLATO 2004 for agrammatic subjects and VOLPATO 2008, 2010 for hearing-impaired and cochlear implanted children).

Conversely, ADANI et al. (2010) revealed that in normal subjects the mismatch of number features facilitates the comprehension of thematic roles, and the possibility of intervention (interpreted as lexical restriction) decreases.

In line with these previous studies, the aim of this paper was to further investigate the role of number features for the agrammatic comprehension of object relative clauses with an embedded preverbal subject.

Contrarily to our predictions, the results of the test show that the mismatch condition of number features is the most impaired (SING-PLUR; PLUR-SING), in which all the language impaired subjects made several errors (incorrect responses: A1 4/24; A2 5/24; F1 3/24; F2 6/24).
The match condition of number feature presented errors only in A2 and F2 (A2 \( 2^{1/24} \); F2 \( 2^{1/24} \)), the subjects with lower level of comprehension. Remarkably, F1 and A1 only made errors in mismatch condition.

As we have seen, language impaired subjects’ performance was attributed to several linguistic and computational problems. Indeed, the high variability of their performance led us to hypothesize that several linguistic phenomena could affect the comprehension of object relative clauses in the presence of mismatched number features: the phenomenon of attraction, RM effects caused by the intervention of an element (lexical restriction), the temporary underspecification of morphological features.

Severe attraction interferences were observed during the implementation of the syntactic structure and the computation of thematic roles.

Franck et al. (2006) showed cases of attraction by the DP object in OSV sentences, revealing that the establishment of agreement is influenced by the hierarchy of the elements rather than by their linear order. Indeed, the surface hypothesis predicts that we should not expect any interference of the object, since it is placed far from the subject-verb relation, in the extreme periphery of the sentence.

Having found attraction effects ascribable to the object, the presence of an intermediate position, which interferes with the establishment of AGREE, has to be postulated. Hence, the object during its step-by-step movement would occupy this position, placed between the subject and AgrS. Consequently, the relation of Spec-head (between the subject and the verb respectively in the specifier and in the head of AgrSP) would be the checker of subject-verb agreement, eventually correcting contingent errors.

Remarkably, stronger phenomena of attraction have been found in OVS sentences, in which the absence of the Spec-Head relation (the subject remains in specVP) makes the subject-verb agreement weaker.

Regarding our study, attraction can be responsible for the inversion of number features both in the head and in the embedded subject. Indeed, the object in specAgrOP interferes with the establishment of AGREE between the subject and the underspecified position of AgrS, preventing the copy of the subject’s inflectional features in this head. At a later stage, the object features would merge on the verb (which in the meantime has moved to AgrS) and the subject would
move to specAgrSP. Hence, a Spec-Head relation would take place between the verb and the subject, even though they carry different features.

Finally, the number features of the subject would be modified to restore the agreement relation.

At that point, the subject’s un-interpretable feature of number could be deleted, as the minimalist program predicts, or it can be merged on one suitable and close element (the object located in specAgrOP), as occurs in reversed number features errors in SING-PLUR sentences. Hence, the subject-verb agreement is established with the features of the object, and the extra [+Num] deleted from the subject merges on the object, modifying its number features.

As have we seen, reversed number features errors in PLUR-SING sentences present a different pattern and a non-canonical case of attraction.

Surprisingly, we found attraction effects both in the direction predicted by Kayne (1989) and in the opposite direction.

Indeed, if attraction in SING-PLUR condition is expected to occur, since the unmarkedness of DP object can exert its influence on the marked verb, the opposite phenomenon was not predicted on the basis of linguistic theories.

Conversely, in three language impaired subjects out of four, attraction occurred even in PLUR-SING sentences, with the marked head attracting the unmarked verb. Maybe Kayne’s principle is not always valid in agrammatism, in which the computational cost can sometimes overwhelm the processing capacities, then leading to a randomly choice of thematic roles. Relying on linear order, patients would assign the role of subject to the first DP encountered, establishing an
erroneous agreement between the head of the relative and the verb, regardless of the number features.

