UNIVERSITÀ
DEGLI STUDI
DI PADOVA

Università degli Studi di Padova

Dipartimento di studi linguistici e letterari

Tesi di Laurea

Corso di Laurea Magistrale in Linguistica

Classe LM-39

Study on brain mechanisms in neglect dyslexia: the reading of relative clauses

Relatore

Prof. Carlo Semenza

Laureanda

Martina Ruggieri

n° matr.2021074 / LMLIN

Anno Accademico 2022 / 2023

Index

Introduction

When our brain suffers a damage, this can cause a deficit of a function that is processed in the specific area that suffered that trauma. Functions that are processed in other areas of the brain, however, remain intact. In this regard, we know that tasks related to language proficiency are processed separately from tasks of a non-language nature, so when a brain trauma affects an area of the brain, that does not deal with language tasks, language skills are preserved (Newmeyer, 1994). This study aims to demonstrate how, in patients who have suffered a specific brain injury, linguistic knowledge and syntactic structures can modulate other brain functions, such as attention in reading tasks. In particular, in this study we analyze the way in which patients affected by neglect dyslexia (ND) read Italian sentences with subjective and objective relative clauses. These patients normally ignore the left side of the sentence, so they may show differences in the reading of these two types of sentences.

Neglect dyslexia (ND) is a reading impairment caused by a cerebral lesion located in the temporo-parietal cortex. This deficit leads patients to suffer an inability to read: in particular, they ignore the left side of a letters or words string. Thus, they omit all (or some of) the elements that are located at the beginning of a sentence. For this reason, several tests have been carried out to verify if, in some way, a particular sentence construction could lead patients with ND to improve their reading performance. For example, there might be elements that draw patient's attention to the left side of the sentence and thus allow him/her to make fewer omissions the reading tasks. This means that syntactic competence allows patients to recognize certain structures and to judge the parts of the sentence they read as implausible, thus they search for the elements that will make that sentence plausible on the left side.

In this study, I analyze the way in which patients with neglect dyslexia read sentences with relative clauses in Italian. There are two types of relative clauses: subject relative clauses and object relative clauses. Consider the following example:

(1) a. Il ragazzo che ama Maria

b. Il ragazzo che Maria ama

In construct (1a), the subject of the sentence is *il ragazzo* and the relative clause is *che ama Maria*, which refers precisely to something concerning the subject. Instead, in construct (1b), *il ragazzo* is the object of the object relative clause *che Maria ama*, in which Maria is the subject of the sentence.

My experiment aims to understand whether patients with ND show different behaviours in reading sentences with subject relative clauses and sentences with object relative clauses. The prediction is that they will make more errors of omission in object relative clauses than in subject relative clauses, where they may make fewer errors and also read the left side of the sentence. This would happen because patients, during the task of reading the constructs with object relative clauses, considering only the final part of the sentence (*Maria ama*), would judge this portion of the sentence as plausible and would not be lead to search for other elements in the left part. Indeed, the sentence *Maria ama* in Italian is grammatical and the patients could therefore omit the initial part of the construct, as well as the object of the sentence. On the contrary, reading the construct with the subject relative clause (*Il ragazzo che ama Maria*), patients, who at first read only *ama Maria*, could judge this sentence implausible and could go in search of the subject, committing fewer omissions in this case. In fact, patients know the correct syntactic structure and they know that sentence would require a subject, or at least from a semantic point of view (since Italian is a pro-drop language, i.e. it may not express the subject explicitly, but may leave it implied). Or, if they interpret *Maria* as the subject, will judge the word order VS as non-grammatical. Instead, in the case of the object relative clause, the order of the sentence that they read (*Maria ama*), is SV, that is absolutely grammatical in Italian. Therefore what we expect is that they could commit fewer errors of omission in sentences with subject relative clauses, rather than in sentences with object relative clauses, which on the contrary have the subject in themselves and are plausible without the addition of any further element.

In ***Chapter 1***, there is an overview about spatial neglect and a brief description of neglect dyslexia. At the end of the chapter, there is a brief introduction of the reading performance of ND patients in tasks where syntactic competence is required. In ***Chapter 2***, I describe relative clauses, their syntactic representation and their processing. In ***Chapter 3***, there is the presentation of the experimental study, with the description of the stimuli, the working hypothesis and the error analysis of the control group.

1. Neglect dyslexia

1.1. Unilateral spatial neglect

Unilateral spatial neglect is a neuropsychological disorder whereby patients fail to detect, or identify objects, or execute movements in the portion of space contra-lateral to the side of the lesion (contra-lesional), with reference to a specific coordinate frame (Bisiach & Vallar, 2000; Vallar, 1998). The disorder frequently occurs after a damage to the right hemi-sphere, involving the left contra-lesional portion of the space, including the somatic space. The most frequent anatomical correlate of left spatial neglect is damage to the right inferior parietal lobe (supramarginal gyrus) at the temporo-parietal junction (Vallar & Perani, 1987), but lesions involving the premotor cortex, or confined to subcortical structures, may also be associated with neglect (Vallar, 2001). This kind of deficit cannot be directly explained by any other primary sensory or motor deficit although these neurological conditions may sometimes co-occur with unilateral spatial neglect (Bisiach et. al., 1986). This deficit can be seen in patients without hemianopia (a partial blindness or a loss of sight in half of the visual field); in fact, cases with hemianopia perform an active search of the contra-lesional visual hemifield; in contrast, patients with USN are unable to be aware of the contra-lesional visual field, even if their visual sensation is intact. In fact, several authors have attributed visual neglect to a deficit in the allocation of attention to the contra-lesional part of space.

1.1.1. Cause and nature of USN

The most common cause of unilateral spatial neglect is stroke, but it can also be associated to cerebral haemorrhages, tumours, trauma and neurodegenerative diseases (Heilman, 2000). During everyday activities, they may eat food only from the ipsi-lesional side of the plate, bump into objects located in the contra-lesional side when walking, and wash, shave, or apply cosmetics only to the ipsi-lesional side of the face (Bisiach, 1999).

Over the years, many theories have emerged that aim to explain the nature of unilateral spatial neglect. We can classify them, according to the different type of origin, between *attentional theories* and *representational theories*.

Among attentional theories, Kinsbourne (1987) proposes that there are two attentional vectors: the vector located in the right hemisphere directs the attention to the left field and, conversely, the vector located in the left hemisphere directs attention to the right field. However, the left vector is much more powerful, in fact the attention we place to the right is greater than the attention we direct to the left. Therefore, if the right hemisphere is injured, attention to the left will weaken further, in favour of hyperattention to the right, mediated by the left hemisphere which is still functioning (Kinsbourne, 1987).

In the model proposed by Heilman (1985), there is a double right spatial representation: in the right hemisphere there is a spatial representation that involves the whole space, as it controls not only the left hemispace, but also the ipsi-lateral hemispace; instead, in the hemisphere of the left, which is also the hemisphere that processes the function of language, the spatial representation is reduced to the visual perception of the right space. Therefore, if the right hemisphere suffers a posterior lesion, what remains is only the left posterior part of the brain exploring the right space. If, on the other hand, the lesion is located on the left, the right hemisphere would be able to compensate for the deficit caused by the lesion (Heilman, 1985).

Posner defines neglect as the inability to release attention from the ipsi-lesional hemispace to move it to the contralesional one (Posner, Petersen, 1990). These theories are not completely proven.

Representative hypotheses are based on experimental data. Bisiach and Luzzati (1978) proved that patients experience neglect even in imaginary space: if they neglect left hemifield in the visual space, they are not aware of it even in the imaginary one. A very famous case studied by Bisiach et al. (1978) is that of a taxi driver in Milan who had been diagnosed with neglect. During the study, the clinical examiner asked the patient to mentally represent Piazza Duomo in Milan and to pretend to be exactly at one end of the square opposite to the cathedral. When the examiner asked to imagine what there was to his right, the patient answered without any problem by listing the buildings to the right of the square; instead, imagining what was to his left, the patient answered

by saying that the square was empty, with no buildings. Conversely, sometime later, the patient was asked to imagine that he was at the exit of the cathedral and facing the square. At this point the patient described everything he had to his right and affirmed that, instead, to his left the square was empty. This is a remarkable phenomenon: it allows us to understand how much this deficit can affect not only visual reality, but also mental representation (Bisiach, Luzzati, 1978).

1.1.2. Classification of USN types

Generally, we classify different types of USN based on whether it causes a change in sensation, a change in the ability to move, or a change in internally generated images; therefore, we can differentiate sensory, motor and representational neglect.

Sensory neglect is characterized by an unawareness of sensory information in the body or coming from the environment. This inability occurs on the side of the body opposite the side to which the damage to the brain has occurred (Bisiach, 1978; Bowen, McKenna, & Tallis, 1999; Vallar 2010). Different sensory abilities can be affected. Neglect may lead to a patient's inability to fully reproduce an image based on a model image, ignoring the details that are on the affected side. Sensory neglect can also be observed in the auditory faculties of the affected patient: he can be unaware of the voices and environmental noises coming from the left side. This is not because the patient has damage to the ear itself, but because damage to the brain has caused an inability in the patient to be consciously aware of an auditory input (Heilman, Valenstein, 1972). *Somatosensory neglect* is a subcategory of sensory neglect. This is characterized by inattention to sensory information originating in the body of the patient.

There are also two types of sensory USN based on whether the patient has symptoms within the body (personal neglect) or within space outside of the body (spatial neglect; Heilman, Valenstein & Watson, 1994).

Personal neglect is characterized by a lack of awareness of the side of the body opposite of the damage. For example, a patient with personal neglect may deny ownership to a limb, ignoring its presence and believing that it belongs to another

person (*hemiasomatognosia* and *somatoparaphrenia*). He can ignore the side of the body even when doing activities.

Spatial neglect occurs in a patient who is unable to acknowledge stimuli originated in space opposite of damage. There are two types of spatial neglect: peripersonal neglect and extrapersonal neglect. *Peripersonal neglect* is characterized by a patient's inattention to items near him, while *extrapersonal neglect* refers to the neglect of items that are further away.

Motor neglect occurs with a reduced ability to initiate movement in response to stimuli even though the patient is aware of the presence of the stimuli. This inability is not attributable to weakness of the muscles or to any primary motor deficit (Heilman, Watson, Valenstein, 1993).

Finally, *representational neglect* is characterized by unawareness of portions of mentally generated images (memories, dreams and hallucinations). The patient will ignore the left side of the image.

1.1.3. Assessment of USN

When diagnosing USN, it is important for clinicians to evaluate how extended is the portion of space that patients ignore, because a person may demonstrate neglect in one domain of space but not in another (Beschin & Robertson, 1997; Halligan & Marshall, 1991). For example, a patient may eat food from only one side of a plate (peripersonal space) but shave both sides of the body (personal space; Plummer et al., 2003). Concerning this point, the assessment of USN in the clinical setting has involved the use of "pen-and-paper" tests, such as line bisection, cancellation tasks, copying, and drawing (Robertson & Halligan, 1999; Carr & Shepherd, 1998). These tests are simple and quick to administer. One of the most used is line bisection test: it requires patients to indicate the midpoint of a horizontal line presented on a piece of paper placed in front of them, the line is usually centred with respect to the patient's midline. The test is scored by measuring the deviation of the bisection from the true centre of the line. A deviation toward the side of the brain lesion (unaffected side) is indicative of neglect. There are many versions of the line bisection test, and the procedures are rarely standardized.

As anticipated, another popular test consists in copying a drawing: if the patient copy only the half of the model image that is opposite to the damaged side of the brain, it may be a sign of neglect. The cancellation test, or *Albert Test* (Albert, 1973), requires the patient to search for and cross out target symbols presented on a page: patients with USN typically fail to cancel stimuli on the side of the page opposite the brain lesion. Many versions of the cancellation task exist: they include cancellation of segments, or figures like shapes, bells, stars, circles, and the performance can vary according to the presence of distractor symbols, single or double target stimuli, and structured or unstructured stimuli.

1.2. Neglect Dyslexia

There is a reading disorder that can be associated to unilateral spatial neglect, called *neglect dyslexia*. It may or may not coexist with unilateral spatial neglect, whereby the leftmost part of the space is ignored. Patient with this disorder make frequent errors in reading the contra-lesional portion of single words or text.

Neglect dyslexia was described for the first time by Arnold Pick who, at the end of the XIX century (Pick, 1898), described a patient with a left hemianopia, who omitted the first (left-sided) word of each line. After the patient's death, it was discovered that he had encephalomalacia in the left temporal lobe and in the right thalamus, and this was the cause of the reading deficit (Pick, 1898). Another patient, with a right frontal meningioma, showed a tendency to ignore objects on the left side and, during reading tasks, she held the paper to the right or read only the right side of the paper. These disturbances gave an impression of hemianopia, but later it was concluded that the deficit was attentional rather than sensory (Silberpfennig, 1941). This patient is one of the few reported cases with a lesion confined to the frontal lobe. These observations show a close association of ND with other manifestations of USN, and other early studies report reading disorders associated with left USN after right-brain damage.

1.2.1. Neglects dyslexia and unilateral spatial neglect

It has long been thought that ND was an integral component of USN, due to the co-occurrence of the disorders and the similarity of the symptoms. In the last years, this view has been challenged by observations and studies of neglect dyslexia in the absence of USN symptoms for non-verbal materials, and by neglect dyslexia for one side of space and spatial neglect for non-verbal materials for the opposite side of space (Costello & Warrington, 1987). In a study of right-brain-damaged patients, Bisiach found two patients with severe USN, but without ND, and six patients with hemianopia, but with no ND. Nineteen patients show left ND, all of them had a visual defect, but only nine exhibited left USN (Biasiach at al., 1990). Moreover, a dissociation between these two disturbances has been demonstrated by verifying a separate recovery of neglect dyslexia in a patient who showed persistence of behaviours correlated to unilateral spatial neglect in other activities (Cantoni, Piccirilli, 1997). Therefore, sometimes, ND dissociates itself from the sensory and motor asymmetry and it concerns only written material. ND may occur independently of USN. However, both neglect dyslexia and unilateral spatial neglect can be used to answer linguistic questions.

1.2.2. Errors of patients with ND

Neglect dyslexia patients make errors on single words, sentences and/or texts, influencing their reading performance.

Errors due to left neglect dyslexia can be classified into three categories (Ellis et al., 1987): omissions, substitutions and additions.

Omissions occur when patients omit reading one or more letters that are in the contra-lesional part of a letter string (e.g., *able* instead of *cable*).

Substitutions are present when patients substitute one or more contra-lesional letters (e.g., *dryer* instead of *flyer*).

