

Generalized Minimality: Feature impoverishment and comprehension deficits in agrammatism

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Abstract

Agrammatic Broca's aphasics have been shown to have particular problems in comprehending sentences in which a DP has moved over an intervening DP. The explanation of the nature of this observation has played a central role in neurolinguistic and psycholinguistic in the last thirty years. This paper proposes that this pattern can be explained by the Relativized Minimality approach to locality given the natural assumption that agrammatics have trouble with the representation of *scope-discourse* related features. This approach presents considerable advantages from an empirical perspective and to be conceptually desirable from a theoretical perspective. Among the advantages, it is claimed to allow a better integration of these facts with other well-known asymmetries in agrammatic comprehension, such as those involving binding, and models that relate processing and representational accounts of their deficits.

Keywords: Agrammatic aphasia, canonicity, Locality, Relativized Minimality, feature hierarchy, passives.

1. Introduction

In this paper I further develop a minimality-based account of some typical comprehension asymmetries in agrammatic Broca's aphasia, often dubbed *canonicity effects* in the literature, introduced in Grillo (2003, 2005); Garraffa & Grillo (2008). *Canonicity effects* refers to the widely discussed issue (since the seminal work by Caramazza & Zurif 1976) that Broca's aphasics tend to display a deficit in comprehension of semantically reversible sentences with non canonical order of thematic role assignment (one in which for example the DP carrying the *theme* role precedes the DP to which the *agent* role is assigned).

The minimality-based account discussed here makes crucial use of some recent developments in the Relativized Minimality approach to locality in syntax (see Rizzi (1990, 2004); Starke (2001)). The account seeks to explain the effects of *canonicity* as a special type of minimality violation that results from their impoverished morphosyntactic featural make-up. More specifically, it is claimed that agrammatic patients have particular difficulties with the representation of scope-discourse related features. The asymmetry in comprehension is thus reduced to a special case of the theory of *islands*.

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The paper is organized as follows: in section 2 some basic issues concerning the debate on agrammatic comprehension are introduced, with particular reference to canonicity effects. Section 3 discusses the hypothesis of featural underspecification in agrammatic sentence representation. Section 4 introduces some recent developments of the Relativized Minimality approach to locality and in section 5 the idea of deriving canonicity effects from the interaction of RM with impoverished syntactic representations is discussed in some detail with reference to the relevant syntactic structures. In the last part of the paper, the approach to passives developed in Gehrke & Grillo (2008) is extensively discussed in connection to the present proposal. Section 6 sums up the paper.

2. Canonicity effects

A turning point in the study of Broca's aphasia came about with the discovery in the mid 70s that, contrary to what was generally assumed at the time, their deficits are not restricted to the typically observed effects on production (e.g. the prototypical *telegraphic/elliptic speech* characterized by omission and substitution of functional material) but do extend to comprehension. Particularly, they have deficits in their syntactic ability to comprehend movement derived sentences displaying a *non-canonical* order of thematic roles (Caramazza & Zurif, 1976). This discovery, by revolutionizing classical interpretations of language localization in the brain and the nature of aphasia, has given an incredible impulse to the research in this field and several accounts have been proposed to characterize the observed deficit (see Grodzinsky 1986, 2000; Caplan & Hildebrandt 1988; Caplan et al. 1999, 2007a,b; Kolk 1987, 1998; Haarmann & Kolk 1991; Drai & Grodzinsky 2006a,b; Linebarger 1987; Linebarger et al. 1983; Mauner et al. 1993; Hickok et al. 1993; Hickok & Avrutin 1995; Bastiaanse & Van Zonneveld 1998; Friederici & Gorrell 1998; Piñango 1999; Avrutin 2006, among many others; for an overview see e.g. Avrutin 2001).

Reasons of space prevent me from presenting each and every one of these accounts and from discussing the several issues raised in the last 30 years or so of debate around these topics. It is commonly held that one of the main issues of debate relates to the characterization of agrammatism as a *representational* or a *processing-based* deficit. Following this view, the former sees the deficit as a consequence of the loss of part of the grammatical competence (or the loss of a specific algorithm related to a module of the grammar, i.e. *qualitative deficit*); while for the latter it is not the knowledge that is lost, but rather the computational resources necessary to put such knowledge into use (*quantitative deficit*).¹

In order to ground the discussion against a specific and well discussed account of canonicity effects, in what follows I introduce the influential Trace Deletion Hypothesis (Grodzinsky, 1990, 2000). The Trace Deletion Hypothesis, given its explicit character, testable predictions and the high degree of interest and discussion that it raised in the field, seems particularly well-suited for this purpose.

One of the most debated approaches to the canonicity problem in agrammatic aphasia is the Trace Deletion Hypothesis (henceforth TDH) formulated by Grodzinsky (1990, 2000) which states that traces of referential NPs (the phonologically empty categories at the tail of a movement chain in the syntactic representation) are deleted from the S-structure representation in

¹Notice, however, this might be taken as an oversimplification, given that no representational approach would probably deny that the process underlying a given representation is impaired in agrammatism.

agrammatism. Deletion of the trace of a moved argument NP makes it impossible to assign the NP its thematic (θ) role using the standard grammatical mechanism (chain interpretation); interpretation is instead assigned through a non-grammatical strategy which assigns the *agent* θ -role to the first NP encountered. This strategy leads to correct (*above chance*) performance where the first NP encountered does indeed carry the *agent* role, as is the case in (*unscrambled*) *actives*, *subject relatives* and *subject clefts*. The same strategy, however, does not necessarily lead to the correct interpretation (and thus to *chance* performance) when the second NP is also assigned the *agent* role structurally. This should be the case with e.g. *passives*, *object relatives* and *object clefts*. An example of θ -role assignment in actives and passives in unimpaired adult speakers' grammar is given in (1), and in Broca's aphasics in (2).

(1) **normal interpretation**

- | | | |
|----|---|---------------------|
| a. | The boy pushes the girl | <i>above chance</i> |
| | <i>agent</i> <i>patient</i> | |
| b. | The girl _i is pushed t _i by the boy | <i>above chance</i> |
| | <i>patient</i> <i>agent</i> | |

(2) **agrammatic interpretation**

- | | | |
|----|------------------------------------|---------------------|
| a. | The boy pushes the girl | <i>above chance</i> |
| | <i>agent</i> <i>patient</i> | |
| b. | #The girl is pushed (t) by the boy | <i>chance</i> |
| | <i>agent</i> <i>agent</i> | |

In (2-a) application of the non-grammatical strategy leads to correct assignment of the *agent* θ -role to the first NP and the remaining *theme* or *patient* role to the second NP, which leads to correct interpretation and thus to *above chance* performance. In (2-b), however, the same strategy leads the subject to perform at *chance level* because the *agent* role is assigned twice, i.e. to the first NP encountered and through the *by*-phrase to the second one. In the prototypical experimental setting used to test agrammatic comprehension, i.e. the *sentence to picture matching task*, the subject must associate a sentence with the picture representing it. When confronted with the representation in (2-b) the patient can only guess the correct interpretation, choosing the picture in a completely non-systematic way, which generates *chance level* performance. Table 1 shows how the TDH applies to different kinds of constructions, making clear predictions about the performance levels.