Hence, even in PLUR-SING sentences the subject-verb agreement is established with the features of the object, and an extra [+Num] merges on the subject.

However, in this case, both DPs would share the same number features, and the underspecification of features leads to intervention effects in agrammatism.

To avoid RM effect, agrammatic subjects would differentiate the two DPs, deleting the weaker number projection (encoded on the object), whereas the [NumP] associated with the subject cannot be eliminated, being strictly preserved by the spec-head relation.

Regarding the RM effects, GRILLO (2005) claimed that agrammatic comprehension would be influenced by the computational cost of complex syntactic structures; a limitation of their computational abilities, a fast decay of their lexical information, a general deficit in the recovery of information (GRILLO 2005:111). The more reduced their abilities are, the more likely the cost of the sentence overwhelms their capacities.

GRILLO (2005) hypothesized that the movement of a NP over another similar one is harder to process; even sentences with long distance relationship over an intervening NP would be more difficult to compute than sentences characterized
by a short distance movement or by a movement which does not involve any interveners (GRILLO 2005:107). Thus the RM principle should block the formation of the link whenever an intervening element cannot be differentiated for reduced processing capacities. RM cannot interfere if the two NPs features are correctly interpreted and shown to belong to different morphological classes.

However, agrammatics impoverished representation does not allow to link the moved phrases to their traces, causing the impossibility to assign the correct theta role to each argument (2005:114).

RM effects can also be observed in the second and in the third typologies of errors, specifically in head’s number change errors and in the change of the subject-verb agreement.

Remarkably, the change of the object’s number was observed in F2 and A2, whilst the third typology of error (the change of subject-verb agreement number features) occurred only in F2, linguistically the most impaired subject. The change of the object’s number was found in match condition in F2 (in PLUR-PLUR irreversible sentences) and A2 (in SING-SING and PLUR-PLUR reversible sentences), whereas in mismatch condition in A2 (only one error in a PLUR-SING irreversible sentence) and in F2 (in both SING-PLUR irreversible and reversible sentences). RM effects occurred in both the possible conditions of Number, in match and mismatch number features.

RM effects are predicted to occur in the third typology of error (made only by F2), which is very rare (it occurs only twice). Its rarity can be due to the expensive computational cost: trying to differentiate the two DPs, F2 would change the number of the subject, instead of the number of the object, which certainly is easier to modify. Undoubtedly, this not canonical behavior has to be imputed to a temporary (it occurred very rarely), but severe computational black-out, which would totally delete her resources, leading to a random assignment of number features.

Similarly to what has been stressed by the results, several psycholinguistic theories establish that agrammatic impairment does not entail the deletion of grammatical knowledge, rather it consists in a weakness of procedural abilities.

Hence, agrammatic deficits in comprehension patterns would be ascribable to a reduction of the procedural resources required for the execution of some linguistic operations (CAPLAN & HILDEBRANDT 1988; HILDEBRANDT et al. 1987;
Conversely, other authors have interpreted the deficit in comprehension as the outcome of a delay in building the syntactic structure, which would prevent the execution of the linguistic operations in adequate temporal limits. In this view, agrammatic system would not be qualitatively different from normal subject (as Grodzinsky claimed), rather it would be characterized by a slower processing.

The Weak syntax or Slow-syntax model (Avrutin 2006; Burkhardt et al. 2008) attributed this delay to a specific weakness of the syntactic module. In their hypothesis, agrammatic impairment would depend on delayed syntactic operations, preventing the formation of any syntactic structure, which would not be completed in time. Consequently, they would be forced to choose extra-syntactic principles in the interpretation of the sentence.

Hence, their impairment would not compromise the ability to establish the syntactic chain (as Grodzinsky predicted), rather it delays the process of sentence construction, which would become excessively slow for the linguistic comprehension.

