On Syntactic Computation in Aphasia: a Study on Agreement and Movement in a non-fluent Aphasic Speaker

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To investigate the linguistic competence of a non-fluent aphasic speaker we focus on certain properties of the patient's deficit in the functional lexicon, and ascribe occurrences of non standard use to defective syntactic computation. By manipulating the position of constituents, we tested agreement in sentences with post-verbal subjects and the patient's ability to detect errors induced by different elements in attraction configurations.
The results show clear asymmetries in grammaticality judgments of the different agreement conditions. A deficit in the computation of agreement in sentences with postverbal subjects was reported, indication of the fragile nature of postverbal subject agreement. In the experiment on attraction we found a clear impairment with attraction induced by linear intervention of a prepositional modifier. In order to evaluate our subject's performance we compare the results from this single case study with data from a range of experiments involving other languages and populations.
By investigating the finer properties of functional elements we hope to show the extent to which certain characteristics of aphasic speech may be attributed to a possible reduction in processing abilities.

Introduction

Subjects with aphasia caused by cerebral lesions present an interesting empirical source for investigating the correlation between the organization of neural structures and linguistic models. The functional lexicon is one aspect of language in which this correlation may be studied. Much work on aphasia focuses on the functional lexicon, since the tendency to drop functional elements is characteristic of so-called agrammatic or non-fluent speech (see Menn and Obler, 1990 for cross-linguistic data). Functional categories trigger fundamental linguistic computations, such as verb movement, stepwise from subordinate to super-ordinate categories in the tree structures. An impairment of concatenation (and/or movement) should therefore lower the likelihood of these operations succeeding. From this perspective, it is

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possible that specific properties of the computation are responsible for certain distinctions present in the lexicon[1].
In the present research we focus on the various distinctions covered by the global term 'functional lexicon' by testing *fluctuations* in the grammatical system, area of constrained variations, where the occurrence of an element in the syntactic structure is coherent with its configurational environment. This issue is closely linked to investigation of the general anti-optional character of human language and its consequences in terms of hierarchical restriction and parametric selection. It is possible that finer distinctions related to the possibility of dropping material depending on the grammatical contexts are what count in syntactic derivations (see, for example, Rizzi, 2005 on the possibility of dropping pronouns in a restricted structural environment in acquisition; or Hamman et al., 2003 for a study on complement pronouns in Specific Language Impairment; or Friedmann, 2002 for production of interrogatives in aphasia related to different structural layers).
In the present study we analyze the implementation of Subject – Verb agreement in the language of a non-fluent aphasic speaker, by manipulating the position of constituents in an experiment on preverbal and postverbal subject agreement. Evidence from comparative syntax and language acquisition reveal differences in the realization of agreement morphology depending on whether the subject is preverbal, hence in a *local* Spec/head configuration, or whether it is postverbal, i.e. in a *non-local* environment (see Guasti and Rizzi, 2002).
We also tested the ability of our subject to judge agreement errors in attraction configurations where elements intervene between the subject and the verb. In the light of previous research on French adults speakers (Franck et al., 2006) we investigated number mismatches within the VP by testing attraction induced by different attractors: prepositional modifiers and object clitics.
Before presenting materials and results, in the following sections we present the empirical evidence that forms the background to our experiments.

1.1 On agreement in non-fluent aphasia

In the literature on non-fluent aphasic speech, it has been suggested that not all the functional lexicon is necessarily damaged, indicating that distinctions may be made within this category.
Friedmann and Grodzinsky (2000) found that in the patients they studied omission of items from the functional lexicon is sensitive to the position of these elements in the syntactic tree. Cross–linguistic observations show selective omission of temporal morphology yet preserved number features in subject-verb agreement; this led Friedmann to hypothesize a structural reduction of the syntactic tree (*The Tree Pruning Hypothesis*; Friedmann 2002).
Friedmann's explanation of the Split IP dissociation is directly linked to the argument put forward in Pollock's study (Pollock, 1989) and to the idea that Tense phrase (TP) occupies a position above Agreement phrase (AgrP). On the other hand, many cross-linguistic data as well as evidence from generative syntax and from acquisition favor a

[1] That the functional lexicon is a natural class, distinct from the contentive lexicon, is made plausible by much evidence stemming from language acquisition, language use and pathology. Functional elements form a closed class comprising lexical material such as determiners, auxiliaries, modals, copulas, conjunctions and complementizers. They are few and diachronically very stable. They do not participate in derivational morphology and have "abstract" interpretative properties (see Rizzi, 2004a for an overview of the functional lexicon related to syntactic computation).