The TDH, however, has been criticized on both conceptual and empirical grounds. The first issue typically raised by its opponents, is related to the actual empirical coverage of the hypothesis. The most important discussion in this respect is that of *variability* (on which see [Drai et al. 2001](#); [Caplan 2001](#); [Caramazza et al. 2001](#); [Burchert et al. 2003](#); [Drai & Grodzinsky 2006a,b](#); [Caplan et al. 2007a,b](#) among many others), i.e. the existence (or not) of a uniform pattern among different subjects cross-linguistically supporting Grodzinsky's hypothesis.

Given this debate I will take the data in table 1 to indicate *tendencies*. We can say then that non-canonical structures *tend* to be more problematic to comprehend and produce, and raise significantly more errors, than their canonical counterparts. This is possibly an understatement (in particular if recent work of [Drai & Grodzinsky 2006a,b](#) is on the right track). Nevertheless, it will suffice for the purposes of the present discussion.

Critics of the TDH often point out that the *canonicity effect* is not the only comprehension problem agrammatics display, agrammatic aphasics also have selective problems with compre-

Construction	Language	Performance
Active	(It/Eng/Heb/Sp/ Jap/Kor/Du/Ger)	Above Chance
Verbal Passives	(Eng/Heb/Sp/It)	Chance
Adjectival Passives	(Eng)	Above Chance
<i>which</i> -x subject	(Eng)	Above chance
<i>which</i> -x object	(Eng)	Chance
OSV scrambling	(Jap/Kor)	Chance
OVS scrambling	(Ger)	Chance
OVS Topic mov.	(Heb)	Chance
OSV Topic mov.	(Heb)	Chance

Table 1: See [Grodzinsky \(2000, 2006\)](#)

hension of pronominal binding. It is not clear what relation if any there is between deletion of traces and binding (on binding in agrammatism see [Grodzinsky et al. 1993](#); [Ruigendijk et al. 2006](#); [Piñango & Burkhardt 2001](#); [Burkhardt 2004](#); [Avrutin 2006](#); [Vasić 2006](#); [Vasić et al. 2006](#), among others). While there is in principle no reason to attribute all comprehension patterns to the same underlying deficit, it is clear that an approach that succeeds in identifying such an underlying factor should be preferred, all else being equal.

[Piñango \(1999\)](#) discusses an argument from the comprehension of sentences derived from *unaccusative* predicates such as the one in (3).

- (3) a. The girl spun <the girl> because of the boy
└──────────┘

In (3) the subject DP *the girl* has been moved from its original post-verbal position where it leaves a trace. Piñango argues that the TDH should predict chance performance with these structures. The non-grammatical strategy of thematic role assignment assigns the *agent* role to the first DP. The DP *the boy*, however, also receives the agentive role by virtue of the *because* phrase. This double assignment of agent role should lead the subject to guess and perform at chance level on these constructions, which, as Piñango shows, is not the case.

Some recent empirical findings pose a strong empirical challenge to the TDH. [Friedmann \(2008\)](#) tested agrammatic comprehension of object relative clauses in Hebrew. This language has the property of allowing two types of object relative clauses: a ‘standard’ variety, with a gap at the first merge position of the relative head noun, and one with a resumptive pronoun at the trace position bound by the head of the relative NP. Crucially, agrammatic patients perform at chance level in both conditions, despite the absence of any trace at S-structure in the latter condition.

Everything considered, the issues discussed above constitute a strong challenge to the idea that the agrammatic comprehension deficit can be captured by the TDH as it stands.

Recent findings concerning the time course of lexical access and antecedent reactivation at trace positions provide alternative interpretations for the deficit that might avoid the problems listed above (see e.g. [Zurif 1995](#)). [Shapiro & Levine \(1990\)](#) (based on [Shapiro et al. 1987](#)), [Swinney et al. \(1989\)](#) have showed that lexical access of both Nouns and Verbs appears to be slowed down in agrammatic patients in comparison to non-brain damaged speakers. The delay is not limited to access of single words in isolation and has been showed to have effects on lexical

reactivation of a moved antecedent at the trace position. Similar delays have been observed in the domain of binding (see the recent works by [Swinney & Zurif 1995](#); [Love & Swinney 1996](#); [Prather et al. 1997](#); [Piñango 1999](#); [Zurif et al. 1993](#); [Burkhardt et al. 2008](#) among others).

These findings show that the speed of processing of syntactic structures is slowed down in agrammatic aphasics when compared to that of non-brain-damaged adult speakers.²

[Piñango \(1999\)](#), elaborated on these result and proposed that agrammatic comprehension patterns could be better understood as a consequence of a slow-down of the processes responsible for building up the syntactic structure. Agrammatic aphasics' ultimate problem, she posits, is that they cannot build up the syntactic structures in the required time constraint imposed by the grammatical system, preventing them from being able to perform certain grammatical operations.

As observed also by [Caplan et al. \(2007a\)](#), these works are particularly promising in the realm of processing-based accounts, in that they do not pose some problems raised by other processing accounts based on the controversial concept of *resource limitation*³.

The idea of a slowed-down syntactic component have been shown to interact in interesting ways with recent approaches to binding theory and the architecture of grammar, such as the *Primitives of Binding* approach of [Reuland \(2001\)](#), in predicting complex behavioral patterns in agrammatics in this domain. The Primitives of Binding approach takes the representation of purely syntactic dependencies to be more economical (in terms of processing costs) than that of dependencies that require the interface of narrow syntax and extra-syntactic information, in particular those belonging to the (linguistic) discourse level.

This opens up the possibility (explored in [Ruigendijk et al. 2006](#); [Piñango & Burkhardt 2001](#); [Burkhardt 2004](#); [Avrutin 2006](#); [Vasić 2006](#); [Vasić et al. 2006](#)) to predict that highly selective effects in agrammatic comprehension emerge from the interaction of this hierarchy with a slowed down syntax. A result of this interaction is that the representation of those dependencies that require interfacing the syntactic representation with the discourse structure is more likely to be impaired in agrammatism than the representation of purely syntactic dependencies.⁴ The *Slow/Weak-Syntax* approach has proved successful in explaining subtle asymmetries in agrammatic comprehension of pronominal binding and linking these asymmetries with a theoretical model and with the data from on line experiments on real time processing of binding in unimpaired adults speakers.

Nevertheless it is not clear to me how a slow syntax approach derives the *canonicity effects* without resorting to some additional assumption.

Partly following a similar reasoning (but without being committal to the details of the Weak Syntax analysis)⁵, in what follows I discuss the possibility that a processing problem might compromise the representation of scope-discourse related morphosyntactic features in agrammatic patients.