Additions means that patients add one or more letters in the contra-lesional section of the string (e.g., *disable* instead of *sable*).

The proportion of neglect errors varies across patients, with omissions and substitutions being the most frequent errors (Vallar et al., 2010). These two error types

have been ascribed to a diverse severity of the deficit of contra-lesional spatial attention: omission errors may reflect the patients' inability to encode even the presence of a letter, due to a more severe spatial deficit; instead, substitutions errors may occur when patients are able to encode the position, but not the identity, of the misread letters, due to a less severe spatial deficit (Ellis et al., 1987). According to this view, patients producing substitutions might be more sensitive to lexical effects because the substituted letters are implicitly processed. However, this is not always the case: in contrast with this theory, a study of oculomotor performance by patients with neglect dyslexia suggests that the position of contra-lesional letters during reading performance is not always registered (Behrmann et al., 2002). Therefore, the precise mechanisms responsible for the production of omission and substitution reading errors by neglect dyslexia patients are still unclear.

Finally, additions are the most infrequent error type in neglect dyslexia and have been ascribed to productive or confabulatory responses (Vallar et al., 2006). Up to now, studies investigating error types in ND show heterogeneous results regarding the question whether substitutions or omissions present the most frequent error type. Many studies report a predominance of substitution errors in patients with ND. The main evidence comes from single cases of English-speaking patients (e.g., Arguin & Bub, 1997; Ellis et al., 1987; Kinsbourne & Warrington, 1962), but also includes studies with other more transparent orthographies, like those on Italian patients (e.g., Arduino, Daini & Silveri, 2005; Cubelli, Nichelli et. al., 1991). Contrasting findings suggest that omission errors are the most frequent error type in ND patients. Here, much evidence comes from single case studies (e.g., Cubelli & Simoncini, 1997, Di Pellegrino, Làdavas & Galletti, 2002). Despite these differences in the relative frequency of substitutions and omissions in ND, most authors agree that addition errors are rare in left ND (Arduino et al., 2002; Arguin & Bub, 1997; Cantoni & Piccirilli, 1997; Ellis et al., 1987). A further error type, the *transposition error* (e.g., *beard* instead of *bread*) is sometimes reported but also rare (Caramazza, Capasso, & Miceli, 1996; Friedmann & Gvion, 2005). This latter error type is regarded as a sub-type of substitution errors, in which the identity of target letters is processed correctly but letters are organized in the wrong order. Recent research suggests the appearance of *mixed errors*, where multiple errors can occur in one response (Lee et al., 2009; Patterson & Wilson, 1990; Rusconi et

al., 2004). Even here, however, single substitutions or omissions seem to be the most frequent error categories and mixed errors are rather rare (Lee at al., 2009; Patterson & Wilson, 1990).

1.2.3. ND and linguistic competence

Neglect dyslexia patients make errors on single words, sentences and/or texts, influencing their reading performance. In fact, as anticipated, ND cannot be defined only as a visual or an attentional deficit, but it is influenced by the linguistic competence of the patient (Behrmann et al., 1990; Warrington, 1990).

Indeed, reading in neglect dyslexia patients is not just determined by the left position of the stimuli in the space. It has been shown that the nature of the stimulus can modulate the ability to read (Friedmann, 2011; Abbondanza et al., 2020). Manifestations of neglect dyslexia as well as the stimulus properties that affect performance are very different from one case to another (Ellis, Young, & Flude, 1993; Riddoch, 1990).

Semantic competence has been demonstrated to influence neglect dyslexia patients' reading performance, helping them to commit fewer errors of omission. Kartsounis and Warrington (1989) showed that if a sentence is semantically plausible the patient omits fewer words in the left side than if the sentence was semantically implausible. If the sentence is semantically plausible it is easier to read it all, but if it is semantically implausible the patient tends even more to ignore the part on the left. It is not just a reading matter (Kartsounis & Warrington, 1989).

Karnath and Huber proved that if the sentence still makes sense by removing the first word, the patient can easily omit it; but if, instead, the omission of the first word compromises the entire sense of the sentence, then the patient read the word at the beginning. Therefore, they showed how much semantics influences the information of the left space (Karnath & Huber, 1992).

Làdavas and co-workers showed that a patient with neglect dyslexia can read more easily a word that is in the right side if this is presented in association with a word in the left visual field (e.g., he reads faster the word *dog* in the right field if there is the

word *cat* in left field). The content influences the ability to read the left part of the sentence. (Làdavas E., Paladini R., & Cubelli R., 1993).

Semenza and Arcara studied the influence of semantics on ND patients with binomials: participants make fewer omission and substitution errors on irreversible binomials (e.g., *hit and run*, *sale e pepe*) than on simple pairs of words constituted by the same words but in reverse order (e.g., *run and hit, pepe e sale*; Semenza, Arcara & al., 2011).

Veronelli gave sentences to read and the patient had to mark the middle of the sentence (such as the line bisection task): if these sentences had meaning, the mid-sentence mark tended to be more to the left than when the sentence had no meaning. Another example of how semantic content reduces negligence (Veronelli et al., 2014). All these findings show that the exploration of linguistic material is more accurate than the spatial exploration of non-linguistic material (Abbondanza et al., 2020).

From the morphological point of view, however, studies on compounds have been carried out, which have shown that patients with neglect dyslexia read compounds with the head on the left more easily (the first component carries the information) than compounds with the head on the right, of which they only read the right side (Semenza et al. 2011; Marelli & Luzzati 2012).

Finally, some studies have demonstrated that syntactic competence of ND patients can influence their reading performances. Friedmann studied patients with neglect dyslexia in Hebrew, a language that is read from right to left. Thanks to this way of reading this language, he discovered that Jewish patients tend to make errors of omission or substitution of the final elements of the sentence (those on the left) when these are optional and their absence does not compromise the grammatical correctness of the sentence (Friedmann et al., 2011).

Abbondanza et al. (2020) explored the left periphery, the highest level of syntactic structure that represents the interface between syntax and pragmatics. Topic and focus sentences are the two main types of LP in Italian, with marked word order in which the topicalized or focused constituent is located to the left of the visual field. Therefore, the constituent emphasized by the structure of a sentence with LP is located in the disadvantaged part of the visual field of a patient with ND. The authors thought that the syntactic salience of the sentence with LP could help patients move their

attention even more to left and compensate for their deficit. For example, they used sentences like *Il vino rosso lo bevo poco*, where the direct object *red wine* is emphasized and brought to the left (the canonical order would be *Bevo poco il vino rosso*). This is a clear example of topic. Another type of sentences is *In Spagna vorrei tornare (non in Francia)*, which is what we call focus (the canonical order would be *Vorrei tornare in Spagna*). Sentences with periphery should be more difficult because they are less frequent. But, if it were just a matter of ease or frequency of use, a person would more easily read sentences in canonical order, even patients with ND. On the contrary, the attention of a ND patient is concentrated in the left periphery. In fact, patients with neglect dyslexia read topics and focuses better than sentences with canonical order: nine patients were tested, and all showed this effect (Abbondanza 2020). Others evidences of the influence of syntactic competence on ND patients are provided in the next paragraph (***1.2.4. Neglect dyslexia and syntactic competence***).

1.2.4. Neglect dyslexia and syntactic competence

Over the years, several studies have been carried out to demonstrate that patients with neglect dyslexia have a preserved syntactic proficiency, which allows them to perform reading tasks correctly. A well-known example is the work of Friedmann et al. (Friedmann, Tzailer-Gross, Gvion, 2011): this study tests the syntactic competence of patients with ND in Hebrew. Hebrew is a language that is written and read from right to left, and this peculiarity has allowed researchers to test the competence of patients regarding the valence of the verb.

The valence of the verb is its ability to bind one or more nominal elements to itself, based on the meaning or meanings it has (Tesnière, 2001). Tesnière called the nominal elements *actants*, while Italian scholars qualify them as *arguments*. Based on their valence, predicative verbs can be divided into zerovalent, monovalent, bivalent, and trivalent. Verbs that do not hold any argument are defined as zerovalent; for example, the verb *piovere*, does not need complements to have a complete meaning, but, by itself, it provides sufficient information for the comprehension of the sentence (see the example in 5a). Monovalent verbs are verbs that support a single argument, for

example the verb *correre*, which only needs a subject to express complete information, as in 5b. Bivalent verbs take two arguments, like the verb *mangiare*, which holds a subject (who) and a direct object (what), as in 5c. An example of a trivalent verb is the verb *dare*, which needs to specify the subject (who), the direct object (what) and the indirect complement (to whom), therefore it takes three arguments (see the example in 5d) .

(5) a. Piove.
b. Luca corre.
c. Paola mangia un panino.
d. Tommaso da un abbraccio a Chiara.

Obviously, the sentences can be expanded in different ways and with many elements. Consider the examples in (6).

(6) a. Piove *da tre giorni*.
b. Luca corre *in giardino da solo*.
c. *Oggi* Paola mangia un panino *comprato al bar.*
d. Tommaso da un abbraccio a Chiara *prima della partenza*.

However, these elements are only accessories that contribute to expand and create a more detailed context to the sentence; but the sentences in (5) make complete sense even without these expansions, because their arguments are sufficient to make the sentence complete and grammatical, precisely because of the value of the verb that governs them.

The results of the work of Friedmann et al. showed that the preserved syntactic proficiency of ND patients modulated sentences reading. The patients recognized the valence of the verb and omitted more or less elements in the part contra-lateral to the lesion according to whether or not they were arguments of the verb. Patients continued to read in the left side of the sentence until syntactic, lexical, and semantic requirements

had been satisfied; instead, they made more errors of omission when the final constituents were optional.

Taking advantage of the right-to-left reading mode of Hebrew, Friedmann and co-workers manipulated various sentence components to demonstrate in different ways that preserved syntactic competence allows ND patients to commit fewer errors in reading tasks. Citing a few more experiments, they worked on the difference between reading sentences and reading sequences of words of the same length. The results of the experiment show that the patients did significantly more omissions of words in meaningless sequences of words rather than sentences.

Friedmann (Friedmann & Novogrodsky, 2004) also conducted a work on relative clauses. Participants were presented with a short story about two people and asked to choose which of these people they preferred to be. The task was constructed in such a way that the choice had to be formed as a subject or object relative clause. When the target sentence was a subject relative clause, the choice was as follows in (7):

(7) A woman gives a gift, a woman receives a gift; which woman would you rather be?

Instead, the choice that elicited an object relative clause was posed in this way (8):

(8) A doctor visits woman, a nurse visits woman; which woman would you rather be?

The results of this test showed that, while Hebrew-speaking individuals with agrammatism generally failed to produce both SRC and ORC, individuals with ND produced correctly all subject relative clauses and most object relatives. In the rest of the cases, however, they produced a grammatical sentence, even if not relative, and they never omitted the embedding marker, contrary to patients affected by agrammatism.

All these studies demonstrated that the syntactic structure of sentences is a crucial determinant of omissions in reading of ND patients. It can modulate the portion of the

sentence that patients consider in reading tasks. It has been demonstrated that, if the portion of the sentence under consideration is ungrammatical, the syntactic competence of the patients allows them to shift their attention to the portion of the sentence contra-lateral to the lesion to go in search of the elements that make the sentence grammatical, up to when the syntactic and lexico-semantic requirements have been met.

2. Relative clauses

Relative clauses (RC) are subordinate clauses that have the function of modifying a noun phrase (NP), called *antecedent* (or *head*), and are introduced by a relativizer. RC are clauses embedded in a NP, of which they constitute an anaphoric reference (Givón, 1990). According to Givón, relativization is a process that allows merging two propositions that share the same referent. Consider the example in (1):

(1) a. Maria legge il libro. Sua zia le ha regalato il libro.
b. Maria legge il libro *che le ha regalato sua zia*.

In (1a) there are two independent sentences; in (1b) the two sentences are merged, thanks to the co-referentiality of their referent, in a hierarchical structure in which a relative subordinate clause is embedded in a main subordinate clause. The noun phrase shared by the two starting clauses (in this case, *il libro*) remains expressed in the main clause, while in the relative clause there is a gap in correspondence to the head position.

From a semantic point of view, RCs can be distinguished between *restrictive relatives* and *non restrictive* (or *appositive*) *relatives* (Poletto & Sanfelici, 2015). Restrictive relatives restrict the reference of the head noun and specify its meaning, as occurs in the example in (2).

(2) Il ragazzo *che ho conosciuto oggi* si chiama Mario.

Non restrictive relatives, on the other hand, add additional information, unnecessary for understanding the meaning of the antecedent. These latter are often found post-posted to the antecedent and delimited by two commas. Consider the example in (3).

(3) Mia cugina, *che è tornata per le vacanze*, è venuta a farmi visita.

Furthermore, we can classify relative clauses according to the way they are introduced. As previously mentioned, relative sentences are introduced by relativizers: a relative pronoun is a portion of the NP included in the relative clause, and this explains why demonstratives, which are elements internal to the Determiner Phrase (DP), can be used as relative pronouns (Poletto & Sanfelici, 2015). In Italian, two types of relative elements can be observed: wh- elements, such as *quale, cui*, and the complementizer *che*. Their distribution changes according to whether they introduce a restrictive or an appositive relative clause, and according to the argumentative role of the relative clause. In the case of restrictive relative clauses, the element *che* introduces constituents not preceded by prepositions, as in (4a). Instead, appositive relative clauses are introduced by relativizers such as *il (la, i , le) quale (quali)* (4b). In the case of other indirect complements introduced by prepositions, the relativizers *cui, il (la, i, le) quale (quali)*, introduce both restrictive relative clauses and appositive relative clauses (4c).

(4) a. La donna *che* abita al terzo piano.
b. Mia cugina, *la quale* abita a Milano, mi ha chiamato stamattina.
c. Quello è il ragazzo *con cui/il quale* gioco a calcio.

Another type of relativizer in Italian consists of a distal demonstrative, agreed with the antecedent, followed by *che*. This form is used when the demonstrative indicates a precise element of a set of entities introduced by the antecedent, as in (5).

(5) Paolo, *quello che* hai conosciuto ieri, parla cinque lingue.

Obviously, this type of relativizer is used when the antecedent does not have a unique reference (the speaker and the listener know more than one person named Paolo). For example, the sentence in (6) is not pragmatically sensible.

(6) #Tua madre, *quella* che cucina bene, ci ha portato una torta.

Furthermore, it is not possible to use this type of construction when the antecedent is a first or second person pronoun (as in 7a), or when the noun is indefinite (7b).