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subject agreement head higher than the Tense node (see Belletti, 2000 and Guasti and Rizzi, 2002 for related discussion).
The existence of a distinction between an accessible projection in the tree (Subject agreement, AgrP) and more inaccessible positions (Tense phrase, TP) is an index of an active grammatical property in agrammatic production.
These neuropsychological data provide a strong argument in favor of morphological features not being projected from overt morphology but instead being related to morphosyntactic variation. Morphology therefore has a partly realizational function: it interprets syntactic computations.
Assuming that grammatical selections are parsing strategies, the impairment in verbal morphology witnessed in Broca's aphasics could be explained in terms of computational preferences. Interesting evidence comes from a recent study on processing in adults speakers (De Vincenzi, et al., *in preparation*). Reading times and event related potentials were collected in order to investigate responses to number violations and tense violations on verbs. Agreement violations were detected in an early phase while violations of temporal morphology were detected in a successive temporal window. Number violations in SV agreement elicited a left anterior negativity (LAN) 60 msec earlier than the LAN elicited by violations of Tense concordance.
These are converging evidence (from behavioral, electrophysiological and neuropsychological data) for distinct processing of the two morphosyntactic relations. Data from patients with cerebral lesions complement the evidence from normal adult systems. The evidence appears to be consistent with two possible explanations regarding the grammatical impairment: a purely *knowledge based* approach related to positional variables such as that advanced in Friedmann‘s Structural Tree Pruning Hypothesis, or a more integrated approach in which grammatical distinctions are processing aids to parsing sentences. Clarification on this issue requires examination of more finely detailed grammatical phenomena.
Implementation of subject-verb agreement is related to the position of the subject. An interesting property of VS order is the different way agreement morphology is realized in different languages (see Guasti and Rizzi, 2002 and quoted literature). English realizes morphological agreement, as in (1a), whereas in French the postverbal subject does not agree with the verb, as in (1c).On the contrary the sentence with SV order in French shows number inflection, as in (1b).

(1) a. There come three girls

b. Trois filles sont arrivées
Three girls are arrived

c. Il est arrivé trois filles
‘It has arrived three girls’

d. Sono arrivate tre ragazze
Are arrived three girls
‘Three girls have arrived’

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In this paradigm standard Italian patterns with English, compare (1a) and (1d), while some Italian dialects pattern with French (data reported are taken from Brandi and Cordin, 1989).

(2) Fiorentino / Florentine dialect
a. Gl'è venuto le su' sorelle
to-him is come the his sisters

b. Le su' sorelle le son venute
the his sisters they are come

Trentino/ Trentino dialect
c. E' vegnù le so' sorele
is come the his sisters

d. Le so' sorele le son vegnude
The his sisters they are come

As seen in (2a) and in (2c), in postverbal configurations morphological realization of number is not mandatory. These observations are consistent with the proposal that realization of agreement is related to the positional properties of the elements concerned and support a grammatical interpretation of the phenomenon.
Guasti and Rizzi (2002) have suggested an explanation of this morphosyntactic distinction in terms of different configurations. In SV structures agreement is checked twice: AgrS gets valued through AGREE, and its features are then checked, after movement of the subject, in a local Spec-head configuration. In VS structures agreement is established uniquely under AGREE, as agreement checking in the local Spec-head configuration is not available. The two configurations are exemplified in (3).

(3) a DP … AGR syntactic checking
b AGR … DP specific property of the system

Under the view that agreement processes can be taken to be the reflex of an established Spec-head relation inside an Agr projection, as revealed by (preverbal) subject agreement, postverbal subject agreement involves checking in a non-local configuration, and the building of a syntactic chain. The formalism expressed in (3) presents Agreement as a grammatical process related to hierarchical factors. The interplay between active subject positions, whether pre-verbal (SV) or post-verbal (VS), and the morphological realization of agreement is subject to constrained variation and offers us a precise domain in which to evaluate performance on grammatical distinctions.
We will see that this effect is visible at a processing level and that in configurations such as (3b) the system is more prone to error: agreement has variable morphological expression.