²Interestingly this evidence has been used as a decisive argument by both detractors and supporters of the TDH (see e.g. [Zurif 2003](#); [Avrutin 2006](#)). I believe that this is not just a pure coincidence of the result of a total misunderstanding on one or the other side. Rather, it constitutes an additional indication that an integrated approach should be formulated, possibly abandoning some of the most radical categorization on both sides.

³This consideration is valid for *time-based* approaches in general. Independently from their formulation in terms of delay/slow down of activation or alternatively in terms of faster than normal decay, as in the seminal works by [Friederici & Kilborn 1989](#); [Haarmann & Kolk 1991](#)

⁴This idea is explored further in the domain of production in relation to omission of the subject in non-null subject languages, omission of Tense and Det by agrammatic speakers ([Avrutin, 1999, 2000a,b, 2001, 2006](#)).

⁵In fact in many respects the present hypothesis and the one explored in [Avrutin \(2006\)](#) are very different. A more detailed comparison is attempted in [Grillo \(2008\)](#).

3. Feature underspecification

Grillo (2003, 2005) hypothesizes that *canonicity effects* can be explained as the consequence of an impoverishment of the morphosyntactic feature sets normally associated with the elements in the syntactic tree. More specifically it is assumed that *scope-discourse* related features are more likely to be targeted by this impoverishment. The main result of this assumption, to be discussed below, is the prediction that selective minimality effects can be expected to arise as a natural consequence of the interaction of this impoverishment with principles of locality.

While the impoverishment could be simply assumed here, and justified on the basis of the minimality considerations discussed below, in what follows I will explore some possible scenarios that might be at the source of this deficit. While some of the arguments to be developed might need further refinement, the idea is to place the current hypothesis against the more general discussion of the syntactic deficit in agrammatism, which as we have seen above exceeds the domain of non-canonical sentences.

Following the ideas presented above, I hypothesize that (i.) there is a slower than normal activation of the syntactic information associated with lexical items (Zurif et al. 1993; Piñango 1999 among others), (ii.) a slowed-down building up of this information into well-formed syntactic constituents, or (ii') a faster than normal decay of syntactic representations (see Friederici & Kilborn 1989; Haarmann & Kolk 1991; Kolk 1995, 1998) can be at the base of an impoverishment of the featural make-up of syntactic elements. As mentioned above, I assume that features of a certain class, i.e. Quantificational class, scope-discourse related, and more generally those features related to the periphery of the clause and of the *vP*, are more likely to be compromised in this kind of scenario. The assumption that underspecification is more likely to target scope-discourse features than e.g. categorical ones, is based on different considerations. The general logic behind the idea is that not all morphosyntactic features are activated at the same time, i.e. different type of features are accessed at different time points in the processing of a sentence. Based on this assumption, I will assume that the representation of features that are accessed later in the derivation is more likely to be compromised as a consequence of a slowed-down syntactic system.⁶

Independent evidence that this approach is on the right track comes from some important observation discussed in Hagiwara (1995); Friedmann (1998); Friedmann & Grodzinsky (1997); Friedmann (2002), which, according to the authors, indicates that material associated with the left periphery of the clause is more problematic for agrammatic aphasics to access than that lower down in the syntactic tree.⁷ These observations lead to the formulation of the influential Tree Pruning Hypothesis (TPH), which states that the representation of higher nodes in the syntactic tree could be impaired in agrammatism. Of interest to the present discussion higher nodes in the

⁶Much recent work on the real time status of language performance (on which see Shapiro et al. 1998 and reference cited therein) reveals that lexical access during sentence comprehension is not immediately influenced by contextual factors, rather all the meaning of a word are accessed at a first stage. Contextual factors start playing a role only at a later processing stage. Given this temporal distinction, and considering the slowed down lexical access in agrammatics, one might speculate that activation of discourse/contextual information (and crucially the syntactic encoding of such information, the relative morphosyntactic feature) is delayed beyond the limits required for the establishment of a chain. See Kolk (1995) for a discussion of the importance of synchrony in the construction of syntactic representations and the idea of desynchronization as a possible source of agrammatic comprehension.

⁷See Neuhaus & Penke (2003); Penke (2000, 2001) for a contrasting perspective based on data from German agrammatism. Notice also that the TPH explores the effect of agrammatism on production, while the present paper is concerned with comprehension. See Garraffa & Grillo (2008) for a more detailed comparison between comprehension and production in agrammatism and a preliminary attempt to extend this hypothesis to both.

tree are associated with higher types of features in the hierarchy in (4), thus providing support for the present claim.

A rather different kind of evidence for the present approach comes from some recent studies on the syntax of improper movement. Traditionally improper movement has been formulated following the a/\bar{A} distinction; May (1979) Chomsky (1981, 195-204): a derivation is ruled out if a constituent undergoes A movement after having been targeted by \bar{A} movement in terms of the A/\bar{A} . Recent works on this topic (Grewendorf, 1993; Abels, 2007) show that the classical characterization distinction is too coarse. These detailed studies derive a rich hierarchy of movement types ((4) from Abels 2007)⁸

- (4) $\theta < \dots < \text{Case} < \dots < \text{Scrambling} < \dots < wh < \dots < \text{Topicalization}$
(if $\alpha < \beta$, we say that α precedes β .)

This point is crucial for the analysis developed here. I will take this hierarchy to be responsible for the selective disruption of certain feature *types/classes* rather than others. Further, I will assume that the order of application of internal merge reflects the order of activation⁹ of different classes of features. This derives the prediction that a reduction of syntactic processing capacity (e.g. a slowed down activation of syntactic representations) will have significantly worse effects on the outcome of features belonging to a higher type than on the representation of lower types in the hierarchy in (4). Ultimately, we should observe the association of higher levels of complexity with feature types higher in the hierarchy.¹⁰

To sum up, it is assumed that the activation of features higher in the hierarchy in (4) will not be reached (or when reached will decay faster than normal) *if* this cost overwhelms the system's processing abilities. It is important to point out that syntactic tree and feature hierarchy do not necessarily overlap completely. Features of the same type in fact could be associated with different classes of positions in the tree and receive more specific interpretation on the basis of the position itself or the kind of element to which they are associated (see Belletti 2004, see also Gehrke & Grillo 2007; Grillo 2008 for a discussion in this vein with reference to passivization and edge features of the νP). Thus, the present analysis, though it presents certain similarities, is not reducible to a version of the *syntactic tree pruning hypothesis*, but it seems that the latter might be reduced to the former (Friedmann & Grodzinsky, 1997; Friedmann, 1998, 2002).

A final note before moving on with the discussion. An anonymous reviewer noticed that the present approach merges a processing notion (syntactic slowing) with a representational generalization (cartographic hierarchy), without a theory of how this syntactic hierarchy can be implemented within a model of processing. Indeed the attempt to establish this link is very tentative here and the system is not completely worked out. I recognize the need to proceed in clarifying this aspect of the model, and acknowledge the possible problems that might raise in connection to this point. I will leave to future work any attempt to further clarify the relation between the

⁸Interestingly, this hierarchy turns out to be identical to the hierarchy of positions in the syntactic tree as emerged from recent *Cartographic* works.