To Burkhardt et al. (2008), agrammatic deficit in the comprehension stems from a specific weakening of the syntactic module, which would compromise the operation of Merge, preventing the formation of the syntactic structure on time.

Conversely, our data showed that these language impaired subjects would suffer from an intermittent reduction of their processing resources. Thus, agrammatic performance cannot be influenced by a single syntactic operation, otherwise they would perform in a similar way.

Suffering from an intermittent resources reduction, they would be occasionally prevented from assigning thematic roles. More importantly, these reductions have been observed to vary in severity and frequency of occurrence from one subject to another.
5.5 Final considerations

Some final considerations about the test will be reported in this section. The structure of the test did not allow the selection of the reversed agent character. Indeed, it cannot be understood whether the language impaired individuals did confuse thematic roles, computing linearly the sentence, then assigning the first DP the role of subject. In all the images, the roles matched the sentence, never reporting the reversed condition, in which the agent becomes the patient of the action.

Thus, even if they have interpreted the object as the agent of the sentence, then they would have recognized and corrected their errors, thanks to the images.

Nevertheless, note that the purpose of the test was to investigate contingent influences of Number over agrammatic comprehension. Hence, the four pictures only depicted all the possible combinations of number features in the two DPs of the sentence. Adding other pictures, it would have extremely increased the computational cost in order to process the request, then invalidating the results, which would have been influenced by this overload.

Conclusions

Contrarily to our predictions, based on typical comprehension, results showed that all the language impaired subjects made several errors in mismatch number features (SING-PLUR; PLUR-SING), which is the most impaired condition.

Following FERRARI’s proposal, which stated that projection of number is realized only in plural features, sentences such as the following would be computationally expensive to process, and subject to errors.

\[(\text{40}) \quad (+\text{Num}) [+\text{Num}] \]

\[
\begin{align*}
\text{SING-PLUR: Object} & \ldots \text{Subject} & \ldots \text{verb} & \ldots \\
\text{PLUR-SING: Object} & \ldots \text{Subject} & \ldots \text{verb} & \ldots 
\end{align*}
\]

To avoid minimality effects, language impaired subjects either inverted or changed the number features, just to differentiate the two DPs.
Nevertheless, even the match condition of number features created disturbances in case of weaker comprehension, again causing RM effects in agrammatic comprehension.

As have we seen, language impaired subjects’ performance was attributed to several linguistic and computational problems. Indeed, the high variability of their performance led us to hypothesize that several linguistic phenomena can affect the comprehension of object relative clauses in the presence of mismatched number features: the phenomenon of attraction, the intervention of the lexical restriction, the underspecification of morphological features.

Severe attraction interferences were observed during the implementation of the syntactic structure and the computation of thematic roles.

Indeed, the object’s intermediate position in AgrOP interferes with the establishment of AGREE, preventing the copy of the subject’s inflectional features in AgrS. At a later stage, the object features would merge on the verb (which in the meantime has moved to AgrS) and Spec-Head relation would take place, even though the verb and the subject carry different features.

Hence, the number features of the subject would be modified to restore the agreement relation.

However, the change of number features would totally consume the patients’ computational resources, leading to widespread RM effects in the following steps of sentence derivation. Agrammatic subjects would differentiate the two DPs to avoid these RM effect, de facto deleting the weaker number projection (encoded on the object), whereas the [NumP] carried by the subject should not be removed, being strictly preserved by the spec-head relation.

In the third typology of errors, (occurred only in F2) the fluent subject changed the number of the subject-verb agreement, just to avoid the match of number feature. Clearly not economical, this strategy has been used only twice and only by this patient, and it has been explained as a temporary computational black-out.

F2 would be forced to assign randomly the thematic roles. In this case, the Weak syntax model cannot account for this not-expected pattern, which definitely stems from reduced processing capacities.