(7) a. *La professoressa ha interrogato me, *quello che* aveva studiato.

b. #Ho salutato una donna, *quella che* conosce mia madre.

This suggests that this type of relative clauses has the same structure as the appositions (8a), but are different from the epithets, which instead contain a noun with a single reference (8b).

(8) a. #Tua madre, quella simpatica.

b. Mario, *quel fannullone*, ha preso un'altra insufficienza.

It is possible to add a further type of relative, namely the *relative clause without antecedent* (or *indefinite*). These sentences are introduced by a relative pronoun or an interrogative pronoun, while the function of antecedent is performed by an abstract element. For example:

(9) *Chi non è stato invitato* deve andarsene.

Another distinction of relative clauses in Italian concerns *proper relative clauses* and *improper relative clauses*: proper RC have an attributive value, i.e. they modify the NP by adding a quality. They can also be enclosed between two commas (as in 10b).

(10) a. La ragazza *che ho salutato* si chiama Marta.

b. Quella rivista, *che leggo ogni settimana*, si trova in edicola.

Improper RC, on the other hand, assume the value of other subordinate clauses. They can be of different types: some examples are provided in (11).

(11) Temporal relatives:

a. Sono arrivato *che (mentre)* dormiva.

Causal relatives:

b. Beato te *che (perché)* hai passato l'esame.

Final relatives:

c. Chiamerò uno *che (affinchè)* possa aiutarci.

Consecutive relatives:

d. Paolo non è uno *che (tale che)* farebbe una cosa del genere.

Concessive relatives:

e. Marta *che stava (nonostante stesse)* male venne lo stesso.

Conditional relatives:

f. *Chi (se uno)* ti sposerà, sarà fortunato.

As the other types of subordinate clauses, RC can be explicit or implicit, depending on whether they contain a verb in a respectively finite or infinite mood. Indeed, *explicit relative clauses* have the verb in the indicative (12a), subjunctive (12b) or conditional mood (12c).

(12) a. La torta *che ho mangiato* era molto buona.

b. Vorrei un uomo *che ami ballare*.

c. Uno sport *che mi piacerebbe fare* è il pattinaggio.

Implicit relative clauses, on the other hand, contain a verb in the infinitive (13a) or participle mood (13b).

(13) a. Vorrei un cane *da coccolare* tutto il giorno.

b. Mario ha abbracciato la sorella *tornata* da Londra.

With respect to the main clause, the relative clause can be placed before (14a), after (14b), or inside, enclosed between two commas (14c).

(14) a. *Ad alzare per primo la mano* sono stato io.

b. Ho conosciuto il ragazzo *che lavora con mio fratello*.

c. La fidanzata di Marco, *che ha 18 anni*, frequenta il liceo scientifico.

2.1. Subject and object relative clauses

Subject relative clauses and *object relative clauses* differ based on the NP that is modified by the relative clause. If the argument (NP), which is replaced by the relative pronoun, is the subject of the main clause, then the embedded relative is a subject relative, as in (1a); instead, if the argument is the object of the main clause, it is an object relative, as in (1b).

(1) a. Il signore *che aiuta Marco*

b. Il signore *che Marco aiuta*

The two relative clauses contain exactly the same words and both modify the NP *il signore*. However, what changes is the relationship between the words and their order, which causes a change in the meaning of the whole period. In fact, in the sentence in (1a), which contains a subject relative clause (SRC), the subject of the sentence (*il signore*) helps *Marco*, who in this case is the object (or patient) of the action. Instead, in the sentence in (1b), which contains an object relative clause (ORC), it is *Marco* who performs the action, and plays the role of subject (or agent), while the direct object of the verb is *il signore*.

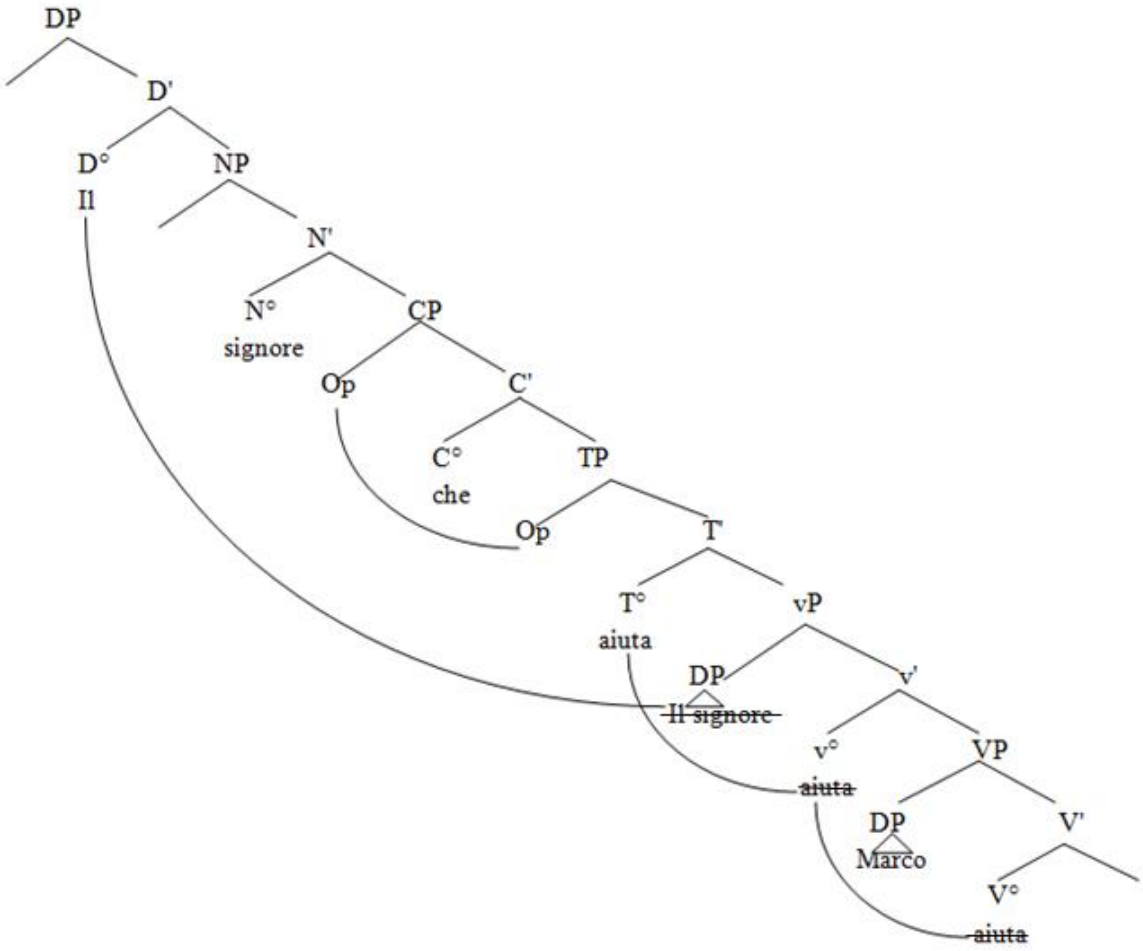
2.1.1. Syntactic representation of SRC and ORC

In syntax, when an element is displaced from its original position to another position in the sentence, this mechanism is called *syntactic movement* (Chomsky, 1981). When this happens, the moved constituent leaves a trace in its original position, which is connected to the moved element, i.e. its antecedent. Hence, the relationship created between the relative head and the corresponding gap found in the relative clause is a movement dependency. In the position of SpecTP, the verb assigns the thematic role to the trace of the constituent which has risen to the CP position, and the trace, in turn,

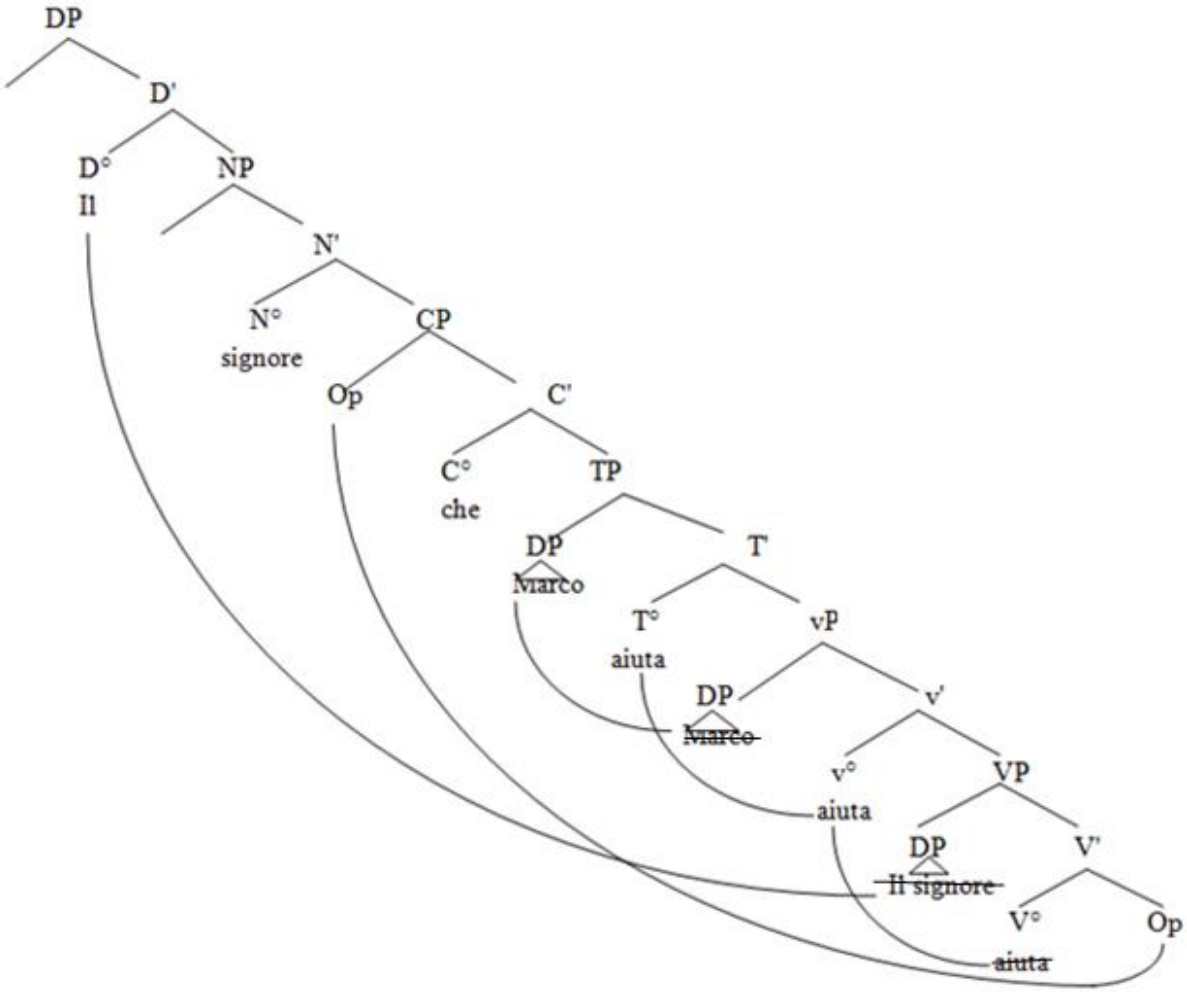
transfers the role to its antecedent, thanks to the relationship between the head and the trace.

A RC is formed starting by the movement of a constituent that is relativized from its starting position upwards, to an arrival position, in the highest node of the syntactic tree, i.e. the complementizer phrase (CP). Thus, subject relative clauses and object relative clauses differ in the position from which the constituent of the NP has moved: SRC are formed by the movement of the NP from the agent position, i.e. SpecvP (or SpecVP, if the predicate is an inaccusative verb), to the highest position of SpecCP, as in (2a). ORC are formed through the movement of the NP, which originally is in the position of the object (or patient), to the position of SpecCP. In this position, the NP that is moved is co-indexed with the relative head (Cinque, 1978; Chomsky, 1986). According to this theory, SRC and ORC can be represented in this way:

(2) a. Il signore che aiuta Marco.



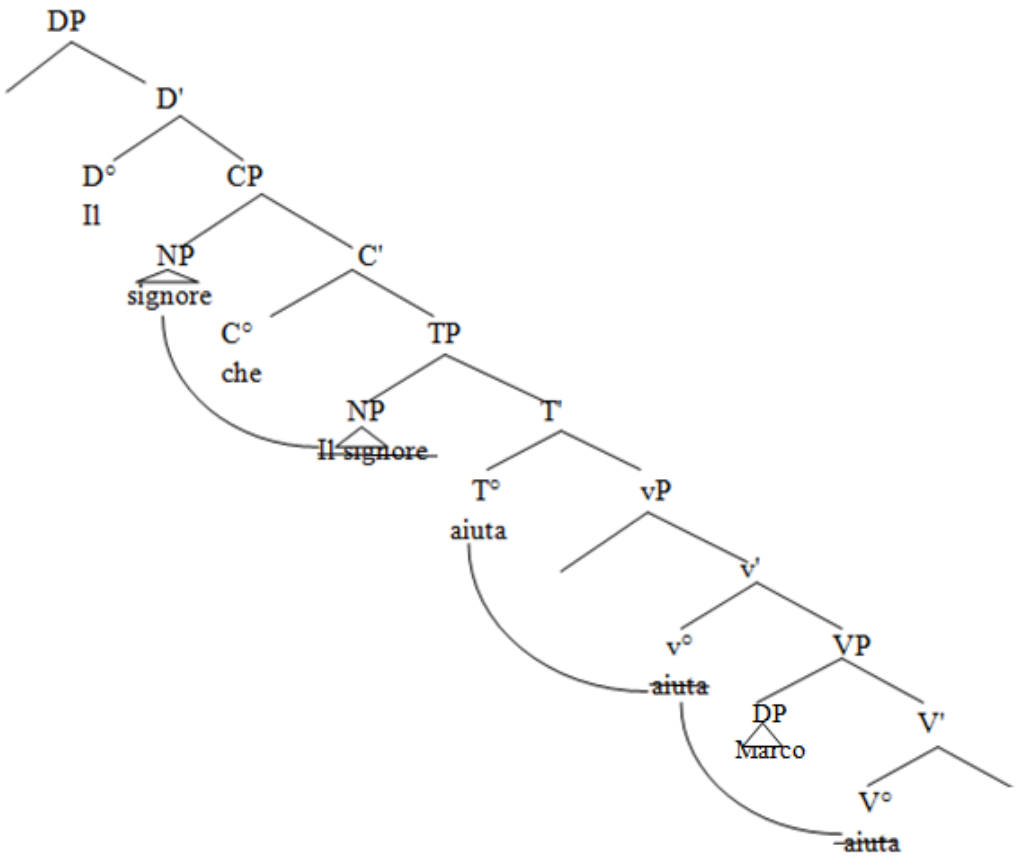
b. Il signore che Marco aiuta.