⁹And thus the order of accessibility in an economy hierarchy which is somewhat reminiscent of the one hypothesized by Reuland (2001) in the already mentioned Primitives of Binding approach. Space limitations prevent a more detailed comparison to be pursued here.

¹⁰Notice in passing that different degrees of impairment could give rise to different patterns of disruption. If the hypothesis presented here is correct, however, we should expect differences to be consistent with the hierarchy of access of syntactic feature *types* and not to target different features randomly. If this is not the case, then there is the possibility that an alternative account in terms of localization of different classes of features in the brain is in order. This alternative possibility, which I believe should not be contemplated as the *zero* option, is explored in Grillo (2008).

syntactic hierarchy and processing.

Before discussing the main advantage of this hypothesis, which emerges when considering the interaction of the proposed impoverishment with independent principles regulating locality in syntax, a brief introduction of these principles and of some recent developments of the Relativized Minimality approach to locality is in order. This introduction is a necessary step in constructing the explanation that follows and deriving the relevant comprehension patterns.

4. Relativized Minimality

Locality constraints are one of the most deeply investigated topics in generative grammar. Relativized Minimality (RM) approaches (Rizzi, 1990, 2004; Cinque, 1990; Starke, 2001) capitalize on the observation that syntactic relations have to be satisfied in the most local structural domain in which they can be satisfied. A formal definition of RM is given in (5) (from Rizzi (2004)).

- (5) MINIMAL CONFIGURATION: ...X...Z...Y...
 Y is in a Minimal Configuration (MC) with X iff there is no Z such that
- i. Z is of the same structural type as X, and
 - ii. Z intervenes between X and Y.

Intervention in (5)[ii.], is defined in terms of c-command¹¹. The exact characterization of ‘sameness’ in (5)[i.] has been the object of debate and modifications in the course of the last 15 years; however the fundamental nature of locality as an anti-identity principle has not been altered by such modifications¹².

The approach we adopt here is the one developed in Rizzi (2004). Rizzi’s definition of ‘sameness’ is based on the empirical observation that only features belonging to the same class, in the sense defined below, block each other. Different classes of features are identified on the basis of their intrinsic properties and their distribution by taking as a point of departure the hierarchy of positions in the syntactic tree as studied in detail in recent cartographic studies. Each of these positions, in fact, can be defined by its particular set of morphosyntactic features, and such features can be cataloged in virtue of the ‘class’ they belong to:

- (6)
- a. Argumental: person, gender, number, case
 - b. Quantificational: *wh*-, Neg, measure, focus ...
 - c. Modifiers: evaluative, epistemic, Neg, frequentative, celerative, measure, manner
 - ...
 - d. Topic

By virtue of this classification, we can define ‘same structural type’ as in (7):

- (7) ‘Same structural type’ = Specifier licensed by features of the same class in (6).

¹¹Note that intervention for minimality can and does exceed strict c-command and is commonly found in simple linear order, as in gapping: *John sells books; Mary buys records and Bill V newspapers* Rizzi (2004, ex. 9, attributed to Koster (1978)); where the elided V can only be *buys*.

¹²For an extensive formulation of Relativized Minimality as an anti-identity principle, meaning a principle that forbids any identical element to intervene in a syntactic relation, see Starke (2001). More extensive discussion of Starke’s work in relation to the present hypothesis can be found in Grillo (2008).

Given the above formulation, we expect RM effects to be generated by intervening elements whose set of features belong to the same class, but not by features sets that belong to a different class.¹³

5. Generalized Minimality

In the previous section RM was introduced: minimality effects arise only in presence of an intervening element whose feature set belong to the same class the probe belongs to. (8) represents the idea schematically.

$$(8) \quad \begin{array}{ccccccc} (\alpha, \beta, \gamma, \delta)_{\text{Class}\Delta} & (\alpha, \beta, \gamma)_{\text{Class}\Gamma} & & (\alpha, \beta, \gamma, \delta)_{\text{Class}\Delta} \\ X & . & . & . & Z & . & . & . & Y \\ \hline & & & & \Delta & & & \end{array}$$

In (8) a particular set of morphosyntactic features (represented with Greek letters) is associated with every node. The presence of the feature δ suffices for RM to ‘see’ the difference between X and Z and therefore to authorize the movement of Y over Z. Recall from the discussion in the previous section that a difference on a single feature of the same class (e.g. a mismatch in gender or number features) is not enough to avoid a minimality effect unless that feature introduces a change of class. It is necessary then to think about δ as the distinctive feature of the particular head and the relevant relation we are considering, e.g. a *wh*-feature in the relevant head of the CP layer, whose presence suffices to imply a change of *class* of the relevant set from Argumental to Quantificational. Changing the nature and number of the features associated to a particular node in the syntactic tree, we should expect a variation in terms of legitimacy to form a chain, especially if such modifications imply the change of *class* in the sense defined above.

$$(9) \quad \begin{array}{ccccccc} (\alpha, \beta, \gamma)_{\text{Class}A} & (\alpha, \beta, \gamma)_{\text{Class}A} & & (\alpha, \beta, \gamma)_{\text{Class}A} \\ X & . & . & . & Z & . & . & . & Y \\ \hline & & & & * & & & \end{array}$$

If for any reasons the *wh*-feature is missing (as in (9)) X and Y would not be in a local configuration anymore: its absence in fact turns X into a member of the Argumental class and thus Z qualifies as a potential intervener.

Recall that in 3 I proposed that agrammatic aphasics have troubles representing the full array of features associated with syntactic elements. More specifically, that the representation of *scope-discourse* related features is compromised, possibly as a consequence of slowed down activation of syntactic representations. The main result of this idea is that agrammatic aphasics’ comprehension asymmetries with canonical vs. non-canonical sentences may be reduced to a special case of RM violation, due to the correct application of this constraint to impoverished syntactic structures. If a feature α is absent from the syntactic representation (i.e. if activation of a feature α is not reached in the required time frame) AND α is necessary to distinguish the class of the moving element from that of an hypothetical intervener, then RM will block chain

¹³Note that the definition in (7) allows us to avoid the excessive restriction on movement generated by the simple A/ \bar{A} distinction (of the system developed in Rizzi 1990) on the one hand, and the excessive freedom generated by the Minimal Link Condition (see Chomsky 1995) on the other. See Rizzi (2004) for extensive discussion of this point.

formation. The minimality effect generated by this impoverishment and the consequent impossibility to form a chain necessarily leads to poor comprehension of the relevant structures. In other words, those structures that require establishment of a movement dependency over an intervening NP will be more complex to process and thus more likely to be compromised in agrammatic aphasia comprehension.