Finally, these errors confirm the extreme precariousness of number features in these language impaired subjects. Despite their mild damage, the computational cost of complex sentences can sometimes overwhelm their resources.
Being occupied with the processing of thematic roles, and being affected by reduced computational capacities, these language impaired subject would ignore the correct elaboration of the number features.

The language impairment of these subjects cannot entail the deletion of grammatical knowledge, rather it consists in a weakness of procedural abilities, which affect the required grammatical knowledge.

In this pattern, agrammatic syntactic capacities should not be definitively compromised, otherwise it could not be possible to add or to delete number features. Although number features would be computed in the sentence derivation, they would be characterized by an extreme precariousness and they would be subject to modifications.
CONCLUSIONS

The aim of this work was to investigate the influence of marked number features in the agrammatic comprehension of reversible and irreversible object relative clauses. In order to achieve this goal, a sentence-picture matching test was used, matching agrammatic patients with fluent subjects and non-language impaired adults for age and years of education.

Sentence’s number features have been manipulated, making DPs both similar (match condition: SING-SING; PLUR-PLUR) and dissimilar (mismatch condition SING-PLUR; PLUR-SING) in terms of number features.

The patients’ errors were coded into three categories: reversed number features errors (made by all patients); head’s number change errors (in A2 and F2); reversed subject-verb agreement errors (only in F2).

Outcomes showed that in most cases, errors were made in the condition of mismatch features. Indeed, lower percentages of correct responses were showed in sentences with dissimilar DPs rather than in match condition for number features.

The complexity of mismatch features can be understood under the proposal of FERRARI (2005), which states that the projection of number would be realized only in the plural, making mismatched number features more computationally expensive to process.

However, the high variability of patients’ performance led us to hypothesize that several linguistic and computational problems could affect these patients. Specifically, the phenomenon of attraction, the intervention/interference of an element (lexical restriction), the temporary underspecification of morphological features: all these factors are claimed to influence patients’ capacities.

Surprisingly, if attraction in SING-PLUR sentences is expected to occur (KAYNE 1989), since the unmarkedness of the DP object can exert its influence on the marked verb, attraction in the opposite mismatch condition (PLUR-SING) was unforeseen. Three out of four language impaired subjects showed however attraction effects even in PLUR-SING sentences, with the marked head attracting the unmarked verb.

It could be that the computational cost sometimes overwhelms the processing capacities, leading to a random choice of thematic roles.
Relying on linear order, these patients would assign the role of subject to the first DP encountered, establishing an erroneous agreement between the head of the relative and the verb, regardless of the number features.

To summarize, the verb would actually agree with the object, since the intermediate position (AgrOP) of the latter would interfere with the establishment of subject-verb agreement. Hence, Spec-Head relation would occur in a condition of subject-verb disagreement, and agreement could be restored only by modifying the number feature of the subject. However, the change of features would totally consume their computational resources, leading to widespread RM effects in the following stages of the sentence derivation (GRILLO 2005).

In this pattern, agrammatic impairment would stem from a limitation of computational abilities, in the presence of a fast decay of the lexical information (GRILLO 2005:111). The more reduced their abilities are, the more likely the cost of the sentence overwhelms their capacities.

With regard to our test, these patients would differentiate the two DPs to avoid these interventions, de facto deleting the weaker number projection, which is encoded on the object. Conversely, the [NumP] carried by the subject is not removed, since it is strictly preserved by the spec-head relation.

Minimality effects can be also observed in the second and in the third typologies of errors. In the latter, even the number of the subject-verb agreement was changed, just to avoid the match of number feature. Being clearly not economical, this strategy has only been used twice. As a consequence of a temporary computational black-out, F2 would be therefore forced to assign the thematic roles randomly.

Vis-à-vis these findings, we hypothesize that these language impaired subjects might be affected by an intermittent reduction of the processing resources, which would occasionally prevent them from assigning thematic roles. More importantly, these reductions have been observed to vary in severity and frequency of occurrence from one subject to another.