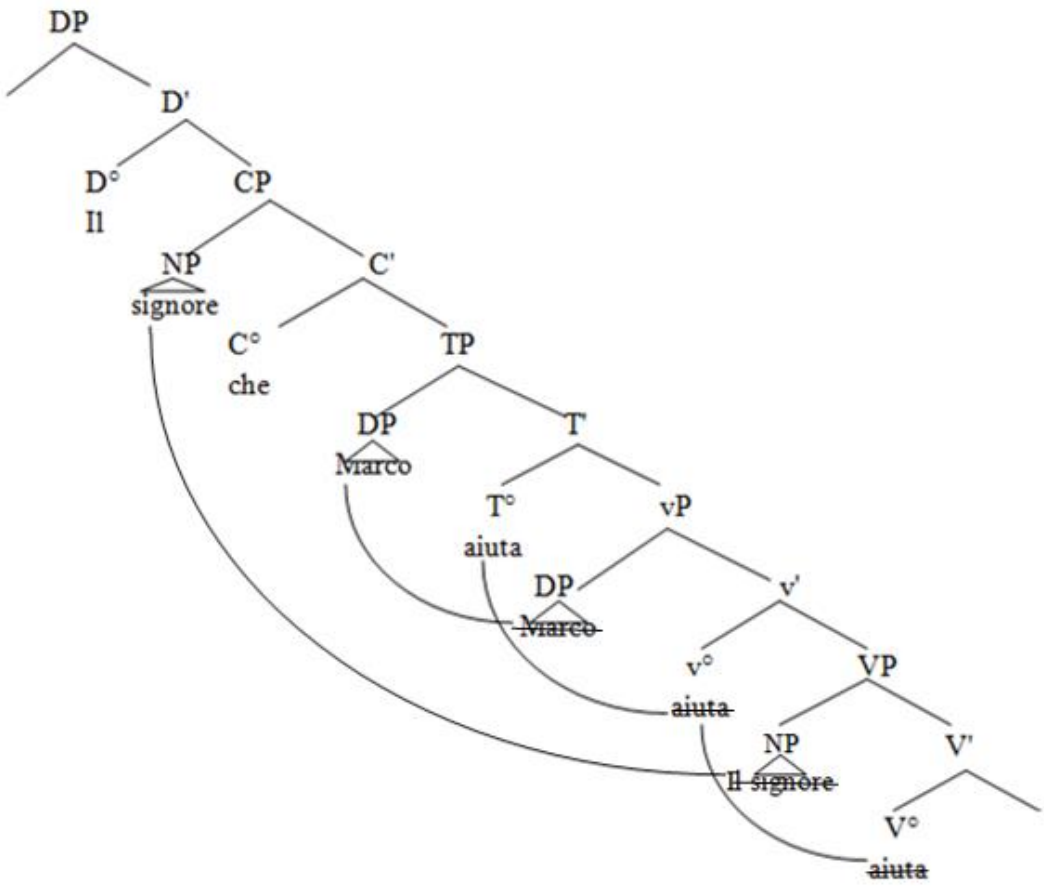
As we can see, in (2a), the DP *Marco* is generated in the position of the object, or patient, and does not move to any other position. Instead, in (2b), it is generated in the position of the agent, i.e. SpecvP, and then it moves towards the position of SpecTP, in which it assumes the function of subject: here the verb gives the agent the nominative case and, in turn, the agent (which becomes the subject) transfers its characteristics of gender and number to the verb, so that agreement can take place. In this sentence, *Marco* is the subject, instead the DP *il signore* assumes the value of object of the relative clause.

Instead, according to other theories (Vergnaud, 1985; Bianchi 2002; Kayne 1994), the element that moves from the relative to the CP is the head of the relative, as in the syntactic trees in (3a) and (3b).

(3) a. Il signore che aiuta Marco.



b. Il signore che Marco aiuta.



2.1.2. Processing SRC and ORC

Across the several studies that aimed at explaining the comprehension of relative clauses, it has been seen that subject relative clauses are processed more quickly than object relative clauses. Tests conducted on children (Friedmann et al., 2004), for example, showed that ORC required more time to be comprehended than SRC. To interpret this result, we need to introduce Relativized Minimality.

Relativized Minimality (RM) was formulated in the homonymous book *Relativized Minimality* by Luigi Rizzi (1990), on the basis of wh- islands and negative islands, starting from studies carried out on L2-speaking children and patients with mental illnesses. Relativized Minimality encodes a psychological effect of interference,

or intervention, whereby when there is an element (X) that moves from its starting position, if it bypasses another element of its same type (Z) that c-commands the position of the track but not the arrival position (X), this element (Z) will be considered, in the search procedure, as the effective antecedent element of the track (Y). The antecedent element of Y is in fact X, and not Z.

Y cannot be related to X if the element Z intervenes which has the same morpho-syntactic features as X. Thus, Y must be in a minimal configuration with X, in which there is no Z which has the same features as X and intervenes between X and Y. Indeed, it is never possible, in syntax, to have an element that bypasses another element of the same type.

(1) .....X……Z……Y.....

To better understand this concept I can provide the examples in (2).

(2) a. Il ragazzo che ha visto Maria è biondo.
b. Il ragazzo che Maria ha visto è biondo.

In the subject relative clause (2a), the subject (*il ragazzo*), in the syntactic tree, moves from the position in which it is generated, i.e. SpecvP, to the SpecCP position, without "crossing" any other possible position suitable for its function as subject. Instead, in the object relative clause (2b), *il ragazzo*, which in this case performs the function of object, moves from the position of patient in SpecVP, to the position in SpecCP, crossing with the subject (*Maria*), which is on its path to the position of SpecvP. So, in the search procedure, the wh- element crosses the nominal constituent that appears before the object in the syntactic structure.

Why object relative clauses are possible, then? Because it is true that the wh-element interferes with another element, i.e. the nominal constituent, but it is also true that this has different traits, as it is, in fact, a noun. When a subject interferes in an object relative clause with another element, we are dealing with a wh- element and a nominal constituent, which are related because the wh- (*che*) also represents the NP, but is not exactly of the same subtype. The interfering element in the track does not have

the same traits, because it is not a wh- element, but a noun. Furthermore, in Italian the sentence *Il ragazzo che ha visto Maria* is further ambiguous, because Italian is a language that allows post-verbal subjects. However, a phrase like *Il ragazzo che Maria ha visto* would sound unnatural in spoken language for native speakers.

As anticipated, it has been seen that an intervention effect incurs object relative clauses, which are more difficult to interpret for children (Friedman, 2004) and Alzheimer's patients (Caloi, 2013) than subject relative clauses. Therefore, it was observed, also thanks to a study carried out on Hebrew and Italian (Belletti, Friedmann, 2012), that the more the features of the two interfering elements are different, the less the intervention effect will be and the greater the comprehensibility of the phrase. So much so that in 2015 the term Relativized Minimality was corrected with *Feature Relativized Minimality*, precisely because it is due to the traits of the elements, for example two nominal elements can have different traits of gender, number, animation, etc.

Indeed, Belletti and Friedmann (Belletti, Friedmann et al., 2012) tested Jewish and Italian children on comprehension of object relative clauses, in which the object and the subject had different lexical gender, as in (3b).

(3) a. Mostrami la bambina che la nonna bacia.
b. Mostrami il dottore che la bambina disegna.

A sentence-picture task was used, in which the children had to attribute the picture to the sentence just heard. The results showed that, while in Hebrew the gender difference improved understanding of object relative clauses, in Italian, the gender trait did not affect the sentence comprehension at all. This occurs due to a different gender characteristic in the two languages: in Hebrew, gender is part of the composition of the inflected verb, therefore of that set of characteristics which attract the subject; instead, in Italian, verbs are not inflected according to gender. Therefore, actually, the result of the tests is due to the difference between the morphosyntactic characteristics of each language.

Adani (Adani et al., 2010), tested Italian children's understanding of object relative clauses, where the subject and object of the sentence do not match with respect to number, as in (4b).

(4) a. La bambina che la nonna sta chiamando.

b. La bambina che i nonni stanno chiamando.

A sentence-picture task was used here as well. The results showed that children's understanding improves when there is a difference in number characteristics than when the subject and object have equal number. Furthermore, this difference in the performance is more visible when it is the number rather than the gender characteristic that changes.

3. The experimental study

3.1. Introduction

In this work, I will address the influence of the syntactic structure on reading performance in ND. As reported in ***Chapter 1***, reading performance is modulated by the content and by the structure of linguistic material. Across this chapter, I will investigate whether ND patients recover their syntactic competence in reading subject relative clauses and object relative clauses.

The information I will collect is meant to be informative of the processing of written material in the brain and in the cognitive system.

Many studies have been aimed at demonstrating that ND patients' syntactic competence modulates their attention, allowing them to become aware of parts of the sentence that were in the side contra-lateral to the lesion (see Abbondanza et al. 2020; Semenza et al. 2011; Marelli & Luzzati 2012; Friedmann et al. 2011). In this way, it could be seen how syntactic competence allowed patients to make fewer errors of omission or substitution in sentence reading tasks.

In this work, I try to understand if the syntactic proficiency of ND patients could modulate their attention in tasks with relative clauses, and precisely subject relative clauses and object relative clauses. As anticipated, SRC and ORC are composed of the same constituents, but placed in a different order, which causes the meaning of the sentences, in which they are embedded, to change completely. We have seen that, in studies with children (Friedmann et al., 2004) and Alzheimer patients (Caloi, 2013), object relative clauses cause much more processing problems than subject relative clauses in comprehension tasks, resulting in a process of intervention of a constituent (the subject) during the search procedure for the trace of the antecedent (the object).

This study aims to discover if ND patients perform differently in tasks with SRC or ORC, and precisely if they produce more omission (or substitution) errors in sentences containing object relative clauses, rather than in sentences containing subject relative clauses. The two different types of relative sentences could lead patients to a different reading of the whole sentence. Consider the sentences in (1).

(1) a. La signora che ha visto Lara ieri. SR

b. L'uomo che Marco ha incontrato in metro. OR

If ND patients read only the portion of the sentence which is located in the field contra-lateral to the lesion, therefore the right portion of the sentence, they will read only the relative clause, which is found post-posted to the antecedent which is modified by the relative. Hence, in reading the object relative clause, reading only the portion of the sentence on the right of the visual field (*Marco ha incontrato in metro*), patients could consider this portion of the sentence as grammatical, characterized by an SV order, and, probably, they will stop their reading, not looking for other elements within the sentence. On the other hand, the relative sentence in 1a (*ha visto Lara ieri*) is not a well formed sentence and patients could consider it as ungrammatical. If they consider that something is missing from the sentence (the subject, in this case), they could be induced to read also the left part of the sentence. Therefore, they would produce more errors of omission in sentences containing object relatives, than in sentences containing subject relatives.

3.2. Stimuli

To create this experimental material, I used sentences containing subject relative clauses and object relative clauses of similar length, containing simple and high-frequency words. The sentences were formed with the addition of an adverbial constituent at the end of the sentence in order to avoid patients to develop a strategy after reading a certain number of sentences. Affirmative independent sentences are also introduced into the study as a control and filling element.

The stimuli consist of 150 sentences, generated under three different conditions: 50 sentences containing subject relative clauses, 50 sentences containing object relative clauses and 50 affirmative sentences. These sentences are of the same length. Sentences containing relative clauses have been constructed with a noun phrase which is modified by a relative clause (subject relative or object relative), introduced by the pronoun *che*. The sentences have an adverbial phrase of time, manner or place at the end. Instead, affirmative sentences are constructed with an SVO order. The sentences of the three conditions have this structure:

(2) a. Il signore che ha chiamato Mario ieri. SR
(The man that called Mario yesterday)

b. Il libro che Luca ha letto con interesse. OR
(The book that Luca read with interest)

c. Sara prova un vestito nel camerino. A
(Sara tries on a dress in the dressing room)

All the stimuli are in ***Appendix 1***.

For the purpose of balancing the length, the number of letters contained in each sentence was checked. For each sentence, the number of constituent letters placed before and after the pronoun *che* and then the total number of characters was counted. The definitive sentences had a total number of about 30-40 letters. The average was calculated between the number of letters before and after the pronoun *che*, and of the total characters, for all three conditions.

These data in the three conditions are reported in (3).

(3)

AVERAGE OF LETTERS BEFORE *CHE* IN SR	AVERAGE OF LETTERS BEFORE *CHE* IN OR	
8,36	7,62	
AVERAGE OF LETTERS AFTER *CHE* IN SR	AVERAGE OF LETTERS AFTER *CHE* IN OR	
22,56	22,04	
TOT AVERAGE OF LETTERS IN SR	TOT AVERAGE OF LETTERS IN OR	TOT AVERAGE OF LETTERS IN A
33,82	32,66	33,94

The frequency of the words contained in the sentences of all three conditions was also carefully controlled. *Subtlex-it* corpus (Crepaldi, Amenta, Mandera, Keuleers, & Brysbaert, 2016) was used to verify the frequency of each word. For each word it was checked whether it was found before or after the pronoun *che* and whether it belonged to the condition SR, OR or A. A sub-corpus containing all the words with the highest frequency was also used, to use easily recognizable and most used words. A *Welch Two Sample T-Test* was carried out to compare the average word frequency across all three conditions, and the results showed that there are not statistically significant differences. The means are reported below, in (4).

(4)

AVERAGE FREQ WORDS IN SR	AVERAGE FREQ WORDS IN OR	AVERAGE FREQ WORDS IN A
26191.67	18758.54	24666.70

The frequencies of all words are reported in ***Appendix 2***.

In order to conduct the experimental study, the stimuli were entered into a Word file, on a horizontal page, printed in Arial font, size 26. Each page contained five sentences. Two files were created, containing the stimuli arranged in a different random order. The order of the stimuli never presented sentences in the same condition three times in a row.

3.3. Working hypothesis

The aim of this work is to understand whether patients with ND show a different behaviour in reading subject relative sentences and object relative sentences, using affirmative sentences as a neutral element. Patients with neglect dyslexia are unable to read the portion of the sentence that is located in the part contra-lateral to the lesion. The test was designed to be administered to patients who have a lesion in the right inferior parietal lobe, which does not allow them to be conscious of the left hemi-space. Patients could therefore only read the final part of the sentences designed for this study.