- (10) (N, θ_2 , ϕ_s ,acc,wh)_{ClassQ} (D,N, θ_1 , ϕ_s ,nom)_{ClassA} (N, θ_2 , ϕ_s ,acc,wh)_{ClassQ}
 The boy_i [[who <boy>]_i] [the girl]_j [<the girl>_j kissed <who boy>_i]]

- (11) (N, $\theta_2, \phi_s, \text{acc}, \text{wh}$)_{ClassA} (N, θ_7, ϕ_s)_{ClassA} (D, N, $\theta_7, \phi_s, \text{wh}$)_{ClassA}
 The boy_i [[who < ... >]_i [the girl]_j [< ... >_i kissed < ... >_j]]

Our original hypothesis, that agrammatics' representation of Operator features is impaired, combined with an independently needed principle of grammar correctly predicts agrammatic aphasics' comprehension to be impaired only for object relatives.¹⁵¹⁶

¹⁵Petra Burkhardt (p.c.) points out that delayed reactivation of the antecedent, instead of total absence of it, could be taken as evidence against the present account (for an overview on late priming in agrammatism, see [Zurif 2003](#)). Notice, however, that delayed reactivation must be separated from proper chain construction; otherwise agrammatics would not have problems with non-canonical word order (on this point see also [Friedmann & Gvion 2003](#)). What these facts seem to suggest is that chain interpretation does not simply require reactivation of a moved element, but rather requires it to be reactivated on time and with its complete featural make-up. Moreover, non-delayed reactivation of the antecedent in turn requires normal activation of the full morphosyntactic feature set associated with it and absence of any intervening element of the same *type*, which is what is claimed goes wrong in the first place. I refer to [Grillo \(2008\)](#) for more detailed discussion of this point. See also fn. 4 above.

¹⁶It is important to emphasize that the intuition of the existence of some long distance principle at work in agrammatic aphasia is not new. We can find some speculation in this direction in [Hickok et al. \(1993, p. 387\)](#) who claim that some sort of long distance principle could be responsible for canonicity effects: “it seems that when two elements that need to be ‘associated’ are separated by lexical material, comprehension is poor”. Much the same intuition is expressed in [Friedmann & Shapiro \(2003, fn.4 p.295\)](#).

At this point we have a clear model of what underlies the malfunctioning of the system. However, as an anonymous reviewer points out, it is not clear how the observed pattern of performance is derived. That is, how do we derive *chance* performance (and not below/above chance) with object relatives (and most of the structures considered below)? One possible option at this point is to follow Grodzinsky and take a strategy a la [Bever \(1970\)](#) to be at the source of this pattern. Although I would not exclude this explanation, I would like to consider another possibility. [Hickok et al. \(1993\)](#) shows the use of different experimental paradigms leads to different conclusions as to the actual comprehension levels. [Hickok et al. \(1993\)](#) used a truth value judgment task instead of the more traditional sentence/picture matching which revealed that the *chance level* performance typical of a guessing behavior might be determined by external factors. The basic difference between the two tasks is that while the sentence/picture matching forces the subject to make a choice between two (or more, including distractors) pictures; the truth value judgment task gives the subject the additional possibility to refuse a sentence type, i.e. by replying no in a systematic way. A first analysis of the data collected with the truth value showed the same pattern obtained with the previous experimental technique, i.e. chance performance with non-canonical structures and above chance with canonical. Under closer scrutiny, however, it appeared that the subjects *systematically refused non-canonical* structures, replying no to all of them. Crucially then the chance performance obtained only because the experiment displayed 50% of correct no answers and the remaining 50% of correct yes replies.

This data, as also the authors commented, seem to show that the subjects are completely lost when presented with sentences with non-canonical word order and don't seem to be capable to attempt any analysis. From this perspective, the tendency to guess in sentence to picture matching task does not seem to be an effect of e.g. the presence of two agents in the same clause (as Grodzinsky's strategy claims). Rather, it seems to be the result of an artifact of the technique itself. This incapacity to deal with the structure is exactly what we should expect if the problem underlying problem was one of minimality. I will leave this issue open here.

In what follows I show that the *generalized minimality* approach presented above can easily be extended to other structures typically problematic for agrammatic patients.

5.1. Clefts

Much the same analysis developed above for relative clauses allows us to predict the correct comprehension patterns in the case of movement of a clefted constituent. At the risk of being repetitive, the relevant analysis is sketched below. (12) is a schematized representation of an *object-cleft* (*it is the boy who the girl kissed*) sentence in normal adult speakers. Relativized Minimality authorizes the formation of the relevant chains between the moved NPs and their traces by virtue of the difference between the feature set associated with the subject NP and that associated with the object NP.

$$(12) \quad (N, \theta_2, \phi_s, \text{acc}, \text{wh})_{\text{ClassQ}} (D, N, \theta_1, \phi_s, \text{nom})_{\text{ClassA}} (N, \theta_2, \phi_s, \text{acc}, \text{wh})_{\text{ClassQ}} \\ \text{It is the boy}_i \text{ [who}_i \text{ [the girl]}_j \text{ [<the girl>}_j \text{ kissed < who >}_i]]$$

The presence of the *wh*- feature, in fact defines the object <who> as a member of a class (Q, the Operator's class) distinct from the one to which the subject <the girl> belongs to. The former belongs to the Operator class while the latter belongs to the Argumental class.

In (13) the proposed representation of the same structure by an agrammatic aphasic is schematized.

- (13) $(N, \theta_1, \phi_s, \dots)_{\text{ClassA}} (D, N, \theta_1, \phi_s, \dots)_{\text{ClassA}} (D, N, \theta_2, \phi_s, \dots)_{\text{ClassA}}$
 It is the boy_i [who_i [the girl]_j [<...>_j kissed <...>_j]]
⏟
×

The impoverishment of the set of features, more specifically the absence of the *wh*-feature, leads to RM blocking chain formation. As a consequence, it is impossible to assign the correct thematic role to each argument, which in turn generates poor comprehension.

This analysis predicts above chance performance with subject clefts, which are, in fact, correctly interpreted by agrammatic patients. In these structures, in fact, no other NP intervenes between the moved constituent and its trace, hence no RM effects are expected (14).

- (14) It is the boy_i [who_i [<the boy>_i loved the girl]]
⏟

5.2. Topicalization

Friedmann & Shapiro (2003) have examined aphasics comprehension of active sentences of the basic form SVO and derived OSV-OVS in Hebrew. The results they obtained are quite clear and indicate that aphasic patients have more problems in comprehending the derived active sentences (of the OSV-OVS form), on which agrammatic performance is at chance level, than the normal active SVO on which their patients perform at a level above chance. I take these facts to provide additional support for the the present hypothesis. Aphasic patients in fact perform badly only when they have to comprehend the structures in which a DP has been moved over another DP.

5.3. Unaccusatives

One of the advantages of the present approach is that it provides a straightforward explanation of the good performance of agrammatics with unaccusative verbs. As mentioned above, Piñango (1999) showed that agrammatic patients have no troubles understanding who did what to whom in potentially ambiguous sentences such as (15).