1.2 On agreement in attraction configurations

The next step is to test subject-verb agreement in complex configurations in order to throw light on distinct processing effects in agreement computations.

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A productive empirical stratagem for studying different agreement configurations at the sentence level is the phenomenon of attraction. Attraction is manifested when an element intervening between two elements sharing an agreement relation, and mismatched in the relevant agreement features, attracts agreement. This can be simplified in the abstract configuration in (4a), producing an effect as in (4c).

(4) a X … Z … Y
[…, $\varphi_{Singular}$] […, φ_{Plural}] […,$\varphi_{Singular}$]

(4) b The boat of the American **soldiers** leaves in the fog
(4) c *The boat of the American **soldiers leave** in the fog

Much experimental work has shown that there is a proximity concord effect determined by the closest noun in elicited production of sentences such as (4) (Bock and Miller, 1991).
We can presume that the processor, having to proceed under time pressure and with strong working memory constraints, wants a clear indication of the nature of the elements to link in a local relation. When linear and hierarchical orders conflict, the system is prone to errors.
A recent study on the structural properties of number features within the VP (Franck et al., 2006) shows different effects with different syntactic relations: linear precedence and hierarchical order. Franck et al. investigated attraction effects with two different classes of interveners in French: prepositional modifiers and clitic object pronouns.

(5) a. Le professeur les lit/*lisent
The professor them reads/read

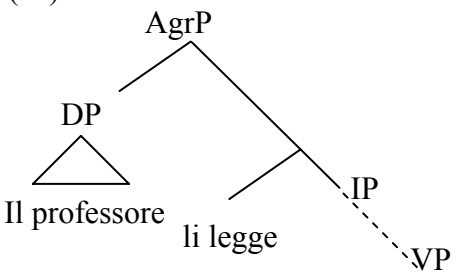
b. Le professeur des élèves lit/*lisent
The professor of the students reads/*read (from Franck et al.2006, [18])

In this experiment a larger number of attraction errors were found with clitics than with prepositional modifiers. This effect was put down to differences in the structural relations involved. In (5a) the intervening constituent, the clitic, is in a c-comand relationship with the agreement head while in (5b) the intervening element is merely in a configuration of linear precedence[2], as can be seen in (6a) and (6b).

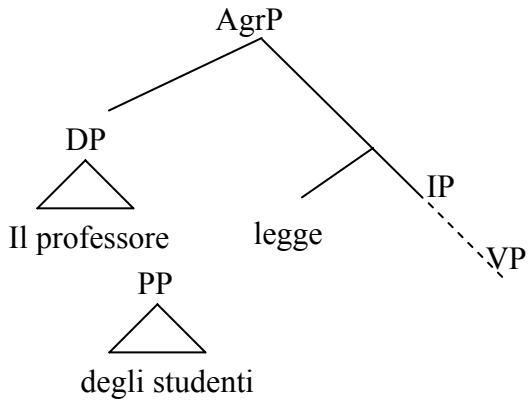
[2] They also found that plural intervening elements generated more errors compared with singulars. This effect is attested in other studies suggesting that plural nouns are marked forms and that they are therefore more disruptive interveners.

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(6a)



(6b)



All these effects on "attraction" are related to locality conditions; an intervening element with certain characteristics disrupts a local relation, in this case concordance. By looking at attraction effects in impaired grammars we can broaden the scope of our investigations to throw more light on these grammatical distinctions than might be possible in research on only standard grammars.

2. Methods

2.1 The Participant

We present here a single case-study of a non-fluent aphasic patient, M.R.. M.R. is a 42 year old, right handed, Italian woman. She has aphasia caused by a focal lesion in the frontal and parietal areas of the left hemisphere caused by a stroke in the zone of the medial cerebral artery (MCA). The unilateral damage was ascertained by CT-scan.
After the lesion event the patient showed global aphasia and right hemiparesis. Her linguistic competence subsequently improved, until she reached a stage of non-fluent elliptical speech.
This study was conducted two years post-onset by which time M.R.'s condition had stabilised. Language screening was carried out with the standard battery for Italian speakers (B.A.D.A.) (Miceli et al.1994). The most typical features which the screening revealed are: difficulties with object and action naming (43.3% of objects are correct, 57.1% of actions), non fluent speech with omission of grammatical elements, an impairment in the comprehension of reversible sentences with inversion of thematic roles, failure in grammaticality judgments of object relative clauses (3/3) and of pronoun reference, low scores in working memory tasks measured at word list level.
Reading and writing abilities were also greatly impaired, but they were not dealt with in this study.