However, the different structure of the sentences could lead them to shift their attention towards the initial part of the sentence, thanks to their syntactic competence, looking for elements that satisfy the syntactic and semantic requirements of the sentence.

Precisely, when ND patients read a sentence containing an object relative clause (as in 5a), they pay attention only to the final part of the sentence (*Silvio ha salvato ieri*). This sentence has an SV order and, although it lacks direct object, it is quite plausible for an Italian native speaker. For this reason, patients could settle for the portion of the sentence of which they are aware and omit the noun phrase, which represents the object of the relative, which is found at the beginning of the sentence, in the left part of the field. Conversely, when the patients are faced with a sentence containing a subject relative clause (as in 5b), the portion of the sentence they read will be the one composed of the verb (*colpì*), the noun phrase (*Sara*) and the adverbial phrase (*in cortile*). Patients would be faced with a construct with VS order, not usual for an Italian native speaker; for this reason, they may be inclined to look for an element in the right part of the sentence that can resolve the ambiguity of the sentence. The syntactic competence of the patients could allow them to understand that the noun phrase found in the relative they read could be the object of the sentence and therefore they could go in search of the agent of the verb *colpì* (the subject *Il ragazzo*) located in the left space.

(5) a. Il ragazzo che Silvio ha salvato ieri.
(The boy that Silvio saved yesterday)

b. Il ragazzo che colpì Sara in cortile.
(The boy who hit Sara in the yard)

Therefore, the working hypothesis is that patients affected by neglect dyslexia do show a different behaviour in reading sentences containing subject relative clauses and sentences containing object relative clauses, committing more errors of omission (or substitution) in the latter than in the former. Naturally, affirmative sentences will serve as a neutral control element.

3.4. Participants

The test was administered to a control group, made up of 18 adults, men and women, who differed in age and years of schooling. Of these, eight had between 8 and 13 years of schooling, of which four were aged between 60 and 67, two between 68 and 73, and two between 74 and 80. The remaining 10 had more than 13 years of schooling, including five between the ages of 60 and 67, three between 68 and 73, and two between 74 and 80. Participants were healthy subjects, with no present or previous neurological disease, fully functioning in normal life.

The first aim of this thesis is to set up an experimental protocol that will be administered to patients with neglect dyslexia. Therefore, the stimuli were submitted to the control group. The results of this preliminary investigation are presented in the following paragraph (***Results 3.5.***).

This test and the results obtained on these subjects, or some of them, could be compared, with the *Crawford Test* (e.g. see Crawford and Howell, 1998), with neglect dyslexia patients closest in age and schooling when such patients will be available. Naturally, in the comparison with the patients, the errors committed by the control subjects will be taken in consideration limited to the first three words of the sentences.

3.5. Results

The following is an analysis of the errors made during the sentence reading test by the control subjects. The number of errors will be calculated, in general and in each of the three conditions, and then the type of errors will be analyzed in detail.

Although the test contains simple sentences and the subjects are normal people without pathology, it was not performed 100% by 15 out of 18 subjects. Out of 150 sentences (of which 50 in the SR condition, 50 OR and 50 A), each subject made from 0 to 8 errors; therefore, the maximum that has been found (8 errors) is 5.33% errors on 150 sentences. Overall there are 49 errors. Looking at the difference between subjects who have an education ranging from 8 to 13 years and subjects with an education of more than 13 years, we note an expected education effect. In fact, 27 errors were made by 8 individuals (3.37 errors per subject) with low education and 22 by 10 individuals

(2.2 errors per subject) with high education. Three individuals made no mistakes, one with low and two with high education.

However, no clear age effect was found, possibly because of the limited number of participants.

3.5.1. Differences in conditions SR, OR, A.

If we consider the errors committed in each of the three conditions (SR, OR, A), we notice that more errors have been committed in the affirmative sentences (condition A). In fact, there are 22 errors (44,8%) in this type of sentence (including two in the same sentence). In sentences with subject relative clauses (SR condition), 17 errors (34,6%) were made, while in sentences containing object relative clauses (OR condition) 10 errors (20,4%) were committed.

This apparently surprising result seems to reflect a strategy, rather than a measure of the relative difficulty of the three conditions.

In fact, in 11 sentences, a relative clause was replaced with a non-relative one and vice versa. In particular, by three subjects, 5 times the pronoun *che* was omitted in a relative sentence (obviously, subject relative, since by eliminating *che* we obtain a plausible affirmative sentence, in contrast to object relative clauses) and, by three subjects, 6 times *che* was added after the NP to an affirmative sentence by making it a subject relative clause. It therefore looks that more errors on subject relatives is due to their transformation in the simpler affirmative.

3.5.2. Error types

Control subjects committed errors of various types, made without substantial differences between portions of the space of the sentence, and more frequent in subjects with low schooling.

By the way, the first part of the sentences (i.e., the first three words) does not seem easier or more difficult: 19 mistakes (38,7%) were made in the first 3 words of the sentence and 30 (61,2%) in the others. From this, it can be deduced that the first three

words do not seem to cause more errors than the rest, and this is a significant data for the comparison with patients with neglect dyslexia.

The various types of errors committed are listed in detail below.

a) Substitution errors of a noun with a noun or a verb with a verb (16,3%).

Several types of substitution were made: semantic substitution (*anni* instead of *giorni)*; gender substitution (*giocatore* instead of *giocatrice*); substitution of the verb tense (*ingannato* for *ingannò*, *accompagnato* instead of *accompagna*); substitution of a verb with a phonologically similar verb (*prenotato* instead of *preparato*, *abbracciato* instead of *baciato*).

There was also a mistake of a diminutive suffix (*gattini* instead of *gatti*).

The prefix *ri-* was once added to the verb *partire*.

b) Proper name substitution errors (28,5%).

Some first names have been erroneously replaced with a phonologically similar first name (*Pietro* for *Piero*, and vice versa, *Maria* for *Mara*, and vice versa, *Luca* for *Lucia*); a first name that is the same but different in gender (*Francesco* instead of *Francesca*); the same name accented on the last syllable, in the case of the first name *Sara* (replaced by the verb *sarà* three times); a verb (*ama* instead of *Anna*).

c) Substitution errors of the initial article (8,16%).

Four times, by three different people, the indefinite article *un/una* was replaced, in the initial position, by the definite article *il/la*. Obviously, the definite article has been replaced by the definite article with a different gender in the case of the substitution of the noun with the same one with a different gender (*il giocatore* for *la giocatrice*).

d) Errors of addition of a definite article (4%).

Two subjects added a definite article *il/la* in non-initial position.

e) Errors of omission of possessive adjective (2%).

One subject omitted the possessive adjective *suo*.

f) Errors of addition of possessive adjective (2%).

A subject added a possessive adjective (*sue*) where it was not present.

g) Prepositions substitution errors (12,2%).

Six times simple and articulated prepositions were replaced by four subjects (*di* instead of *in*, *al* instead of *del*, *con* instead of *per*) and once the simple preposition was replaced with the same articulated one (*al* instead of *a*).

h) Error of addition of the preposition (2%).

Once the simple preposition *di* not present in the sentence was added.

i) Error of omission of the temporal adverb (2%).

Once the adverb temporal (*ieri*) at the end of the sentence was omitted.

j) Errors of substitution of a relative sentence with a non relative sentence (10,2%).

Five times from three subjects the pronoun *che* in subjective relative sentences was omitted, making them affirmative sentences.

k) Errors of substitution of a non relative sentence with a relative sentence (12,2%).

Six times from three subjects the pronoun that was added in affirmative sentences, making them subject relative sentences.

Below, in (1), there is a diagram showing the various types of errors committed by the control subjects divided into categories (a, b, etc.).

(1)

	SUBJECT	GENDER	AGE	YEARS OF EDUCATION	TOT ERRORS	ERRORS CATEGORIES
1	BD	W	60	8_13	2	C
2	AG	W	62	8_13	2	B, C
3	FG	M	61	8_13	1	G
4	FG	M	60	8_13	8	A, C, E, I, K
5	BA	M	71	8_13	6	A, B, K
6	ADS	M	70	8_13	6	A, B, G
7	GB	W	76	8_13	/	No errors
8	MTL	W	78	8_13	2	B
9	RR	W	61	>13	1	B
10	MSL	W	67	>13	1	J
11	TZ	W	66	>13	/	No errors
12	LC	W	61	>13	5	B, F, H, J, K
13	FB	M	60	>13	/	No errors
14	PP	M	71	>13	2	A, B
15	MRF	W	73	>13	1	D
16	OR	M	70	>13	7	A, B, D, G, J
17	AG	M	77	>13	3	A, G
18	AC	W	76	>13	2	B

3.6. Discussion

This investigation consisted in principle of two parts: 1) building a plausible test, allowing a direct comparison of the two types of relative sentences of interest with affirmative sentences. 2) administering the test to patients with neglect dyslexia. Part 2) could not be carried out properly and it is left for the future. The reason is the lack of a proper patient. In fact, one should not expect that all patients with neglect dyslexia would lend themselves to this investigation. Cases of neglect dyslexia are not, indeed, homogeneous. Crucially, the degree of severity plays a pivotal role. A very severe patient would in fact omit the first words of the sentence in every case, irrespective of the structure of the sentence. This was indeed the case of the only patient to whom the material prepared in this thesis has been administered. He omitted the first part of every sentence he was presented with. The expectation is that, with some recovery, the patient would become sensitive to the sentence structure in the predicted way. On the other hand, a person with mild neglect dyslexia would not commit enough errors to allow a statistical comparison.

The first part of the investigation was satisfactorily completed. The test was built according to strict criteria, balancing the linguistic variables in the three conditions. It could be administered to a sufficient number of participants including people with a low as well as a high level of education. This will allow to select from this sample 4 to 6 controls for matching to potential patients with the Crawford method for the study of single cases (Crawford and Howell, 1998). This method is in fact based on the confrontation of a single patient's performance with a small number of controls.

Importantly, healthy participants commit what looks like a negligible number of errors, more or less equally distributed in the first and in the second part of sentences. Most errors can be attributed to lapses of attention and do not seem instead related to spatial factors or factors related to the sentence structure. Patients with neglect dyslexia are instead expected to make much more errors in the first part, depending on the structure of the sentence. Completing this investigation by administering this test to patients with neglect dyslexia will thus be crucial and likely to provide interesting data on the exploration of written space and the representation of sentences in the brain.

Appendix 1

SENTENCE	CONDITION
Il ragazzo che ama Maria da sempre	SR
La donna che ha visto Luca ieri	SR
Il cane che insegue il gatto tigrato	SR
L'amico che ha offeso Gianni un anno fa	SR
Il ragazzo che ha baciato Sara oggi	SR
Il signore che ha colpito Mario martedì	SR
L'uomo che inseguì il ladro durante la rapina	SR
Il poliziotto che arresta il collega per reato	SR
La bambina che ha chiamato Lucia al parco	SR
Il signore che ha ospitato Marco a casa	SR
La signora che ha pagato Ugo per le pulizie	SR
L'impiegato che ha chiamato Luca al telefono	SR
La ragazza che ha assunto Leo l'altro ieri	SR
Il gatto che ha morso il topo in giardino	SR
Il signore che allena il campione in palestra	SR
La donna che ha accudito mia moglie in ospedale	SR
L'uomo che ha lasciato Sofia ieri	SR
Il soldato che ha salvato il compagno in guerra	SR
La signora che ha salutato Leo oggi	SR
Il ragazzo che colpì Sara in cortile	SR
La signora che ha visto Lara ieri	SR
La donna che ha insultato Piero in metro	SR
Il ragazzo che fermò il vecchio per strada	SR
Il comico che imita Gianni alle feste	SR
L'amico che abbracciò Lucio prima di partire	SR
Il signore che ha chiamato Mario ieri	SR
L'uomo che abbagliò Marco con la torcia	SR

La signora che ha chiuso Leo fuori casa	SR
La ragazza che battezzò mia figlia	SR
La donna che ha incolpato Elena dell'accaduto	SR
L'amico che ha soccorso Lucia dopo la caduta	SR
Il boxer che sconfisse l'avversario sul ring	SR
La ragazza che ha lasciato Dario per sempre	SR
La signora che accusò Silvio di furto	SR
La donna che ha cercato Pietro per ore	SR
L'uomo che ingannò Mario per denaro	SR
Il ragazzo che ha corteggiato Sara per un anno	SR
Il signore che ha coinvolto Leo in una rissa	SR
La donna che accompagna Luca in ufficio	SR
Il signore che ha confortato mio figlio ieri	SR
Il ragazzo che aiutò Matteo con i compiti	SR
La signora che ha criticato Mario stamattina	SR
La ragazza che ha calmato Davide ieri	SR
Il signore che ha denunciato Gianni ieri	SR
La giocatrice che sconfisse Mario a scacchi	SR
Il bambino che deride il compagno in classe	SR
Il ragazzo che ha conosciuto Sara in spiaggia	SR
La ragazza che detesta Maria da sempre	SR
La donna che ha educato Marta da piccola	SR
La signora che ha elogiato mio figlio ieri sera	SR
Il libro che Marco ha appena comprato	OR
Il pesce che Giovanni ha mangiato ieri	OR
La ragazza che Lucia odiava a scuola	OR
Il signore che Marco ha insultato al mare	OR
La città che Sofia ha visitato l'anno scorso	OR
L'uomo che Francesca ha incontrato stasera	OR
Il telefono che Matteo utilizza a lavoro	OR

La ragazza che Antonio ha lasciato lunedì	OR
La donna che Paolo ha baciato ieri	OR
L'uomo che Marco ha incontrato in metro	OR
La lettera che Stefano ha scritto stanotte	OR
Il ladro che il poliziotto ha arrestato ieri	OR
Il bambino che il cane ha inseguito oggi	OR
La camera che Maria ha pulito con cura	OR
La casa che Paolo ha visitato con Marta	OR
L'auto che Maria ha guidato attentamente	OR
La pasta che Carlo ha mangiato oggi	OR
La casa che Mario ha comprato stamattina	OR
L'amico che Luca ha salutato dopo pranzo	OR
Il bambino che la mamma ha appena adottato	OR
La signora che Anna ha visto oggi al negozio	OR
L'autobus che Mara ha preso stamattina	OR
I soldi che il ladro ha rubato stanotte	OR
La signora che Angelo ha salutato ieri	OR
Le scarpe che Laura indossa oggi	OR
Il regalo che Sara ha fatto a Chiara	OR
Il dolce che Antonio ha mangiato prima	OR
La torta che Maria ha preparato stamattina	OR
Il libro che Luca ha letto con interesse	OR
Il ragazzo che Silvio ha salvato ieri	OR
Il vestito che Sara indossava al matrimonio	OR
La donna che Anna ha incontrato oggi	OR
L'articolo che Marta ha scritto in un anno	OR
L'esame che Maria farà domani	OR
Il lavoro che Marco fa con passione	OR
Il cane che Luca ha trovato stamattina	OR
L'uomo che Silvia ha conosciuto a lavoro	OR