- (15) a. The girl spun/fell <the girl> because of the boy
⏟

Piñango argues that a trace deletion approach should predict a chance performance with these structures; given trace deletion it is impossible to assign the thematic role to the subject via an A chain, and application of the non-grammatical *agent first* strategy wrongly predicts agrammatics to perform at *chance level*.

The present approach, on the other hand, does not predict agrammatics to fail with these structures; no potential blocker for minimality, i.e. no other DP, intervenes between the moved argument and its trace. No minimality effect can therefore arise and the structure is correctly predicted not to be problematic.¹⁷ Notice that also the Double Dependency Hypothesis (DDH) developed in Mauner et al. (1993) makes the correct prediction for the data under discussion. The correct representation of unaccusatives, in fact, requires the construction of a single syntactic dependency.

¹⁷ Friedmann & Shapiro (2003) also note this problem. Interestingly, they suggest a modification to the TDH which, although presented only as a descriptive generalization without any specific theoretical support, is very much in line with the minimality analysis proposed here. They propose that: “a ... possible ... modification would be to restrict impairment only to ‘non-local movement’ as a movement of an argument over another argument of the same verb. Thus objects that move over subjects will lose their traces, because they move non-locally ...” (Friedmann & Shapiro, 2003, fn. 4 p. 295).

(16) *The Double Dependency Hypothesis*

- i. The deficit underlying asyntactic comprehension affects the processing of syntactic referential dependencies, and
- ii. When there is only one such dependency the resulting syntactic representation, although abnormal, is not ambiguous, but when there are two such dependencies the resulting representation is semantically ambiguous.

An anonymous reviewer notices a similarity between the present approach and the Double Dependency Hypothesis. I believe that a detailed comparison of the frameworks in which the two proposals are formulated would be necessary to discuss this similarities. However, a systematic discussion of this issue would take us too far from the goals of the present discussion. I refer to [Grillo \(2008\)](#) for more on this point.

5.4. *Control*

An issue that deserve some discussion in the present context is that of Control structures in agrammatism. [Caplan & Hildebrandt \(1988\)](#) report the results of an experiment on comprehension of structures involving Control (such as those in (17)) in which two agrammatic patients, A.B. and C.V., were tested.

- (17)
- a. Giorgos persuaded Wieneke to live.
 - b. Giorgos promised Wieneke to live.

Both patients performed significantly better on object control structures such as (17-a.), than with subject control (17-b.). It is important to mention that similar results were obtained in an earlier study on language acquisition by Carol [Chomsky \(1965\)](#) and replicated by [Maratsos \(1974\)](#).

In the context of the present discussion, it immediately appears that in the *non-problematic* case of object control a ‘local’ relation is established between the controller and the PRO inside the infinitive clause (where *local* refers to the fact that no other DP intervenes in the structural configuration). In the case of subject control on the other hand, the object DP intervenes on the path between the controller and the controlled element.

One could be tempted, given the analysis defended so far, to use these data as evidence for a movement based analysis of Control. An introduction to the appeals of a movement based approach to control phenomena and the (many) problems it raises is far beyond the scope of the present paper. On this issue I refer to [Landau \(1999, 2003\)](#); [Hornstein \(1999\)](#); [Boeckx & Hornstein \(2003\)](#); [Jackendoff & Culicover \(2001\)](#). Potentially, a movement based analysis might investigate the possibility of inactivation of the feature responsible for movement of the subject in subject control structures (whatever the exact nature of this feature). Minimality effects would be expected to arise as a consequence of this underspecification and the intervention of the object DP in (17-b.).

However, I will not undertake this path here. I am not sure these data can lead us very far in this particular discussion. This uncertainty originates with the well known fact that the application of minimality constraints exceeds the limits of movement, e.g. in the case of agreement or, maybe more importantly for the present purposes, in *gapping* as discussed in fn. 11.

Though this issue requires deeper investigation before it may be related in an exact way to the present approach, I take it that these data might provide further support for the minimality-based approach proposed here.

5.5. On *wh*-questions

Hickok & Avrutin (1995, 1996) investigated comprehension different types of *wh*-questions in two agrammatic Broca's aphasics. They showed that while the typical asymmetry between subject and object movement-derived sentences emerged with *which*-x type (as usual object movement led to *chance* performance, while *above chance* obtained with object movement), there was no significant difference between subject and object movement in the case of *who* questions. How can the hypothesis developed here deal with these results?

First of all, I would like to point out that Garraffa & Grillo (2008) obtained very different results in a single case study with an Italian agrammatic aphasic. There was no difference in the patient's performance with the two structures, i.e. *chance* performance obtained with both *which* and *who* object movement. Thus, the significant differences in the results of these two studies should be addressed with much care in order to determine what (if any) language-specific mechanisms might be playing a role in the differing behavior of English and Italian agrammatics.

¹⁸ Here I will take into consideration two possible explanation for this asymmetry.

The first possibility is to hypothesize that the case of impoverishment of the moved object, a perfect match between this and the intervening subject obtains only with the *which*-NP type of question, at least in English. Thus, a minimality effect when crossing another NP might be predicted only for this kind of elements.

Another option is to follow Hickok and Avrutin in their idea (developed in more detail in (Avrutin, 2000a, 2006)) that *which*-NP kind of questions are inherently more complex in that they require interfacing the syntax proper with the discourse representation. This higher complexity won't apply in the case of *who*-movement, which would be derived only in the narrow syntax.

From the perspective of this paper, one could follow Starke (2001) who explicitly assumes a hierarchy of features where the feature class associated with *which*-x (S[pecific]Q) constitutes a subset of the Q feature class of *who* elements. Given the approach in terms of feature hierarchy developed here, it makes sense to hypothesize that SQ class, being of a hierarchically higher class, might in fact be more problematic than the lower Q class.

Although a more detailed explanation should be provided for these facts, it seems to me that they do not constitute a serious challenge to the analysis proposed here and could be accommodated in several ways. I refer to Grillo (2008) for a more detailed discussion of these phenomena.

5.6. Verb Movement

A last note on verb movement is in order before moving on with the discussion of passives. Agrammatic aphasics have been shown to deal quite well with (local) verb movement (Lonzi & Luzzatti (1993)). A significant advantage of the present approach is that it allows a straightforward derivation of these facts without requiring any additional stipulation to be made.

The application of the present hypothesis to verb movement in agrammatism is quite straightforward: no particular problems are expected when verb movement proceeds from head to head, in that, by definition, following the Head Movement Constraint of Travis (1984), it is the most local instantiation of movement and never crosses any potential intervener.

Though it is in principle conceivable that traces created from NP movement have to be kept distinct from traces of V movement, I believe that an account of agrammatic behavior that does not have to rely on such distinctions should be preferred for reasons of economy.

¹⁸ On the difference between these two constructions in Italian and English, see De Vincenzi (1991).