Concluding, the performance of these language impaired subjects is sometimes influenced by an extreme precariousness of number features. Being occupied with the processing of thematic roles, and being affected by reduced computational capacities, these subjects would occasionally ignore the correct elaboration of the number features.
REFERENCES


APPENDIX A: THE TEST

Irreversible sentences

1. irr. Tocca il cucchiaio che l’uomo lava SING-SING
2. irr. Tocca le rondini che la bambina dipinge PLUR-SING
3. irr. Tocca i bicchieri che gli uomini lavano PLUR-PLUR
4. irr. Tocca il lampione che gli uomini riparano SING-PLUR
5. irr. Tocca le scarpe che le bambine allacciano PLUR-PLUR
6. FILLER tocca le donne che mangiano le arance
7. FILLER tocca la donna che raccoglie la margherita
8. FILLER tocca i fazzoletti che l’uomo stira PLUR-SING
9. FILLER tocca la palla che le ragazze tirano SING-PLUR
10. irr. tocca i limoni che gli uomini raccolgono PLUR-PLUR
11. irr. Tocca la pianta che la donna annaffia SING-SING
12. irr. tocca le caramelle che la bambina compra PLUR-SING
13. irr. tocca le nuvole che la ragazza guarda PLUR-SING
14. irr. Tocca la carota che le donne tagliano SING-PLUR
15. irr. tocca le valigie che le donne portano PLUR-PLUR
16. FILLER tocca i ragazzi che lavano il piatto
17. irr. Tocca l’arancia che la donna mangia SING-SING
18. irr. Tocca le erbacce che le donne tagliano PLUR-PLUR
19. irr. tocca i televisori che l’uomo ripara PLUR-SING

172
20 irr tocca la coperta che la nonna cuce SING-SING
21 irr tocca la rosa che le donne portano SING-PLUR
7 FILLER tocca l'operaio che ripara il tetto
8 FILLER tocca gli uomini che stiroano il fazzoletto
22 irr tocca i panini che i bambini mangiano PLUR-PLUR
23 irr tocca i calzini che il ragazzo indossa PLUR-SING
24 irr tocca il cespuglio che il giardiniere taglia SING-SING
25 irr tocca i fogli che il ragazzo taglia PLUR- SING
26 irr tocca il regalo che i ragazzi portano SING-PLUR
27 irr tocca i libri che gli uomini leggono PLUR-PLUR
9 FILLER Tocca la bambina che dipinge la rondine
28 irr tocca la lettera che la donna imbuca SING-SING
29 irr tocca il muro che l'uomo pittura SING-SING
30 irr tocca la borsa che le donne portano SING-PLUR
10 FILLER tocca gli uomini che raccolgono il limone
31 irr tocca le rose che le ragazze piantano PLUR-PLUR
32 irr tocca i funghi che i cuochi tagliano PLUR-PLUR
33 irr tocca le mensole che la donna spolvera PLUR-SING
11 FILLER Tocca la donna che taglia le carote
34 irr tocca la farfalla che la bambina disegna SING-SING
35 irr tocca la maglietta che le donne stirano SING-PLUR
36 irr tocca i rami che gli uomini prendono PLUR-PLUR
12 FILLER Tocca l'uomo che lava i bicchieri
37 irr tocca le mele che la donna mangia PLUR-SING
38 irr tocca il foglio che il bambino strappa SING-SING
39 irr tocca le margherite che la ragazza raccoglie PLUR-SING
13 FILLER *Tocca gli uomini che riparano i lampioni.*