Il tema che gli alunni scrivono in classe	OR
Il bicchiere che Carla ha rotto ieri	OR
Il ragazzo che Maria chiama al telefono	OR
L'uomo che l'assassino ha ucciso stanotte	OR
Il libro che Mara ha scritto l'anno scorso	OR
La ragazza che Marco ha appena investito	OR
I fiori che Serena ha raccolto in giardino	OR
La pizza che Leo ha mangiato ieri	OR
La ragazza che Maria ha incontrato stamattina	OR
La signora che Monica ha aiutato oggi	OR
Il cane che Chiara ha adottato ieri	OR
Il piano che il maestro suona sul palco	OR
Il film che Sara ha visto ieri sera	OR
Il ragazzo ama Maria da due anni	A
La ragazza ama leggere libri di fantascienza	A
Il cane insegue il gatto in giardino	A
Matteo ha aiutato un bambino con i compiti	A
Angela ha lasciato Dario per sempre	A
Sara ha mangiato un gelato in centro ieri sera	A
Il bullo ha deriso un compagno in classe	A
Gianni ha denunciato un signore l'anno scorso	A
Chiara ha conosciuto un ragazzo in spiaggia	A
Un uomo ha ingannato Mario per denaro	A
Il soldato ha salvato il compagno in guerra	A
Il gatto ha catturato un topo in campagna	A
Matteo ha mangiato lasagne per pranzo	A
Piero ha insultato una donna sull'autobus	A
Un ragazzo ha spinto Mario giù dalle scale	A
Una donna accompagnò Luca dal direttore	A
Il mister allena il campione prima della partita	A

Il direttore ha assunto Carlo il mese scorso	A
Marco ha ottenuto un nuovo lavoro	A
La maestra ha premiato Matteo con un bel voto	A
I miei genitori hanno adottato un cane ieri	A
Lucio ha abbracciato l'amico prima di andarsene	A
L'uomo ha inseguito il ladro durante la rapina	A
La compagna ha calmato Lucia prima dell'esame	A
Il boxer ha sconfitto l'avversario sul ring	A
Silvio ha visto tutti i film di Tarantino	A
Il cane ha mangiato tutto il cibo sul tavolo	A
Andrea ha visto una bella ragazza sull'autobus	A
Un signore ha coinvolto Giacomo in una rissa	A
Il ladro ha rubato tutti i gioielli di famiglia	A
Maria beve un tè con le sue amiche	A
Sara prova un vestito nel camerino	A
Anna ha invitato Giulia a casa sua	A
Gianni ha incontrato un suo amico due giorni fa	A
Luca ha studiato tutti i libri per l'esame	A
Il professore elogia Stefano davanti a tutti	A
Matteo ha rubato la penna al compagno	A
Marta ha comprato delle tende nuove	A
Mauro prende l'autobus tutte le mattine	A
Laura ha baciato Andrea alla festa	A
La giocatrice ha sconfitto Luca a biliardo	A
Un medico ha curato mia moglie dalla malattia	A
Sonia guida l'auto da corsa di suo padre	A
Elena accarezza i gatti nel cortile di casa	A
Giorgio accompagna Mara a casa dopo la festa	A
Matteo organizza la sua festa di compleanno	A
Una signora ha criticato Marco stamattina	A

Una bambina guarda il pagliaccio al circo	A
La maestra insegna la matematica ai bambini	A
Giorgia ha bevuto il caffè al bar stamattina	A

Appendix 2

SENTENCE NUMBER	WORD	BEFORE/AFTER	FREQUENCY
1	ragazzo	prima	44729
1	ama	dopo	6199
1	Maria	dopo	5407
1	sempre	dopo	107511
2	donna	prima	44546
2	visto	dopo	89168
2	Luca	dopo	713
2	ieri	dopo	22347
3	cane	prima	13494
3	insegue	dopo	331
3	gatto	dopo	4110
3	tigrato	dopo	24
4	amico	prima	81626
4	offeso	dopo	822
4	Gianni	dopo	410
4	anno	dopo	28954
5	ragazzo	prima	44729
5	baciato	dopo	1486
5	Sara	dopo	3310
5	oggi	dopo	49190
6	signore	prima	81895
6	colpito	dopo	7470
6	Mario	dopo	1181
6	martedì	dopo	2173
7	uomo	prima	84459
7	inseguì	dopo	20
7	ladro	dopo	3079
7	durante	dopo	13927
7	rapina	dopo	2895
8	poliziotto	prima	8608
8	arresta	dopo	202
8	collega	dopo	3597
8	reato	dopo	1520
9	bambina	prima	12385
9	chiamato	dopo	23241
9	Lucia	dopo	561
9	parco	dopo	3854

10	signore	prima	81895
10	ospitato	dopo	149
10	Marco	dopo	1583
10	casa	dopo	129959
11	signora	prima	45011
11	pagato	dopo	6687
11	Ugo	dopo	209
11	pulizie	dopo	1137
12	impiegato	prima	1390
12	chiamato	dopo	23241
12	Luca	dopo	713
12	telefono	dopo	19611
13	ragazza	prima	43963
13	assunto	dopo	2728
13	Leo	dopo	2880
13	altroieri	dopo	18
14	gatto	prima	4110
14	morso	dopo	1987
14	topo	dopo	1789
14	giardino	dopo	3741
15	signore	prima	81895
15	allena	dopo	144
15	campione	dopo	4850
15	palestra	dopo	2294
16	donna	prima	44546
16	accudito	dopo	39
16	mia	dopo	225102
16	moglie	dopo	38338
16	ospedale	dopo	14272
17	uomo	prima	84459
17	lasciato	dopo	23232
17	Sofia	dopo	792
17	ieri	dopo	22347
18	soldato	prima	5519
18	salvato	dopo	7113
18	compagno	dopo	4264
18	guerra	dopo	19555
19	signora	prima	45011
19	salutato	dopo	369
19	Leo	dopo	2880
19	oggi	dopo	49190

20	ragazzo	prima	44729
20	colpì	dopo	257
20	Sara	dopo	3310
20	cortile	dopo	1419
21	signora	prima	45011
21	visto	dopo	89168
21	Lara	dopo	468
21	ieri	dopo	22347
22	donna	prima	44546
22	insultato	dopo	344
22	Piero	dopo	104
22	metro	dopo	2155
23	ragazzo	prima	44729
23	fermò	dopo	202
23	vecchio	dopo	21089
23	strada	dopo	26412
24	comico	prima	664
24	imita	dopo	136
24	Gianni	dopo	410
24	feste	dopo	2544
25	amico	prima	81626
25	abbracciò	dopo	44
25	Lucio	dopo	164
25	prima	dopo	141982
25	partire	dopo	6688
26	signore	prima	81895
26	chiamato	dopo	23241
26	Mario	dopo	1181
26	ieri	dopo	22347
27	uomo	prima	84459
27	abbagliò	dopo	2
27	Marco	dopo	1583
27	torcia	dopo	824
28	signora	prima	45011
28	chiuso	dopo	9013
28	Leo	dopo	2880
28	fuori	dopo	96097
28	casa	dopo	129959
29	ragazza	prima	43963
29	battezzò	dopo	12
29	mia	dopo	225102

29	figlia	dopo	25670
30	donna	prima	44546
30	incolpato	dopo	236
30	Elena	dopo	2530
30	accaduto	dopo	3670
31	amico	prima	81626
31	soccorso	dopo	2892
31	Lucia	dopo	561
31	caduta	dopo	3296
32	boxer	prima	364
32	sconfisse	dopo	40
32	avversario	dopo	1008
32	ring	dopo	859
33	ragazza	prima	43963
33	lasciato	dopo	23232
33	Dario	dopo	99
33	sempre	dopo	107511
34	signora	prima	45011
34	accusò	dopo	57
34	Silvio	dopo	111
34	furto	dopo	2634
35	donna	prima	44546
35	cercato	dopo	11156
35	Pietro	dopo	578
35	ore	dopo	26753
36	uomo	prima	84459
36	ingannò	dopo	22
36	Mario	dopo	1181
36	denaro	dopo	9859
37	ragazzo	prima	44729
37	corteggiato	dopo	45
37	Sara	dopo	3310
37	anno	dopo	28954
38	ragazzo	prima	44729
38	coinvolto	dopo	3470
38	Leo	dopo	2880
38	rissa	dopo	1194
39	donna	prima	44546
39	accompagna	dopo	512
39	Luca	dopo	713
39	ufficio	dopo	19782

40	signore	prima	81895
40	confortato	dopo	28
40	mio	dopo	279462
40	figlio	dopo	48706
40	ieri	dopo	22347
41	ragazzo	prima	44729
41	aiutò	dopo	205
41	Matteo	dopo	625
41	compiti	dopo	2556
42	signora	prima	45011
42	criticato	dopo	112
42	Mario	dopo	1181
42	stamattina	dopo	7429
43	ragazza	prima	43963
43	calmato	dopo	198
43	Davide	dopo	307
43	ieri	dopo	22347
44	signore	prima	81895
44	denunciato	dopo	894
44	Gianni	dopo	410
44	ieri	dopo	22347
45	giocatrice	prima	104
45	sconfisse	dopo	40
45	Mario	dopo	1181
45	scacchi	dopo	935
46	bambino	prima	29844
46	deride	dopo	23
46	compagno	dopo	4264
46	classe	dopo	7405
47	ragazzo	prima	44729
47	conosciuto	dopo	8431
47	Sara	dopo	3310
47	spiaggia	dopo	3848
48	ragazza	prima	43963
48	detesta	dopo	200
48	Maria	dopo	5407
48	sempre	dopo	107511
49	donna	prima	44546
49	educato	dopo	706
49	Marta	dopo	718
49	piccola	dopo	22087

50	signora	prima	45011
50	elogiato	dopo	22
50	mio	dopo	279462
50	figlio	dopo	48706
50	ieri	dopo	22347
50	sera	dopo	29592
51	libro	prima	14462
51	Marco	dopo	1583
51	appena	dopo	50877
51	comprato	dopo	6832
52	pesce	prima	5106
52	Giovanni	dopo	1268
52	mangiato	dopo	5829
52	ieri	dopo	22347
53	ragazza	prima	43963
53	Lucia	dopo	561
53	odiava	dopo	696
53	scuola	dopo	25238
54	signore	prima	81895
54	Marco	dopo	1583
54	insultato	dopo	344
54	mare	dopo	6919
55	città	prima	30700
55	Sofia	dopo	792
55	visitato	dopo	519
55	anno	dopo	28954
55	scorso	dopo	5905
56	uomo	prima	84459
56	Francesca	dopo	807
56	incontrato	dopo	7210
56	stasera	dopo	24998
57	telefono	prima	19611
57	Matteo	dopo	625
57	utilizza	dopo	197
57	lavoro	dopo	83272
58	ragazza	prima	43963
58	Antonio	dopo	2681
58	lasciato	dopo	23232
58	lunedì	dopo	2923
59	donna	prima	44546
59	Paolo	dopo	900

59	baciato	dopo	1486
59	ieri	dopo	22347
60	uomo	prima	84459
60	Marco	dopo	1583
60	incontrato	dopo	7210
60	metro	dopo	2155
61	lettera	prima	7949
61	Stefano	dopo	383
61	scritto	dopo	14105
61	stanotte	dopo	7760
62	ladro	prima	3079
62	poliziotto	dopo	8608
62	arrestato	dopo	3550
62	ieri	dopo	22347
63	bambino	prima	29844
63	cane	dopo	13494
63	inseguito	dopo	589
63	oggi	dopo	49190
64	camera	prima	11686
64	Maria	dopo	5407
64	pulito	dopo	3654
64	cura	dopo	14338
65	casa	prima	129959
65	Paolo	dopo	900
65	visitato	dopo	519
65	Marta	dopo	718
66	auto	prima	23532
66	Maria	dopo	5407
66	guidato	dopo	11301
66	attentamente	dopo	1576
67	pasta	prima	1267
67	Carlo	dopo	1125
67	mangiato	dopo	5829
67	oggi	dopo	49190
68	casa	prima	129959
68	Mario	dopo	1181
68	comprato	dopo	6832
68	stamattina	dopo	7429
69	amico	prima	81626
69	Luca	dopo	713
69	salutato	dopo	369

69	dopo	dopo	79891
69	pranzo	dopo	8701
70	bambino	prima	29844
70	mamma	dopo	59343
70	appena	dopo	50877
70	adottato	dopo	528
71	signora	prima	45011
71	Anna	dopo	5110
71	visto	dopo	89168
71	oggi	dopo	49190
71	negozio	dopo	8132
72	autobus	prima	4028
72	Mara	dopo	542
72	preso	dopo	44292
72	stamattina	dopo	7429
73	soldi	prima	52601
73	ladro	dopo	3079
73	rubato	dopo	8584
73	stanotte	dopo	7760
74	signora	prima	45011
74	Angelo	dopo	4329
74	salutato	dopo	369
74	ieri	dopo	22347
75	scarpe	prima	7415
75	Laura	dopo	3687
75	indossa	dopo	1718
75	oggi	dopo	49190
76	regalo	prima	7587
76	Sara	dopo	3310
76	fatto	dopo	222451
76	Chiara	dopo	2002
77	dolce	prima	8612
77	Antonio	dopo	2681
77	mangiato	dopo	5829
77	prima	dopo	141982
78	torta	prima	5258
78	Maria	dopo	5407
78	preparato	dopo	3579
78	stamattina	dopo	7429
79	libro	prima	14462
79	Luca	dopo	713