5.7. Passives

The case of passives deserves a longer discussion for two reasons: the first is that it is not immediately evident how the present account explains agrammatic difficulties with these structures¹⁹; the second (which I find very interesting in connection to the overall frame of this discussion) is that what we know about the structure of passives poses some interesting problems in relation to locality.²⁰

Strong Crossover effects (18-a), the availability of subject-controlled infinitival clauses (18-b) and subject-oriented modifiers (18-c), depictives (18-d), binding (18-e,f), and purpose adverbials (18-g), provide empirical evidence for the assumption that the external argument is still present in verbal (eventive) passives.

- (18) *Presence of the external argument in verbal passives*
- a. *They_i were killed by themselves_i.
 - b. The book was written to collect the money. (Manzini, 1980)
 - c. The book was written deliberately. (Roeper, 1983)
 - d. The book was written drunk. (Baker, 1988)
 - e. Damaging testimony is always given about oneself in secret trials. (Roberts, 1987)
 - f. Such privileges should be kept to oneself. (Baker et al., 1989)
 - g. The book was written on purpose.

It is generally acknowledged (even in the traditional approach assumed in Baker et al. 1989) that the external argument is generated in the same position (Spec, vP) in active and passives. This, as Collins (2005) (among others) notices, raises problems in connection to RM, i.e. how can the internal argument be moved over the external one without violating minimality given that there is no distinction in the feature class to which the two DPs belong to?

Collins provides the following solution to this problem. *Smuggling* of the VP over the vP makes the internal argument the closest to Spec TP allowing for its promotion to subjecthood without any violation of Relativized Minimality or its derivational counterpart. *Smuggling* is defined in (19).

- (19) *Smuggling* (Collins, 2005)
- a. Suppose a constituent YP contains XP. Furthermore, XP is inaccessible to Z because of the presence of W, some kind of intervener that blocks any syntactic relation between Z and XP. If YP moves to a position c-commanding W, we say that YP smuggles XP past W.
 - b.
$$\begin{array}{c} Z \dots [_{YP} XP] \dots W \dots <[_{YP} XP]> \\ \underbrace{\hspace{1.5cm}} \\ \text{OK} \end{array}$$

Gehrke & Grillo (2008) notice that even though Collins' account seemingly solves the locality issue, it raises several new ones. Among other problems they notice that a smuggling approach:

¹⁹As an anonymous reviewer pointed out "it is not immediately clear that the account would have anything to say about passives, without making many additional assumptions about their structure". This is clearly true and justifies the huge amount of space dedicated to explaining those assumptions and the reasons that lead to them.

²⁰This section is entirely based on the joint work with my colleague Berit Gehrke. A more detailed analysis appears in Gehrke & Grillo (2007, 2008).

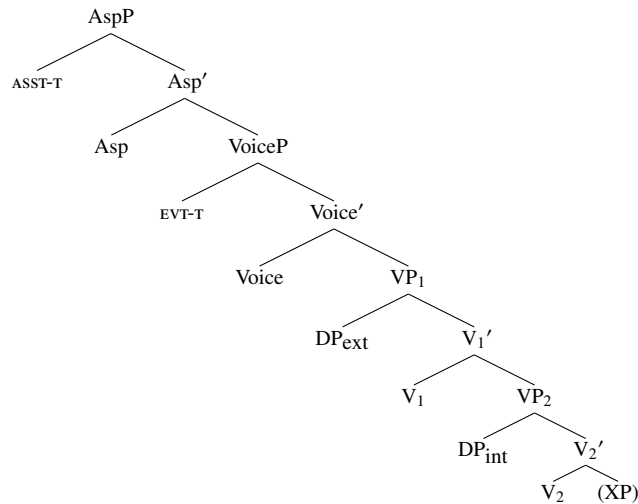
(i) poses serious look-ahead problems; (ii) have no clear status in the theory; (iii) has no clear limitations (why doesn't it over generate? Can it be used to avoid minimality effects in general?); (iv) does not capture the basic empirical facts about passives, i.e. that passivization applies in absence of movement of the internal argument to [Spec,TP] (e.g.: *there was a man killed*), which was the crucial reason for *smuggling*. Finally, they note, *smuggling* might not even solve the minimality problem. This operation, in fact, moves a subevent (VP) across another subevent vP, which according to the assumptions shared by Collins himself should generate a minimality effect.

Gehrke & Grillo (2008) develop a novel approach to passives by shifting the perspective from argument structure to event structure. They claim that this shift provides new predictions for and insights into the nature of passivization and solves the locality issue in a natural way. They dissociate the movement of part of a complex event structure, which is taken to be the essential characteristics of passivization, from the movement of some argument DP to Spec TP to satisfy the EPP.

Gehrke and Grillo propose that the promotion of a consequent state subevent of a complex event to a position above VP is a fundamental ingredient of the passive. Crucially for our present discussion Gehrke and Grillo propose that a semantic requirement, some kind of topicalization, singles out this consequent state and assigns it a feature that will determine the movement of the lower VP to a discourse-related projection at the edge of the VP phase, represented as VoiceP in (20).²¹ The correct representation of this feature is thus necessary to avoid minimality between the moved subevent and the intervening one (respectively VP₂ and VP₁ in (20)).

In the spirit of Travis (2000, and subsequent work), they employ a VP shell account for the syntactic representation of event structure. In Travis' model, V₂ introduces the theme argument (DP_{int}) as well as the endpoint of the event, whereas V₁ corresponds to the causing sub-event and introduces the external argument (DP_{ext}). Thus, a consequent state is structurally represented as a lower VP shell with the VP-internal argument DP in its specifier.

(20)



²¹ Contrary to Collins' *smuggling* approach, this operation is completely independent of the promotion of the internal argument to subject position. This is supported by the fact that the internal argument does not necessarily land in Spec TP in passives, i.e. in existential constructions such as: *there was a man arrested*. Hence, Gehrke and Grillo take movement of VP₂ to be the only necessary condition to define passivization.

Gehrke & Grillo (2008) show that there is a tight relation between the availability of a consequent state and passivization. More specifically they show that the possibility to passivize a predicate depends on its event structure in a crucial way. They support their assumptions with evidence from word order in constructions involving secondary resultative predicates, floating quantifiers, ditransitives, and *there*-expletives. All this evidence supports the idea that more than the internal argument moves in passives.²²

It is impossible, for reasons of space, to get into a detailed discussion of Gehrke and Grillo's approach to passivization. The crucial point for our present purposes is that the account assumes that a scope/discourse related feature drives movement of a secondary predicate over the intervening VP. This assumption allows us to predict that agrammatic patients should have problems with passive sentences because of our hypothesis that agrammatics are unable to project scope/discourse features. More specifically, this inability generates an impoverished representation of VP₂ in (20) which ultimately generates a minimality effect whenever VP₂ is moved above VP₁.