40 irr tocca la televisione che le donne guardano SING-PLUR

41 irr tocca il pallone che il ragazzo tira SING-SING

42 irr tocca le scarpe che le donne guardano PLUR-PLUR

14 FILLER *Tocca la donna che annaffia le piante*

15 FILLER *tocca le bambine che comprano la caramella*

43 irr tocca gli alberi che il contadino taglia PLUR-SING

44 irr tocca il tetto che gli operai riparano SING-PLUR

45 irr tocca la stella che la ragazza guarda SING-SING

16 FILLER *tocca la donna che pianta le rose*

46 irr tocca il cancello che i bambini pitturano SING-PLUR

47 irr tocca le collane che le signore indossano PLUR-PLUR

48 irr tocca i piatti che il ragazzo lava PLUR-SING

*Reversible sentences*

1 rev tocca la bambina che la donna saluta SING-SING

2 rev tocca il bambino che gli uomini disegnano SING-PLUR

3 rev tocca le bambine che le mamme vestono PLUR-PLUR

1 FILLER *tocca il contadino che taglia l’albero*

4 rev tocca le ragazze che la donna trucca PLUR-SING

5 rev tocca la cantante che le ragazze ascoltano SING-PLUR

6 rev Tocca la bambina che la nonna imbocca SING-SING

2 FILLER *tocca la nuvola che le ragazze guardano*

3 FILLER *tocca le collane che la signora indossa*

7 rev tocca le nonne che le bambine spingono PLUR-PLUR

8 rev tocca le ragazze che la bambina spia PLUR-SING

9 rev tocca il ragazzo che i professori rimproverano SING-PLUR
10 rev tocca le vecchiette che le ragazze salutano PLUR-PLUR
11 rev tocca le bambine che la donna abbraccia PLUR-SING
12 rev tocca il bambino che il papà pettina SING-SING
4 FILLER tocca i bambini che colorano i fogli
13 rev tocca le bambine che la ragazza copre PLUR-SING
14 rev tocca l’uomo che i ragazzi minacciano SING-PLUR
15 rev tocca i ragazzi che i pirati rapiscono PLUR-PLUR
5 FILLER tocca gli uomini che riparano il televisore
16 rev tocca gli uomini che il ragazzo saluta PLUR-SING
17 rev tocca la bambina che la mamma pettina SING-SING
18 rev tocca la Donna che la bambina bagna SING-SING
6 FILLER tocca la donna che mangia la mela
19 rev tocca la bambina che le donne asciugano SING-PLUR
20 rev tocca le bambine che le commesse consigliano PLUR-PLUR
21 rev tocca i ragazzi che il bambino sporca PLUR-SING
7 FILLER tocca gli uomini che leggono il libro
22 rev tocca la mamma che la bambina accarezza SING-SING
23 rev tocca l’uomo che i bambini mordono SING-PLUR
24 rev tocca le donne che le ragazze massaggiano PLUR-PLUR
8 FILLER tocca la bambina che disegna le farfalle
25 rev tocca le modelle che la donna vota PLUR-SING
26 rev tocca il bambino che il papà lava SING-SING
27 rev tocca la sposa che le bambine accompagnano SING-PLUR
9 FILLER tocca la donna che porta le borse
10 FILLER tocca le donne che stirano le magliette
28 rev tocca i ladri che i poliziotti arrestano PLUR-PLUR
29 rev tocca le bambine che la ragazza chiama PLUR-SING
30 rev tocca la modella che la bambina fotografa SING-SING
31 rev tocca la maestra che le bambine ascoltano SING-PLUR
32 rev tocca le bambine che le dottorisse visitano PLUR-PLUR
33 rev tocca i bambini che il papà rimprovera PLUR-SING
11 FILLER tocca gli uomini che prendono il ramo
34 rev tocca il bambino che il ragazzo copre SING-SING
35 rev tocca la nonna che le bambine baciano SING-PLUR
36 rev tocca gli atleti che l’uomo premia PLUR-SING
12 FILLER tocca la donna che guarda la scarpa
37 rev tocca il postino che il bambino rincorre SING-SING
38 rev tocca il bambino che il medico visita SING-SING
39 rev tocca l’avversario che i ragazzi battono SING-PLUR
13 FILLER tocca i bambini che mangiano il panino
40 rev tocca i bambini che gli uomini vestono PLUR-PLUR
41 rev tocca i ragazzi che i maestri cacciano PLUR-PLUR
42 rev tocca gli uomini che il prete confessa PLUR-SING
14 FILLER Tocca la donna che taglia la carota
15 FILLER tocca le ragazze che tirano le palle
43 rev tocca l’uomo che il bambino spia SING-SING
44 rev tocca i monaci che i turisti fotografano PLUR-PLUR
45 rev tocca la suora che le ragazze guardano SING-PLUR
16 FILLER tocca il giardiniere che taglia i cespugli
46 rev tocca i bambini che i bagnini salvano PLUR-PLUR
47 rev tocca i ladri che l’uomo insegue PLUR-SING
48 rev tocca il bambino che i pagliacci divertono SING-PLUR
## APPENDIX B:

### A1 Results table

<table>
<thead>
<tr>
<th>ID</th>
<th>Reversibilità</th>
<th>Tipo Frase</th>
<th>Numero_oggetto</th>
<th>Numero_soggetto</th>
<th>Sing-Sing</th>
<th>Sing-Plur</th>
<th>Plur-Sing</th>
<th>Plur-Plur</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>Plur</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

177
<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>6 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>7 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>22</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>23</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>rev</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>8 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>26</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>27</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>9 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>10 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>28</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>31</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>32</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>33</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>11 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>34</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>35</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>RE</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
<td>-----</td>
<td>------</td>
<td>------</td>
<td>---</td>
</tr>
<tr>
<td>12 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>37</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>38</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>39</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>0</td>
</tr>
<tr>
<td>13 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>40</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>41</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>42</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>0</td>
</tr>
<tr>
<td>14 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>15 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>43</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>44</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>45</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>16 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>46</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>47</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>48</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>49</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>50</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>51</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>1 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>52</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>53</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>54</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>2 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>55</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>57</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>3 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
</tr>
<tr>
<td>4 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>60</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>5 FILLER</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>65</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
</tr>
<tr>
<td>66</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>6 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>67</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>69</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>7 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td>8 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>IR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>72</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>73</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>74</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>76</td>
<td>FILLER</td>
<td>IR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>77</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>78</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>79</td>
<td>FILLER</td>
<td>IR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>80</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>81</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>82</td>
<td>FILLER</td>
<td>IR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>83</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>84</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>85</td>
<td>FILLER</td>
<td>IR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>86</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>87</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>88</td>
<td>FILLER</td>
<td>IR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>89</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>90</td>
<td></td>
<td>IR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>91</td>
<td>FILLER</td>
<td>IR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>15 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>91</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>93</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
</tr>
<tr>
<td>16 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
</tr>
<tr>
<td>94</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
</tr>
</tbody>
</table>
**APPENDIX C:**

*A2 Results table*

<table>
<thead>
<tr>
<th>ID</th>
<th>Reversibilità</th>
<th>Tipo Frase</th>
<th>Numero_oggetto</th>
<th>Numero_soggetto</th>
<th>Sing-Sing</th>
<th>Sing-Plur</th>
<th>Plur-Sing</th>
<th>Plur-Plur</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>------</td>
<td>-----</td>
<td>-----</td>
<td>------</td>
<td>------</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>49</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>51</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>52</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>53</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------</td>
<td>-----</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>91</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>92</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>93</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>94</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>95</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>96</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX D

**F1 Results table**

<table>
<thead>
<tr>
<th>ID</th>
<th>Reversibilità</th>
<th>Tipo Frase</th>
<th>Numero_oggetto</th>
<th>Numero_soggetto</th>
<th>Sing-Sing</th>
<th>Sing-Plur</th>
<th>Plur-Sing</th>
<th>Plur-Plur</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>rev</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 FILLER</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>--------</td>
<td>-----</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>91</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>93</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>FILLER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>94</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### APPENDIX E