79	letto	dopo	33203
79	interesse	dopo	3436
80	ragazzo	prima	44729
80	Silvio	dopo	111
80	salvato	dopo	7113
80	ieri	dopo	22347
81	vestito	prima	8937
81	Sara	dopo	3310
81	indossava	dopo	1252
81	matrimonio	dopo	14545
82	donna	prima	44546
82	Anna	dopo	5110
82	incontrato	dopo	7210
82	oggi	dopo	49190
83	articolo	prima	3228
83	Marta	dopo	718
83	scritto	dopo	14105
83	anno	dopo	28954
84	esame	prima	3832
84	Maria	dopo	5407
84	farà	dopo	19995
84	domani	dopo	33153
85	lavoro	prima	83272
85	Marco	dopo	1583
85	fa	dopo	129513
85	passione	dopo	2456
86	cane	prima	13494
86	Luca	dopo	713
86	trovato	dopo	45823
86	stamattina	dopo	7429
87	uomo	prima	84459
87	Silvia	dopo	230
87	conosciuto	dopo	8431
87	lavoro	dopo	83272
88	tema	prima	1539
88	alunni	dopo	368
88	scrivono	dopo	332
88	classe	dopo	7405
89	bicchiere	prima	3888
89	Carla	dopo	977
89	rotto	dopo	6898

89	ieri	dopo	22347
90	ragazzo	prima	44729
90	Maria	dopo	5407
90	chiamato	dopo	23241
90	telefono	dopo	19611
91	uomo	prima	84459
91	assassino	dopo	9684
91	ucciso	dopo	31267
91	stanotte	dopo	7760
92	libro	prima	14462
92	Mara	dopo	542
92	scritto	dopo	14105
92	anno	dopo	28954
92	scorso	dopo	5905
93	ragazza	prima	43963
93	Marco	dopo	1583
93	appena	dopo	50877
93	investito	dopo	1576
94	fiori	prima	5238
94	Serena	dopo	2326
94	raccolto	dopo	1885
94	giardino	dopo	3741
95	pizza	prima	2889
95	Leo	dopo	2880
95	mangiato	dopo	5829
95	ieri	dopo	22347
96	ragazza	prima	43963
96	Maria	dopo	5407
96	incontrato	dopo	7210
96	stamattina	dopo	7429
97	signora	prima	45011
97	Monica	dopo	1144
97	aiutato	dopo	5129
97	oggi	dopo	49190
98	cane	prima	13494
98	Chiara	dopo	2002
98	adottato	dopo	528
98	ieri	dopo	22347
99	piano	prima	30598
99	maestro	dopo	6854
99	suona	dopo	4479

99	palco	dopo	1977
100	film	prima	22626
100	Sara	dopo	3310
100	visto	dopo	89168
100	ieri	dopo	22347
100	sera	dopo	29592
101	ragazzo	A	44729
101	ama	A	6199
101	Maria	A	5407
101	due	A	127731
101	anni	A	93530
102	ragazza	A	43963
102	ama	A	6199
102	leggere	A	6744
102	libri	A	5557
102	fantascienza	A	345
103	cane	A	13494
103	insegue	A	331
103	gatto	A	4110
103	giardino	A	3741
104	Matteo	A	625
104	aiutato	A	5129
104	bambino	A	29844
104	compiti	A	2556
105	Angela	A	2446
105	lasciato	A	23232
105	Dario	A	99
105	sempre	A	107511
106	Sara	A	3310
106	mangiato	A	5829
106	gelato	A	2717
106	centro	A	9905
106	ieri	A	22347
106	sera	A	29592
107	bullo	A	319
107	deriso	A	110
107	compagno	A	4264
107	classe	A	7405
108	Gianni	A	410
108	denunciato	A	894
108	signore	A	81895

108	anno	A	28954
108	scorso	A	5905
109	Chiara	A	2002
109	conosciuto	A	8431
109	ragazzo	A	44729
109	spiaggia	A	3848
110	uomo	A	84459
110	ingannato	A	886
110	Mario	A	1181
110	denaro	A	9859
111	soldato	A	5519
111	salvato	A	7113
111	compagno	A	4264
111	guerra	A	19555
112	gatto	A	4110
112	catturato	A	1870
112	topo	A	1789
112	campagna	A	4138
113	Matteo	A	625
113	mangiato	A	5829
113	lasagne	A	254
113	pranzo	A	8701
114	Piero	A	104
114	insultato	A	344
114	donna	A	44546
114	autobus	A	4028
115	ragazzo	A	44729
115	spinto	A	2008
115	Mario	A	1181
115	giù	A	133685
115	scale	A	3040
116	donna	A	44546
116	accompagnò	A	47
116	Luca	A	713
116	direttore	A	6867
117	mister	A	2014
117	allena	A	144
117	campione	A	4850
117	prima	A	141982
117	partita	A	9012
118	direttore	A	6867

118	assunto	A	2728
118	Carlo	A	1125
118	mese	A	11018
118	scorso	A	5905
119	Marco	A	1583
119	ottenuto	A	3432
119	nuovo	A	57478
119	lavoro	A	83272
120	maestra	A	1054
120	premiato	A	112
120	Matteo	A	625
120	bel	A	28820
120	voto	A	2264
121	miei	A	57395
121	genitori	A	14857
121	adottato	A	528
121	cane	A	13494
121	ieri	A	22347
122	Lucio	A	164
122	abbracciato	A	288
122	amico	A	81626
122	prima	A	141982
122	andarsene	A	3737
123	uomo	A	84459
123	inseguito	A	589
123	ladro	A	3079
123	durante	A	13927
123	rapina	A	2895
124	compagna	A	1494
124	calmato	A	198
124	Lucia	A	561
124	prima	A	141982
124	esame	A	3832
125	boxer	A	364
125	sconfitto	A	879
125	avversario	A	1008
125	ring	A	859
126	Silvio	A	111
126	visto	A	89168
126	tutti	A	166194
126	film	A	22626

126	Tarantino	A	44
127	cane	A	13494
127	mangiato	A	5829
127	tutto	A	261041
127	cibo	A	11354
127	tavolo	A	6875
128	Andrea	A	1100
128	visto	A	89168
128	bella	A	39354
128	ragazza	A	43963
128	autobus	A	4028
129	signore	A	81895
129	coinvolto	A	3470
129	Giacomo	A	425
129	rissa	A	1194
130	ladro	A	3079
130	rubato	A	8584
130	tutti	A	166194
130	gioielli	A	1858
130	famiglia	A	38730
131	Maria	A	5407
131	beve	A	1618
131	tè	A	558
131	sue	A	25596
131	amiche	A	3303
132	Sara	A	3310
132	prova	A	19358
132	vestito	A	8937
132	camerino	A	415
133	Anna	A	5110
133	invitato	A	3419
133	Giulia	A	589
133	casa	A	129959
133	sua	A	135715
134	Gianni	A	410
134	incontrato	A	7210
134	suo	A	145196
134	amico	A	81626
134	due	A	127731
134	giorni	A	31088
135	Luca	A	713

135	studiato	A	2024
135	tutti	A	166194
135	libri	A	5557
135	esame	A	3832
136	professore	A	469
136	elogia	A	13
136	Stefano	A	383
136	davanti	A	15774
136	tutti	A	166194
137	Matteo	A	625
137	rubato	A	8584
137	penna	A	2134
137	compagno	A	4264
138	Marta	A	718
138	comprato	A	6832
138	tende	A	1631
138	nuove	A	5036
139	Mauro	A	82
139	prende	A	9551
139	autobus	A	4028
139	tutte	A	46131
139	mattine	A	391
140	Laura	A	3687
140	baciato	A	1486
140	Andrea	A	1100
140	festa	A	19723
141	giocatrice	A	104
141	sconfitto	A	879
141	Luca	A	713
141	biliardo	A	621
142	medico	A	8988
142	curato	A	891
142	mia	A	225102
142	moglie	A	38338
142	malattia	A	4416
143	Sonia	A	652
143	guida	A	5845
143	auto	A	23532
143	corsa	A	5085
143	suo	A	145196
143	padre	A	77591

144	Elena	A	2530
144	accarezza	A	72
144	gatti	A	1795
144	cortile	A	1419
144	casa	A	129959
145	Giorgio	A	520
145	accompagna	A	512
145	Mara	A	542
145	casa	A	129959
145	dopo	A	79891
145	festa	A	19723
146	Matteo	A	625
146	organizza	A	454
146	sua	A	135715
146	festa	A	19723
146	compleanno	A	8531
147	signora	A	45011
147	criticato	A	112
147	Marco	A	1583
147	stamattina	A	7429
148	bambina	A	12385
148	guarda	A	50035
148	pagliaccio	A	630
148	circo	A	1405
149	maestra	A	1054
149	insegna	A	1293
149	matematica	A	1704
149	bambini	A	24260
150	Giorgia	A	64
150	bevuto	A	4337
150	caffè	A	12605
150	bar	A	8719
150	stamattina	A	7429

References

- Abbondanza M., Passarini L., Meneghello F., Laratta S., Burgio F., D'Imperio D., & Semenza C. (2020), *The left periphery in neglect dyslexia*. Aphasiology, 34:8, doi: 10.1080/02687038.2020.1738330
- Adani F., van der Lely H. K. J., Forgiarini M., & Guasti M. T. (2010), *Grammatical feature dissimilarities make relativeclauses easier: A comprehension study with Italian children.Lingua*. International Review of General Linguistics. Revueinternationale De Linguistique Generale,120(9–3), 2148–2166. doi: 10.1016/j.lingua.2010.03.018
- Albert M. L. (1973), *A simple test of visual neglect*, Neurology, 23(6), 658–664. https://doi.org/10.1212/WNL.23.6.658
- Arduino L. S., Burani C., & Vallar G. (2002), *Lexical effects in left neglect dyslexia: A study in Italian patients,* Cognitive Neuropsychology, 19 (5), 421–444. doi: 10.1080/02643290244000013
- Arduino L.S., Daini R., Silveri C. (2005), *A stimulus-centered reading disorder for words and numbers: is it neglect dyslexia?*, Neurocase, 11, pp. 405-415, doi: 10.1007/s00221-010-2386-0
- Arguin M., & Bub D. (1997), *Lexical Constraints on Reading Accuracy in Neglect Dyslexia*. Cognitive Neuropsychology, *14* (5), 765–800. doi: 10.1080/026432997381448
- Avery A. (2009), *Relative clauses*, Language Typology and Syntactic Description, 206–236. doi:10.1017/CBO9780511619434.004
- Behrmann M., Black S.E., McKeeff T.J., Barton J.J.S. (2002), Oculographic analysis of word reading in hemispatial neglect, Physiology & Behavior, 77:4–5, 613-619, doi: 10.1016/S0031-9384(02)00896-X
- Behrmann M., Moscovitch M., Black E., & Mozer M.C. (1990), *Perceptual and conceptual mechanisms in neglect dyslexia. Two contrasting case studies,* Brain, 113, 1163-1183, doi: 10.1093/brain/113.4.1163
- Belletti A., Friedmann N., Brunato D., Rizzi L. (2012), *Does gender make a difference? Comparing the effect of gender on children's comprehension of*

relative clauses in Hebrew and Italian, Lingua, 122:10, 1053-1069, doi: 10.1016/j.lingua.2012.02.007

- Beschin N., Robertson I.H. (1997), *Personal versus extrapersonal neglect: a group study of their dissociation using a reliable clinical test,* Cortex, 33:379–384
- Bianchi V. (2002), *Headed Relative Clauses in Generative Syntax* – Part II, Glot International 6(8), 1-13.
- Biondo N., Pagliarini E., Moscati V., Rizzi L., Belletti A. (2022), *Features matter: the role of number and gender features during the online processing of subject- and object- relative clauses in Italian***,** Language, cognition and neuroscience, doi: 10.1080/23273798.2022.2159989
- Bisiach E., & Luzzatti C. (1978), *Unilateral neglect of representational space. Cortex*, 14:1, 129-133, doi: 10.1016/s0010-9452(78)80016-1
- Bisiach E., Luzzatti C., Perani D., (1979), *Unilateral neglect, representational schema and consciousness.* Brain.; 102:609–618
- Bisiach E, Meregalli S, Berti A (1990), *Mechanisms of production control and belief fixation in human visuospatial processing: clinical evidence from hemispatial neglect and misrepresentation*. In: Commons ML, Herrnstein RJ, Kosslyn SM, Mumford DB (eds) Quantitative analyses of behavior. Computational and clinical approaches to pattern recognition and concept formation, vol IX. Lawrence Erlbaum, Hillsdale, NJ, pp 3–21
- Bisiach E, Ricci R, Berruti G, Genero R, Pepi R, Fumelli T. (1999), *Two-dimensional distortion of space representation in unilateral neglect: perceptual and response-related factors.* Neuropsychologia; 37(13):1491-8; doi: 10.1016/s0028-3932(99)00046-9
- Bisiach E, Vallar G, Perani D, Papagno C, Berti A. (1986), *Unawareness of disease following lesions of the right hemisphere: anosognosia for hemiplegia and anosognosia for hemianopia.* Neuropsychologia.; 24(4):471-82. doi: 10.1016/0028-3932(86)90092-8
- Bisiach E., & Vallar G. (2000), *Unilateral neglect in humans*. In F. Boller, J. Grafman, & G. Rizzolatti (Eds.), Handbook of neuropsychology: Sect 1: Introduction, Sect 2: Attention (pp. 459–502). Elsevier Science Publishers

- Bowen, A., McKenna, K., & Tallis, R.C. (1999), *Reasons for variability in the reported rate of occurrence of unilateral spatial neglect after stroke*. Stroke, 30: 1196–1202.
- Caloi I. (2013), *The comprehension of relative clauses in patients with Alzheimer's disease*, Studies in linguistics, Vol 5, CISCL – University of Siena Goethe, Universität Frankfurt
- Campbell B., Huerta J., Norzin T., Schwartz M., Thao T. (2012), *Hemispatial Neglect*, https://sites.google.com/a/macalester.edu/hemispatial-neglect/home
- Cantoni C., Piccirilli M. (1997), *Dissociation in the recovery from neglect dyslexia and visuospatial unilateral neglect: a case report*. Ital J Neuro Sci, 41–43. doi: 10.1007/BF02106230
- Caramazza A., Capasso R., Miceli G. (1996), *The role of the graphemic buffer in reading,* Cognitive Neuropsychology, 13 (5) pp. 673-698
- Carr JH, Shepherd RB (1998), *Neurological Rehabilitation: Optimizing Motor Performance,* Oxford, England Butterworth-Heinemann Ltd
- Chen Sea M-J , Henderson A. (1994), *The reliability and validity of visuospatial inattention tests with stroke patients.* Occup Ther Int. ;1:36–48.
- Chokron S., Colliot P, Bartolomeo P. (2008), *The Role of Vision in Spatial Representation*. Cortex, 40:2, 281-290, doi: 10.1016/S0010-9452(08)70123-0
- Chomsky N. (1981), *Lectures on Government and Binding*, The Pisa Lectures. Dordrecht: Foris.
- Corrêa L.M.S. (1995), *An alternative assessment of children's comprehension of relative clauses*, *J* Psycholinguist Res 24, 183–203, https://doi.org/10.1007/BF02145355
- Costello A. de L. & Warrington E.K. (1987), *The dissociation of visuospatial neglect and neglect dyslexia*. Journal of Neurology, Neurosurgery, and Psychiatry, 50, 1110–1116
- Crawford J. R., & Howell D. C. (1998), *Comparing an individual's test score against norms derived from small samples.* The Clinical Neuropsychologist, 12, 482-486
- Crepaldi D., Amenta S., Mandera P., Keuleers E. and Brysbaert M. (2016), *Frequency estimates from different registers explain different aspects of visual*

word recognition, International Meeting of the Psychonomic Society, Granada, Spain