2.1.1 The Repertoire of M.R.'s spontaneous speech

We collected spontaneous speech for a period of four months, compiling a corpus of 132 narrative sentences. Analysis of M.R.'s spontaneous production of lexical verbs (60 out of a total of 84 verbs) shows a high percentage of substitution of Tense morphology (21/60) but few errors in subject-verb agreement (3/60). Moreover, it is interesting to note that the few agreement substitutions attested occur with postverbal subjects. Since data from spontaneous speech are quite variable (even if they are the

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most direct expression of linguistic competence) we ran a sentence completion task. In this task the subject had to complete a sentence with the correct verbal form. The target response was either a form inflected for tense or a form inflected for number. M.R. confirmed the tendency presented in spontaneous production: many errors with temporal morphology (23/36) and few with agreement morphology (2/36).
We also elicited postverbal subjects in order to control the occurrences of VS order in appropriate contexts[3]. We found that M.R.'s responses were sensitive to the verb type. More VS orders were found with unaccusative verbs (18/24) than with unergatives (5/16), a phenomenon which is also observed in unimpaired grammars and in acquisition (see Lorusso et al., 2005). These results provide evidence that the syntactic representations of sentences with unaccusative verbs and with unergatives differ and that M.R.'s agreement errors in the experimental task we present cannot be ascribed to general difficulties with VS order per se.

2.2 Materials and procedure

The experiment consisted of a series of auditory grammaticality judgment tasks. M.R had to judge the grammaticality of a battery of sentences, composed of three different sets of propositions. Half the items were grammatical and half were ungrammatical.
The first set involved agreement in SV and VS configurations, such as (7a) and (7b).

(7) a. La nave parte / *partono
'The boat leaves /*leave'

b. Parte / *partono la nave
'Leaves /* leave the boat'

A total of 128 items, 32 for each of the four conditions (SV, *SV, VS, *VS), were presented.
The second set consisted of a list of sentences containing intervening prepositional modifiers and pre/post verbal subjects, as in (8a) and (8b). With these sentences two types of effect were tested: attraction by an intervening prepositional modifier and the possible absence of attraction in sentences with post-verbal subjects due to non-linear intervention.

[DP - PP -VP]
(8) a. L'autista dei ministri guida /*guidano con prudenza
'The driver of the ministers drives /*drive'

[VP - DP – PP]
(8) b. Guida /*guidano con prudenza l'autista dei ministri
'Drives/drive the driver of the ministers'

[3] The task consisted in the elicitation of answers to questions whose pragmatic contexts require a response with a postverbal subject, as in an 'out of the blue' context:
i. Chi è arrivato?
Who is arrived?
ii. E' arrivato Gianni.
Is arrived Gianni.
The task adopted was originally elaborated to test L2 acquisition of specific properties of Italian grammar, such the possibility of placing a subject post-verbally (see Garraffa, 2007 for details).

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This set consisted of 40 items in each of 4 conditions (SPPV, *SPPV, VSPP, *VSPP).
The third set was composed of sequences with complement clitic interveners. In this test we investigated the intervention of an element in a local structural relation and non-linear intervention in VS sentences, as in (9a) and (9b) respectively.

[NP-Clitic-VP]
(9) a. Il corridore li supera /*superano
'The runner them exceeds /*exceed'

[Clitic-VP-NP]
(9) b. Li supera/*superano il corridore
'Them exceeds/*exceed the runner'

A total of 160 items, 40 in each of 4 conditions (ScliV, *ScliV, cliVS, *cliVS), was presented.
All the verbs selected may be both transitive and intransitive. We tested only direct object complement clitics; indirect objects were not included in the list.
A summary of the various conditions and the number of items per condition is presented in Table 1.

Table 1: Experimental conditions and number of items per condition.