*F2 Results table*

<table>
<thead>
<tr>
<th>ID</th>
<th>Reversibilità</th>
<th>Tipo Frase</th>
<th>Numero oggetto</th>
<th>Numero soggetto</th>
<th>Sing-Sing</th>
<th>Sing-Plur</th>
<th>Plur-Sing</th>
<th>Plur-Plur</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>3 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>4 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>IR</td>
<td>SO</td>
<td>SG</td>
<td>PL</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>REV OGG PLUR SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>REV OGG SING SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>REV OGG SING SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>REV OGG SING PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>REV OGG PLUR PLUR</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>REV OGG PLUR SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>REV OGG SING SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>REV OGG SING PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>REV OGG PLUR PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>REV OGG PLUR SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>REV OGG SING SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>REV OGG SING PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>REV OGG PLUR PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>REV OGG PLUR SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>REV OGG SING SING</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>REV OGG SING PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>REV OGG PLUR PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>REV OGG PLUR SING</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>REV OGG SING PLUR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

196
<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>35</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>36</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>12 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>37</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>38</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>39</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>13 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>40</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>41</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>42</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>14 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>15 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>43</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>44</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>45</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>16 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>46</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>47</td>
<td>REV</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>48</td>
<td>REV</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>49</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>50</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>51</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>1 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>52</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>53</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>54</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>55</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>56</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>57</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>58</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>59</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>60</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>61</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>62</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>63</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>64</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>65</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>66</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>67</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>68</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>69</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>70</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>71</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>72</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>73</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>74</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>75</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>76</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>77</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>78</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>79</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>80</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>70</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>71</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>72</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>73</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>74</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>75</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>9 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>76</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>77</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>78</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>10 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>79</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>80</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>81</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>11 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>82</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>83</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>84</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>12 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>85</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>86</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>87</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>13 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>88</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>89</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>90</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>14 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>15 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>91</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>92</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>93</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>SING</td>
</tr>
<tr>
<td>16 FILLER</td>
<td>IRR</td>
<td>SOGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
<tr>
<td>94</td>
<td>IRR</td>
<td>OGG</td>
<td>SING</td>
<td>PLUR</td>
</tr>
<tr>
<td>95</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>PLUR</td>
</tr>
<tr>
<td>96</td>
<td>IRR</td>
<td>OGG</td>
<td>PLUR</td>
<td>SING</td>
</tr>
</tbody>
</table>
Estratto della tesi di Laurea magistrale in Scienze del Linguaggio
Studente: Paolo Frugarello
matricola: 840308
Titolo della tesi:
**THE ROLE OF MARKED NUMBER FEATURES IN THE AGRAMMATIC COMPREHENSION OF OBJECT RELATIVE CLAUSES**

**ABSTRACT**
Il mio lavoro si propone di verificare se la manipolazione del tratto di numero possa influenzare la comprensione di frasi relative oggetto con soggetto preverbale incassato in pazienti affetti da un deficit di tipo agrammatico. A tale scopo la loro performance nelle relative oggetto viene testata tramite un task di selezione dell'immagine corrispondente alla frase pronunciata dall'esaminatore. I risultati mostrano una grande variabilità da un paziente ad un altro, sebbene la condizione mismatch dei tratti di numero tra soggetto e oggetto (soggetto plurale/singolare e oggetto singolare/plurale) sia quella più computazionalmente complessa da analizzare in questi soggetti, per la presenza di un tratto sintattico aggiuntivo, la proiezione di numero NumP, che sarebbe presente solo nel plurale.

This study wants to investigate whether the agrammatic comprehension of object relative clause with embedded preverbal subject is influenced by marked number features. A sentence-picture matching task was used to assess their performance and results show that the mismatch condition of number features (with the subject singular/plural and the object plural/singular) is computationally the most complex. This would be due to the presence of an additional syntactic projection, the NumP, when the number feature is plural. Thus, despite the wide variability found, agrammatic patients would have great difficulty in establishing the right set of syntactic relations.