- Cubelli R., Nichelli P., Bonito V., De Tanti A., Inzaghi. M.G., (1991), *Different patterns of dissociation in unilateral spatial neglect,* Brain and Cognition, 15, pp. 139-159, doi: 10.1016/0278-2626(91)90023-2
- Cubelli R., Simoncini L., (1997), *Dissociation between word reading and word copying in a patient with left visual neglect,* Cortex, 33, pp. 177-185
- Di Pellegrino G., Làdavas E., Galletti C. (2002), *Lexical processes and eye movements in neglect dyslexia,* Behavioural Neurology, 13, pp. 61-74
- Ellis A.W., Flude B.M., & Young A.W. (1987), *"Neglect dyslexia" and the early visual processing of letters in words and nonwords*. Cognitive Neuropsychology, 4:4, 439-464, doi: 10.1080/02643298708252047
- Ellis A.W., Young A.W., Flude B.M. (1993), *Neglect and visual language*, Unilateral Neglect: Clinical and Experimental Studies
- Friedmann N., Gvion A. (2005), *Letter form as a constraint for errors in neglect dyslexia and letter position dyslexia,* Behavioral Neurology, 16 (2–3) pp. 145-158
- Friedmann, N., & Novogrodsky, R. (2004), *The acquisition of relative clause com□prehension in Hebrew: A study of SLI and normal development*. Journal of Child Language, 31, 661–681
- Friedmann N, Tzailer-Gross L., Gvion A. (2011), *The effect of syntax on reading in neglect dyslexia*. Neuropsychologia, 49:10, 2803-2816, doi:10.1016/j.neuropsychologia.2011.05.023
- Gammeri R, Iacono C, Ricci R, Salatino A. (2020), *Unilateral Spatial Neglect After Stroke: Current Insights.* Neuropsychiatr Dis Treat.;16:131-152. doi: 10.2147/NDT.S171461
- Givón T. (1990), *Syntax: a Functional-Typological Introduction*. Amsterdam & Philadelphia, Benjamins.
- Halligan P.W., Marshall J.C. (1991), *Left neglect for near but not far space in man,* Nature, 350:498–500
- Heilman KM, Bowers D, Coslett B, et al. (1985), *Directional hypokinesia: prolonged reaction times for leftward movements in patients with right*

hemisphere lesions and neglect. Neurology ; 35:855–9, doi: 10.1212/WNL.35.6.855

- Heilman, K. M., & Valenstein, E. (1972). *Auditory neglect in man*. Archives of Neurology,26(1),32–35. https://doi.org/10.1001/archneur.1972.00490070050007
- Heilman KM, Valenstein E, Watson RT (2000), *Neglect and related disorders*. Semin Neurol 20: 463–470
- Heilman K.M., Valenstein E., Watson R.T. (1994), *The what and how of neglect. Neuropsychological Rehabilitation*, 4: 133–139
- Heilman K. M., Watson R. T., & Valenstein E. (1993). *Neglect and related disorders.* In K. M. Heilman & E. Valenstein (Eds.), Clinical neuropsychology (pp. 279–336). Oxford University Press
- Hulsey S., Sauerland U. (2006), *Sorting out relative clauses*, Natural Language Semantics, 14:111–137, doi: 10.1007/s11050-005-3799-3
- Karnath, H.-O., & Huber, W. (1992), *Abnormal eye movement behaviour during text reading in neglect syndrome: A case study*. Neuropsychologia*, 30*(6), 593–598. https://doi.org/10.1016/0028-3932(92)90062-Q
- Kartsounis LD, Warrington EK. (1989), *Unilateral visual neglect overcome by cues implicit in stimulus arrays*; J Neurol Neurosurg Psychiatry; 52(11):1253-9; doi: 10.1136/jnnp.52.11.1253
- Kayne R. (1994), *The Antisymmetry of Syntax*. Cambridge, MA: MIT Press
- Kinsbourne, M. (1987), *Mechanisms of unilateral neglect*. In M. Jeannerod (Ed.), *Neurophysiological and neuropsychological aspects of spatial neglect* (pp. 69–86). Elsevier Science. https://doi.org/10.1016/S0166-4115(08)61709-4
- Kinsbourne M., Warrington E.K. (1962), *A variety of reading disability associated with right hemispheric lesions,* Journal of Neurology, Neurosurgery, and Psychiatry, 25 , pp. 339-344, doi: 10.1136/jnnp.25.4.339
- Làdavas, E., Paladini, R., & Cubelli, R. (1993), *Implicit associative priming in a patient with left visual neglect*. Neuropsychologia, 31(12), 1307–1320. https://doi.org/10.1016/0028-3932(93)90100-E
- Lee B.H., Suh M.K., Kim E.-J., Seo S.W., Choi K.M., Kim G.-M., Na D.L. (2009), *Neglect dyslexia: frequency, association with other hemispatial neglects,*

and lesion localization, Neuropsychologia, 47 , pp. 704-710, doi: 10.1016/j.neuropsychologia.2008.11.027

- Marelli M., & Luzzatti C. (2012), *Frequency effects in the processing of Italian nominal compounds: modulation of headedness and semantic transparency.* Journal of Memory and Language, 66:4, 644-664, doi:10.1016/j.jml.2012.01.003
- Moore M.J., Demeyere N., *Dissociating spatial attention from neglect dyslexia: A single case study*, (2020), Cortex 130 246-256, doi: 10.1016/j.cortex.2020.06.004
- Moore M.J., Shalev N., Gillebert C.R., & Demeyere N. (2020), *Dissociations within neglect-related reading impairments: egocentric and allocentric neglect dyslexia*. Journal of Clinical and Experimental Neuropsychology, 42:4, 352-362 doi: 10.1080/13803395.2020.1715926
- Newmeyer, F. (1994), *A note on Chomsky on form and function*. Journal of Linguistics, 30(1), 245-251. doi:10.1017/S0022226700016248
- Patterson K., Wilson B. (1990), *A rose is a rose or a nose: a deficit in initial letter identification,* Cognitive Neuropsychology, 7 , pp. 447-477, doi: 10.1080/02643299008253451
- Pick A. (1898), *Über allgemeine Gedächtnisschwäche als unmittelbare Folge cerebraler Herderkrankung. Beiträge zur Pathologie und pathologische Anatomie des Centralnervensystems mit Bemerkungen zur normalen Anatomie desselben.* Karger, Berlin
- Plummer P., Morris M., Dunai J., (2003), *Assessment of Unilateral Neglect*, Physical Therapy, 83:8, 2003, 732–740, https://doi.org/10.1093/ptj/83.8.732
- Posner MI, Petersen SE. (1990), *The attention system of the human brain*. Annu Rev Neurosci;13:25-42. doi: 10.1146/annurev.ne.13.030190.000325
- Primativo S., Arduino L.S., De Luca M., Daini R., Martelli M., (2013), *Neglect dyslexia: A matter of "good looking*", Neuropsychologia, 51:11, 2109-2119, doi: 10.1016/j.neuropsychologia.2013.07.002
- Riddoch J., Humphreys G., Cleton P., & Fery P. (1990), *Interaction of attentional and lexical processes in neglect dyslexia*. Cognitive Neuropsychology, 7:5-6, 479-517, doi: 10.1080/02643299008253452

- Rizzi L. (1990). *Relativized minimality.* The MIT Press.
- Robertson IH, Halligan PW (1999), *Spatial Neglect: A Clinical Handbook for Diagnosis and Treatment,* Hove, England: Psychology Press
- Ronchi R, Algeri L., Chiapella L., Gallucci M., Spada M.S., Vallar G. (2016), *Left neglect dyslexia: Perseveration and reading error types,* Neuropsychologia, 89, 453-464, doi: 10.1016/j.neuropsychologia.2016.07.023
- Rossetto Alessia, *Neglect dyslexia in Italian and German: Negative concord, Perfekt, Modal verbs and Subordinate clauses* [tesi di laurea magistrale], Università degli studi di Padova (2021), http://hdl.handle.net/20.500.12608/2935
- Rusconi M.L., Cappa S.F., Scala M., Meneghello F. (2004), *A lexical stress effect in neglect dyslexia,* Neuropsychology, 18 (1) , pp. 135-140, doi: 10.1037/0894-4105.18.1.135
- Sanfelici E., Poletto C. (2015), *On demonstratives in relative clauses*, Lingue e Contesti, 561-571, https://www.researchgate.net/publication/301553312
- Semenza, C., Arcara, G., Facchini, S., Meneghello, F., Ferraro, M., Passarini, L., Pilosio, C., Vigato, G., & Mondini, S. (2011). *Reading compounds in neglect dyslexia:*

  The headedness effect. Neuropsychologia, *49* (11), 3116–3120. doi: 10.1016/j.neuropsychologia.2011.07.020
- Silberpfennig J. (1941), *Contributions to the problem of eye movements. III. Disturbances of ocular movements with pseudohemianopsia in frontal lobe tumors.* Conf Neurol 4:1–13, https://doi.org/10.1159/000106147
- Tesnière L. (2001) *Elementi di sintassi strutturale*. A cura di Germano Proverbio e Anna Trocini Cerrina. Torino: Rosenberg & Sellier 2001
- Utzeri I. (2007), *The production and the acquisition of subject and object relative clauses in italian: a comparative experimental study*, University of Siena, Nanzan Linguistics: Special Issue 3, Vol. 1, 283-313
- Vallar, G., Burani, C. & Arduino, L.S. (2010), *Neglect dyslexia: a review of the neuropsychological literature*. Exp Brain Res 206, 219–235. https://doi.org/10.1007/s00221-010-2386-0
- Vallar, G., & Perani, D. (1987), *The anatomy of spatial neglect in humans*. In M. Jeannerod (Ed.), Neurophysiological and neuropsychological aspects of spatial

neglect (pp. 235–258). Elsevier Science. https://doi.org/10.1016/S0166-4115(08)61716-1

- Vallar G., Zilli T., Gandola M., Bottini G. (2006), *Productive and Optic Prism Exposureproductive and Defective Impairments in the Neglect Syndrome: Graphic Perseveration, Drawing Productions and Optic Prism Exposure*, Cortex,42:6, 911-920, doi: 10.1016/S0010-9452(08)70435-0
- Vallar G. (1998), *Spatial hemineglect in humans*. Trends Cogn Sci; 1; 2(3):87-97. doi: 10.1016/s1364-6613(98)01145-0
- Vallar G. (2001), *Extrapersonal visual unilateral spatial neglect and its neuroanatomy.* Neuroimage; 14(1 Pt 2):S52-8. doi: 10.1006/nimg.2001.0822
- Vergnaud J.R. (1985), *Dépendances et niveaux de représentation en syntaxe*. Linguisticae Investigationes Supplementa, 13. Amsterdam: John Benjamins. 1985. Canadian Journal of Linguistics/Revue Canadienne De Linguistique, 32(2), 199-206. doi:10.1017/S0008413100012159
- Veronelli L., Guasti M.T., Arduino, L., Vallar G. (2014), *Combining language and space: Sentence bisection in unilateral spatial neglect*, Brain and Language, , 137(6):1-13, doi:10.1016/j.bandl.2014.07.007
- Warrington E.K. (1990), *Right neglect dyslexia: a single case study,* Cognitive Neuropsychology¸ 8:3-4, 193-212, doi: 10.1080/02643299108253372
- Weintraub S , Mesulam M. (1988), *Visual hemispatial inattention: stimulus parameters and exploratory strategies*. J Neurol Neurosurg Psychiatry. ; 51:1481–1488.
- Weinzierl C, Kerkhoff G, van Eimeren L, Keller I, Stenneken P. (2012), *Error types and error positions in neglect dyslexia: comparative analyses in neglect patients and healthy controls.* Neuropsychologia; 50(12):2764-2772. doi: 10.1016/j.neuropsychologia.2012.08.007
- Williams L. J., Kernot J., Hillier S. L., Loetscher T. (2021), *Spatial Neglect Subtypes, Definitions and Assessment Tools: A Scoping Review*, Frontiers in Neurology, 12, doi: 10.3389/fneur.2021.742365

Acknowledgments

Mi piacerebbe ringraziare tutte le persone che hanno reso possibile questo lavoro e quelle che mi hanno sostenuto in questi anni di studio, fino alla stesura di questa tesi.

In primo luogo, un ringraziamento speciale al professor Carlo Semenza, che ha creduto in questo progetto sin dall'inizio, dandomi l'opportunità di sviluppare delle mie idee a partire dalle conoscenze che ho acquisito durante il suo corso di neuropsicologia. Non limitandosi solo alla stesura della tesi, ha supportato il mio lavoro, facendomi appassionare sempre di più a questa materia affascinante.

Ringrazio la dottoressa Martina Abbondanza, che con la sua gentilezza unita alla sua esperienza ha saputo condurmi in questo lavoro, dandomi sostegno dal punto di vista tecnico, introducendomi alla scrupolosità e alla cura che caratterizzano il meraviglioso mondo della ricerca.

Ringrazio la mia cara amica Gaia, collega e compagna di questo corso di laurea. Ricorderò per sempre i pomeriggi trascorsi a decifrare quella scienza "inesatta" che è la linguistica. Con la tua dolcezza e la tua tenacia mi hai sempre sostenuta, anche in quei momenti che mi sembravano troppo duri, e hai gioito insieme a me per ogni mia piccola vittoria.

Grazie alla mia famiglia, che ha sempre creduto in me e nei miei sogni, dandomi la possibilità di studiare ciò che amo e sostenendomi nei momenti in cui mi sono sentita persa.

E, infine, ringrazio quelle persone speciali che ci sono sempre state in questi anni. Coloro che mi hanno ascoltata, che mi hanno compresa e, spesso e volentieri, aiutata. Ho imparato che non sempre si può fare tutto da soli, e voi ci siete sempre state per tendermi una mano e farmi sentire accolta.