Inversion	Grammaticality	VS	PP	Clitic	Total
+	+	32	40	40	112
-	-	32	40	40	112
-	+	32	40	40	112
+	-	32	40	40	112
total		**128**	**160**	**160**	**448**

Inversion refers to those items with a subject in post-verbal position. Grammaticality refers to the well-formedness of the sentences. VS/Pre/Clitic are the three variables investigated: respectively, the baseline with no intervention, intervention of a prepositional modifier and intervention of a clitic. All conditions were balanced in number mismatches (half the items were Singular/Plural and half were Plural/Singular).
As filler items we selected two different sentence types. For the clitic condition we used sentences with reflexive pronouns, as in (10a). For the prepositional modifier condition we used items with the same number feature or invariable words.

(10) a. Le verdure fresche **si** vendono al mattino
'The vegetables fresh are sold in the morning'

b. Il maglione **di lana** scalda
'The sweater of wool keeps-warm'

The experiment with M.R. was run over ten sessions. In each session a proportional number of experimental sentence types was presented in randomized order.
A control baseline was run in order to test the two attraction conditions without agreement mismatches:
The Singular-Singular [SS] and the Plural-Plural [PP], as in (11a) and (11b).

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(11) a. Il cane del ragazzo morde/*mordono
'The dog of the boy bites/*bite'

b. Le scimmie li saltano/*salta
'The monkeys them jump-over /*jumps-over

M.R. showed little difficulty with the control experiment. She performed the tasks in the SS and PP conditions without a significant number of errors.

3. Results

In this section we report the results of the grammaticality judgment tasks separately for the three conditions: agreement in SV vs. VS structures, attraction with a prepositional modifier and attraction with an object clitic.
The control participant, matched for age and education, performed at ceiling in all conditions.

3.1 Experiment on agreement in VS and SV sentences

In the first experiment M.R. performed well with only 12/128 errors (9.3%). The task is simple to perform since it involves the judging the well-formedness of two-word sentences.

Table 2: M.R.'s performance on SV-VS sentences.

	Inversion	Grammaticality	Errors	%	Sentences
SV	-	+	0/32	0	La nave parte 'The boat leaves'
*SV	-	-	2/32	6.2	*Le navi parte *The boats leave
VS	+	+	0/32	0	Parte la nave Leaves the boat
*VS	+	-	10/32	31.2	*Parte le navi *Leaves the boats

The majority of errors were found with sentences featuring ungrammatical postverbal subjects (*VS) items (10/32; 31.2%). Performance was above chance level ($\chi 2(1)=3.7$, p. <0.05) in this condition and differed significantly from the grammatical VS condition ($\chi 2(1)= 9.6$, p. < 0.05). The difference between the two ungrammatical conditions, *SV and *VS, was also significant ($\chi 2(1)=5$, p. < 0.05).

3.2 Experiment on Intervention with prepositional modifiers

The second experiment tested accuracy of judgment of subject-verb agreement with an intervening prepositional modifier. M.R.'s responses show attraction effects with grammatical SPPV items, 10/40 errors (25%) with performance above chance level ($\chi 2(1)= 9.025$, p. <0.05).

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Table 3: M.R.'s performance on SPPV – VSPP sentences.

	Inversion	Grammaticality	Errors	%	Sentences
SPPV	-	+	10/40	25	La nave dei soldati parte'The boat of the soldiers leaves'
*SPPV	-	-	19/40	47.5	*La nave dei soldati partono *The boat of the soldiers leave
VSPP	+	+	6/40	15	Parte la nave dei soldati Leaves the boat of the soldiers
*VSPP	+	-	27/40	67.5	*Parte le navi del soldato *Leaves the boats of the soldiers
Total			**62/160**	**38.7**	

With respect to subject-verb inversion, performance in the grammatical condition, VSP, was above chance level with 6/40 (15%) errors ($\chi 2(1)= 18.225$, $p.< 0.05$). There were significant differences between the two inverted conditions, VSPP and *VSPP, ($\chi 2(1)= 20.6319$,$p. < 0.05$). A high error rate in the ungrammatical inverted condition,*VSP 27/40 (67.5%) (($\chi 2(1)= 4.225$, $p <0.05$) was found, with performance below chance level.