Additional support for the proposed approach comes from the data on comprehension of *psych*-verb passives in agrammatism discussed in Grodzinsky (1995). Grodzinsky shows that agrammatic aphasic comprehension patterns with these structures is significantly different (i.e. more impaired) than that of actional passives. Specifically, agrammatics perform at *below-chance* level with *psych*-verb passives²³ but not with actional passives (i.e. at *chance*). Grodzinsky takes these data to support the view that the *agent-first* strategy applies across the board, generating more difficulties with predicates that require a different thematic role to be assigned to the first NP.²⁴

A different explanation is available when we consider the novel approach to passives presented above. Following Gehrke & Grillo (2008), in fact, we assume that in order to be able to passivize purely stative predicates, like the *psych*-verbs under discussion, a complex predicate has to be formed syntactically in order to introduce a consequent state the passive will operate on. Considering agrammatics' problems with timing of lexical access and general slow-down of the structure building system, I take that this additional operation will be particularly complex to perform. Two factors will thus contribute in making these structures particularly problematic for agrammatics, their combination leads to below-chance performance.

5.8. *Summing up*

In this section I have shown how a minimality based account can explain *canonicity effects* in a simple and principled way. The same account can be extended to cover a wide array of comprehension patterns in agrammatism, such as the asymmetry between subject and object relatives and clefts; canonical SVO actives and actives in which the object has been Topicalized, as well as that between *actives* and *passives*; between *unaccusatives* and passives, and *adjectival* passives on the one hand and *verbal* passives on the other. Table 2 sums up the relevant data. Structures whose correct interpretation requires movement over an intervening NP lead to chance performance, while structures involving the same kind of movement, but which crucially do not involve crossing an intervening NP, are interpreted correctly by agrammatic speakers. Note that

²²In refer to the original work and to Gehrke & Grillo (2007) for a detailed discussion of these issues.

²³Very similar data are discussed in the acquisition literature. See e.g. Borer & Wexler (1987).

²⁴Mauner et al. (1993, fn. 11, p. 361) point out potential problems for the account: "[these data] force Grodzinsky away from a more appealing version of his Default Principle, according to which the θ -roles assigned by default must come from among the roles associated with the verb in question, to a much less appealing version according to which subjects are assigned *agent* regardless of the semantics of the verb.

Construction	Language	Type	Performance
Active	(It/Eng/Heb/Sp/ Jap/Kor/Du/Ger)	\neg crossing	Above Chance
Unaccusatives	(Eng)	\neg crossing	Above Chance
<i>which</i> -NP sub.	Eng. Ita.	\neg crossing	Above Chance
‘Short’ Passives	(Eng)	+crossing	Chance
‘Long’ Passives	(Eng/Heb/Sp/It)	+crossing	Chance
OSV scrambling	(Jap/Kor)	+crossing	Chance
OVS scrambling	(Ger)	+crossing	Chance
OVS Topic mov.	(Heb)	+crossing	Chance
OSV Topic mov.	(Heb)	+crossing	Chance
<i>which</i> -NP obj.	Eng. Ita.	+crossing	Chance

Table 2: (See [Beretta et al. 2001](#); [Burchert & De Bleser 2004](#); [Drai & Grodzinsky 2006a](#); [Friedmann & Shapiro 2003](#); [Hagiwara 1995](#); [Grodzinsky et al. 1991](#); [Grodzinsky 2000](#); [Luzzatti et al. 2001](#); [Piñango 1999](#); [Hickok & Avrutin 1995](#); among others.)

performance levels are to be taken to indicate general tendencies for a given structure. Given the *processing based* perspective assumed here it is in principle possible to deal with the attested *variation*.

6. Summary and final thoughts

Already in 1905 Ernst Mach advised that “knowledge and error flow from the same mental sources, only success can tell the one from the other” [Mach \(1905/1976\)](#). That Mach was right appears particularly clear when one looks at the huge amount of work on the topic of the last fifty years (for an overview see e.g. [Dell 1995](#)). Linguistic errors, it is now widely accepted, are highly constrained by the grammar. In fact, after a careful analysis we generally realize that they are grammatical in the relevant sense that they obey grammatical rules, i.e. they are generated by the same mechanisms that generates grammatical structures.

The study of linguistic errors has proved extremely important for our comprehension of how the underlying principles of grammar work. In her classical paper on errors, with the eloquent title *The non-anomalous nature of anomalous utterances*, Victoria Fromkin states the issue in these terms: “it is not true that ‘anything goes’, or that speech performance obeys no rules, or that the errors are totally random and unexplainable. While we may not be able to explain as yet the exact mechanisms involved in speech errors, the errors made are not only highly constrained, but provide information about speech performance which non-deviant speech obscures” ([Fromkin, 1971](#), p.48).

A major achievement of modern linguistic theory lies in showing that, under close scrutiny, errors of very different populations, and related to different, though connected, modules underlying language representation (i.e. phonology, syntax, semantics), reveal their underlying grammatical structure. ‘Errors’, when observed through the lens of sophisticated linguistic theory, appear as instantiations of *impoverished*/simpler/underspecified (though highly related to the intended target) grammatical options.

The analysis of agrammatic aphasics' problems with non-canonical word order presented here leads to very similar conclusions: agrammatic errors with these structures are shown to be *grammatical* in the relevant sense that they are derivable by the correct application of grammatical restrictions on an impoverished feature structures.²⁵

The approach to movement-related errors developed here ultimately reduces to a simple assumption: underspecification of the morphosyntactic feature array associated with a moved element Y can, and as the data from agrammatism show *does*, blur the differences between this and any otherwise innocuous intervener Z which already shared some basic properties with Y (e.g. they are both NP), turning a grammatical configuration into a minimality violation. This reasoning is far from new: the logic underlying the present proposal is merely an inversion of the logic underlying much recent work on locality in grammatical constructions. Thus, as Starke (2001) notes, a common strategy of much recent work on asymmetries in extractability from weak islands (traditionally dubbed *arguments/adjuncts asymmetry*) since the introduction of Relativized Minimality has been to capture the apparent exceptions in terms of some additional property associated with the moving element in those cases in which extraction from Weak Islands is allowed.

Starke (2001) provides quite convincing arguments that the additional operative property is *specificity* and constructs his unified approach to weak and strong islands (reducing both to Relativized Minimality) starting from this observation.

The novelty here lies in applying this logic to capture impairment, asking what happens if instead of *adding* we *subtract* features. This step ultimately unifies the theory of agrammatic comprehension of movement-derived sentences with the more general theory of islands. Rephrasing Starke, we could say that “theoretically, the important point is that this unification does not necessitate any enrichment of the model: all is derived with the standard locality principle. The sole enhancement is outside of the syntactic engine itself, in the data structure on which the engine operates: the syntactic feature-tree *loses* one leaf”.²⁶

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²⁵It is encouraging that psychological studies of errors in other domains of cognition reveal a very similar property. On this point see e.g. Reason (1990). See Grillo (2008) for a detailed discussion of this similarity.

²⁶The original sentence of course reads: ... “the syntactic feature tree *gains* one leaf” (Starke, 2001, p. 28).

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