3.3 Experiment on Intervention with complement clitics

The third experiment investigated agreement in attraction configurations with a clitic intervener.

Table 4: M.R.'s performance on ScliV – cliVS sentences.

	Inversion	Grammaticality	Errors	%	Sentences
ScliV	-	+	4/40	10	Il corridore li supera *The runner them exceeds*
*ScliV	-	-	18/40	45	* I corridori lo supera **The runners him exceeds*
VScli	+	+	4/40	10	Lo superano I corridori *Him exceed the runners*
*VScli	+	-	19/40	47.5	*Li superano Il corridore **Them exceed the runner*
Total			**45/160**	**28.1**	

Four out of 40 (10%) errors were found with the pre-verbal grammatical items, ScliV. Performance was above chance level and differed significantly from performance in the ungrammatical condition, *ScliV, ($\chi 2(1)= 10.5956$, $p. < 0.05$).
Few errors (4/40, 10%) were also found with grammatical inverted items, cliSV. Here again, performance differed significantly from the ungrammatical inverted conditon, *cliVS X, ($\chi 2(1)= 11.9603$ $p. < 0.05$).

4. Discussion

In order to throw light on the instantiation of the functional lexicon in an aphasic speaker we studied her grammaticality judgments with respect to attraction effects in a variety of sentence configurations. This experimental stratagem was very revealing, resulting in significant effects that may be ascribed to our participant's impairment.
Many psycholinguistic studies with adults report interesting data with respect to agreement in attraction configurations (see Franck, et al., 2006 for an overview). These studies consistently show between 4% and 11 % agreement errors in

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production, a score significantly higher than the baseline (no mismatched features), with most errors found in the Singular-Plural condition.
The results from our experiment with an aphasic speaker corroborate the tendency reported in experiments with normal subjects; we also explored the nature of grammatical preferences when implementation of the functional lexicon is impaired.
In particular, we would like to highlight two important aspects of the present study: the general fragile nature of post-verbal agreement and the nature of attraction effects related to disruption of syntactic computation.

4.1 On agreement and subject position

Guasti and Rizzi (2002) report data relating to the morphological manifestation of agreement and the possibility of establishing a local Spec-Head configuration, such as in sentences with preverbal subjects. They found that when an AGREE operation is associated with Movement subject agreement has a stable morphological realization; otherwise, specific properties of individual grammars govern the morphological expression of agreement. Computation of Agreement is, therefore, determined by positional factors, and the present study supports this analysis.
M.R.'s low performance on VS ungrammatical items could be interpreted as a selective tendency to judge these items as grammatical, due to the fragile nature of post-verbal agreement in an impaired structure. This tendency was not found in the ungrammatical pre-verbal subject condition, where M.R. correctly judged the ungrammatical SV items[4]. Furthermore, it is interesting to note that M.R. made the most errors in the *VS condition with a singular verb and a plural subject. Performance in this condition, *Singular/Plural, was at chance level (8/16).
The option of not marking agreement on postverbal subjects is found in some Italian dialects and is also present in certain standard grammars such as Arabic (see Guasti and Rizzi, ibidem). M.R.'s grammar appears to accord with these language variations and supports the view that the implementation of agreement is related to positional variables. What these data have in common is that movement appears to be a stabilizing factor in syntactic computation in a maximally transparent interface between form and position.
A more interesting issue concerns the nature of M.R.'s non-standard performance with post-verbal subject agreement.
Postverbal subjects should be linked to the loci of generation to receive agreement and a thematic role. The construction of a chain (a syntactic dependency required to link positions) could be difficult to perform for an impaired spaeaker.
Empirical evidence supports the hypothesis that chain formation is a costly process for the human sentence parser, as can be seen in the study presented here (see, in particular, Grillo's work, ibidem)[5]. We presume the existence of an impairment in

[4] It is relevant to underline the fact that we elicited postverbal subjects in M.R.'s speech, and found a similar distribution to normal adults.
[5] In a study on sentence parsing in adults (De Vincenzi, 1991), adults' reading times of declarative sentences with postverbal subjects were tested. The experiment showed that VS structures with unaccusative verbs were easier to process than ones containing unergatives.
Unergative subjects are generated in an external argument position, while unaccusative subjects are generated in an internal argument position. Postverbal subjects of unergative verbs need to establish a dependency in order to link the two positions for assignment of the thematic role. With unaccusatives, chain formation is not required and the grammatical subject in object position does not share any pronominal feature with the preverbal subject position. A preference for postverbal subjects with

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parsing non-local configurations, such as agreement which involve the establishment of a connection between the preverbal position and the postverbal subject.
Concerning inversion, no evidence for linear intervention in attraction configurations was found. In the experiments with prepositional modifiers and object clitics with postverbal subjects (VSPP, and cliVS) grammaticality judgments showed a high level of accuracy.
On the other hand, the high error rate in the ungrammatical inverted conditions (*VSPP and *cliVS), supports the existing data indicating difficulties with post-verbal agreement.
More interestingly, performance with *VSPP structures was below chance level (27/40; 67,5%), with most of the errors occurring in the Singular/Plural condition (17/40)[6]. In the ungrammatical inverted structures with clitics, *cliVS, we found performance at chance level and unrelated to any markedness effect.

4.2 On attraction and linear intervention

M.R.'s performance clearly shows attraction effects in [Subj-Prep]-Verb configurations, with 25% error rate, higher than that generally attested in normal adult production (4-11%).
A plausible interpretation of this result can be given in terms of minimality effects induced by the agreement feature of the intervening prepositional modifier that can be seen more clearly in an incomplete functional structure. It has been suggested that sets of features normally associated with syntactic heads can be underspecified in cases of a reduced processing capacity and that this gives rise to selective minimality effects. Structures where a dependency is constructed over an intervening DP are more problematic (see Grillo, 2005; and Garraffa and Grillo, 2007).
Attraction is readily explainable in terms of minimality, even in the absence of c-command; it offers a testing ground for the hypothesis sketched above[7].
In judging misleading items, M.R. appears to consider both nouns as possible antecedents for the agreement relation with the verb. We assume suppose that in a situation where processing cost is high (maintaining two agreement realizations before the verb form) the system is prone to error and even more so in linguistically impaired subjects (no effects were found with the control subject, and were few in the study on normal adult production).

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unaccusative verbs has been reported in a longitudinal study on acquisition and on caregivers (Lorusso et al., 2005).

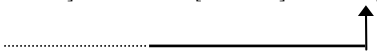
[6] With *VSPP structures M.R.'s performance is at chance level in the Sing/Plural condition ($\chi 2(1)= 0.05$, $p.>0.5$) and above chance level in the Plural/Sing condition ($\chi 2(1)= 8.45$, $p < 0.05$). The difference between the two conditions, however, is more of a tendency than statistically significant ($\chi 2(1)= 2.9762$, $p < 0.5$). It is possible that with a greater number of test items we would see a significant difference between the two conditions.

[7] For example, Rizzi 2002 maintains that *gapping* involves locality conditions in absence of c-comand. In a series of conjoined clauses as in (i), the missing verb can only be interpreted as identical to the closest overt verb (here *buy*, and not *sell*):
i. John sells books, Mary buys records and Bill V newspapers (example from Rizzi 2002: [9])
Rizzi also notes that some configurational condition is at play also in gapping, otherwise any linearly intervening verb would incorrectly block gapping:
ii. John wants to sell books, and Bill V to buy newspapers (example from Rizzi, 2002, footnote 4 [i]).
A linearly intervening verb, *sell*, does not block gapping. To formulate an intervention effect it seems to be necessary to qualify the intervener as a potential participant in the process for which Minimal Configuration is calculated. See Rizzi 2006 for a more detailed account on minimal configuration.

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On the other hand, these data may be explained as a reflection of a possible competition strategy where the agreement specification of the subject position is copied onto the verb. Out of 10 errors, 8 were in the Sing/Plural condition. These data are in keeping with the data obtained from adult French speakers (Franck et al., ibidem)[8].

(12) X … **Z** … **Y**
$[\ldots,\varphi_{[-number]}]$ $[\ldots,\varphi_{[+number]}]$ $[\ldots,\varphi_{[-number]}]$



An effect such as the one represented in (12) is more visible in aphasia due the abnormal nature of syntactic computation, especially in a non-local chain domain where a dependency over a DP has to be built (see Grillo, 2005).

4.3 On attraction and movement

Unlike the adult French speakers tested by Franck et al. (2006), M.R. does not show any attraction effects with a clitic intervener (error rate 4/40; 10%)[9]. This fact might seem surprising at first sight since the clitic intervenes not only linearly but also hierarchically, being in a local relation with the verb. In Italian the clitic head and the verb one are involved in a strong local relation (cliticization with finite verbs occuring in the same functional head).
Other studies on aphasia have reported deficits in the production of clitic forms (see Miceli et al., 1996; Chinellato, 2004; Rossi et al., 2005). It is also well known that complement clitics are acquired late (see Hamann and Belletti, in press).
An initial explanation of the null effect in the present case study could be that the syntactic computation of clitics is more complex than that of other classes of pronouns (Cardinaletti and Starke, 1999). Complement clitics involve a step in their derivation where they give rise to a crossed chain. Being a particularly difficult configuration, and assuming a non standard composition of the feature make up associated with heads (see Grillo, ibidem), clitics are probably not (fully) represented in aphasic computation and therefore not able to cross the relevant position.
Regarding the performance of French adults reported in Frank et al.'s study, it is possible that objects clitics, being more similar to weak pronouns, have a different internal structure which gives rise to more errors in this language (see Kayne, 1984)[10]. This is supported by a recent study on early and adult French L2 learners where

[8] The phenomenon of attraction seems then to be asymmetric and can be interpreted within the formalism that assumes that syntactic features are binary and implemented in terms of a marked value possessing a distinctive property, in this case (+ number), and an unmarked one (- number) lacking that property (Jakobson, 1957).
It is possible that the plural marking on an item $X_{[+Number]}$ pre-activates the agreement sensitive processes to check the grammatical feature of a following Y constituent. On the other hand, a lexical item $X_{[-Number]}$ does not necessarily trigger any agreement checking related to the number feature. As a consequence, a higher expectation regarding the number of a following "supposed-to-agree" constituent should produce more processing difficulties if an agreement violation is detected at this last item. Furthermore a prediction of an asymmetric system of licensing must be linked to the grammatical asymmetric nature where formal feature, as number on verbs, need to be checked with an interpretable feature, as number on nouns, but not the reverse.
[9] Performance did not differ from that on the baseline, the matched condition ($\chi 2(1)= 0.5452$, $p < 0.5$).
[10] As pointed out by Kayne, the possibility of interrupting a clitic-verb sequence with an adverb occurs in some varieties of French.

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placement errors (pronouns produced in DP positions) were imputable to misclassification, all pronouns having been treated as weak (Hamman and Belletti, in press). Hamman and Belletti capitalize on the fact that French, but not Italian, has weak pronominal subject pronouns. Absence of misanalysis in Italian in the present case study is limited to the few instances of weak pronouns, that is, the dative pronoun *loro* ('to them') and the uncommon subject pronoun *egli* ('they') (Cardinaletti and Starke, ibidem).
The result is that M.R. does not regard clitics as potential interveners in agreement relations.

5. Conclusions

The findings reported in this study argue in favor of a selective deficit in the functional lexicon of an aphasic speaker. The functional lexicon in aphasics is a useful source of empirical data, in particular if we select phenomena where the impairment can be structurally defined according to a specific linguistic model.
The central role that the implementation of functional elements has in the syntactic structure can be highlighting by analyzing the different configurations involved in subject –verb agreement. Starting from the well-attested evidence showing unimpaired performance with preverbal SV agreement, we look at more complex computations involved in checking number concordance. The main question of this study concerns to what extent a reduction in processing capacities can impair implementation of the functional lexicon. The conceptual guideline is that the different features comprising morphosyntactic information may be differently parsed in line with theoretical evidence from linguistic models.
We report evidence from our case study in favor of a deficit in syntactic computations such as chain formation.
Our findings also have implications for linguistic theory; converging evidence from comparative syntax and neurolinguistics report data that distinguish pronominal clitics in some Romance languages.
This study has dealt with grammaticality judgment; complementary experiments could be to test similar paradigms in speech production. We consider that the nature of the parser in non-fluency, the extent to which temporal order is a property of structure building and the exact nature of the deficit caused by a reduction in processing capacities to be central issues in neurolinguistics.

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