Structural Connections in Syntax and Processing: Studies in Russian and Japanese

by

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Abstract

This thesis consists of two parts. Part I provides an analysis of the locative inversion construction, the conjunction agreement construction, and the genitive of negation construction in Russian. These constructions are argued to share one formal property: they contain an element other than the highest nominal argument satisfying the Extended Projection Principle. The EPP is shown to be independent not only of morphological features (such as Case or agreement), but also of categorial features (such as N or D); movement to the EPP position is shown to be subject to the Minimal Link Condition for all categories, so that non-canonical subjects can move to the EPP position only when they are as "close" to it as the highest NP argument. Given our assumptions about VP structure, this happens only in sentences containing unaccusative verbs. The syntactic properties of locative inversion, conjunction agreement, and genitive of negation are shown to follow from the manner in which various principles operating in Russian syntax, such as the discourse principles, the properties of covert (as opposed to overt) feature-checking, the morphological Case system of Russian, and the existential closure applying to all VP-internal positions, operate on sentences whose nominal "subjects" remain in their base-generated positions in overt syntax. .

Part II investigates the processing complexity of unambiguous Japanese sentences. The investigation utilizes the theory of processing complexity developed in Gibson & Thomas (1996a), within which the memory cost associated with an incomplete syntactic dependency increases as a function of the number of lexical items that are processed between the point where the relationship is posited and the point where it is satisfied. Two types of processing complexity contrasts found in Japanese are discussed: those associated with the number of "stacked" sentence-initial NPs and those associated with the degree and type of center-embedding present in a sentence. Both experimental and intuitive data are provided as evidence for the existence of the complexity contrasts. It is shown that the contrasts are accounted for within the Locality Theory of Gibson & Thomas. On a more general level, this work describes the properties that any theory of processing complexity must have to successfully deal with the available Japanese data and offers a constrained and principled explanation of apparent variation in the processing complexity of similar structures across languages.

Thesis supervisors: Dr David Pesetsky and Dr. Edward Gibson

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1. Introduction

In this work, we are concerned with developing an analysis of several syntactic phenomena in Russian: locative inversion constructions, illustrated in (1a), conjunction agreement constructions, illustrated in (1b) and genitive of negation constructions, illustrated in (1c,d).

1 a. Na stole stojali lampa i pustoj stakan.
on table stood-pl lamp-sg-fem-nom and empty glass-sg-masc-nom
'On the table stood a lamp and an empty glass'
b. Na stole stojala lampa i pustoj stakan
on table stood-sg-fem lamp-sg-fem-nom and empty glass-sg-masc-nom
'On the table stood a lamp and an empty glass'
c. Ni odin moj znakomyj ne živet v etom rajone
neg single my acquaintance-sg-masc-nom not live-3rd-sg in this area
'Not a single of my acquaintances lives in this area'
d. V etom rajone ne živet ni odnogo moego znakomogo
in this area not live-3rd-sg neg single my acquintance-sg-masc-gen
'Not a single of my acquaintances lives in this area'

We will show that these constructions have similar distribution, being restricted to a subset of sentences containing unaccusative verbs. This similarity will be traced to the structural characteristic that the three constructions share: in them, a non-nominal element satisfies the Extended Projection Principle. Thus, the analyses developed in this work are all based on a particular view of the EPP: we will adopt the approach of Branigan (1992), in which the EPP position is argued to be A-bar and the EPP is argued to be satisfiable by non-nominal elements. The specific properties of the constructions under consideration will be derived from the interaction of the EPP with the argument structure of the verbs present in the

sentences, as well as the semantic and morphological mechanisms that operate in the Russian language generally.

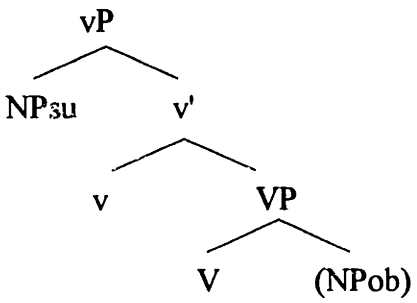
Chapter 2 develops a precise description of the manner in which the EPP operates in Russian. First, arguments are offered that the EPP does operate in Russian, so that some element must occur pre-verbally in a discourse-neutral Russian sentence. Then, it is shown that elements other than the highest nominal argument can fulfill this function in sentences containing unaccusative verbs. We are primarily concerned with constructions in which a PP is satisfying the EPP - these are the Locative Inversion constructions, which have been described in a number of languages (e.g. Bresnan (1994)). We provide evidence showing that the EPP position has A-bar properties, that is, that elements occupying it undergo reconstruction at LF, as well as evidence showing that the "subject" NP raises to a Case-checking position at LF (Spec of TP in our framework). We also discuss the connection between the discourse function of the elements that satisfy the EPP.

Let us say a few words about the syntactic assumptions made in this work. The analysis we present is couched within the syntactic framework of Chomsky (1995). In particular, the structure of a sentence is assumed not to contain Agr Phrases. Nominative case is checked in the Spec of TP and accusative Case is checked in the (outer) Spec of vP. This is not a crucial assumption: our analysis is compatible with a framework that utilizes Agr Phrases, as well. Informally, we will refer to these positions as the "agreement positions" when this is convenient. Since we will be primarily concerned with intransitive verbs, our analysis will also be neutral between an approach to sentence structure in which the direct object moves over the base-generated position of the subject, and an approach to sentence

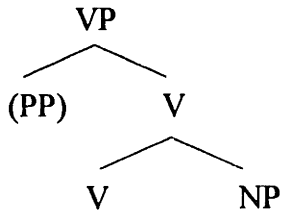
structure, in which the base-generated position of the subject is higher than the shifted position of the object. Again, as a matter of arbitrary choice we adopt the former approach.

In chapter 3 we provide a description of the conjunction agreement phenomenon (see (1b)). We argue that it is restricted to sentences containing unaccusative verbs, in which the "subject" has the opportunity to remain VP-internal because a PP argument is satisfying the EPP. We show that conjunction agreement can arise only as a result of covert feature-checking, so that it can surface only in the Locative Inversion Constructions, whose subject is a conjunction that is able to remain in its base-generated position in overt syntax. We provide an explanation of the inability of both the Locative Inversion Constructions and the conjunction agreement constructions to appear in sentences containing unergative or transitive verbs. Our explanation relies crucially on two syntactic assumptions. First, we follow Chomsky (1995) in assuming that the unergative and unaccusatives verbs have the structures shown in (2)

2 a. Transitive and unergative verbs:



b. Unaccusative verbs:



The subject of unergative (and transitive) verbs is base-generated in the inner Specifier of the vP; the "verb" is a v-V complex formed by movement. For unaccusative verbs, the upper vP projection is absent.

Second, we adopt the formulation of Move/Attract provided in Chomsky (1995), which incorporates the Minimal Link Condition as part of the definition of Move, so that only the "shortest moves" can be made (3a,b).

3 a. (Minimal Link Condition) α can raise to target K only if there is no legitimate operation Move β targeting K, where β is closer to K. (296)
b. (Last Resort) Move F raises F to target K only if F enters into a checking relation with a sublabel of K. (280)
c. if β c-commands α and τ is the target of raising, then β is closer to K than α unless β is in the same minimal domain as a) τ or b) α. (356)

The notion of equidistance, expressed in (3c), also play a central role in our analysis. In all the cases we will be concerned with, the equidistance of the two elements that could undergo a movement operation from the target, rather than the equidistance of the two potential targets from the mover, will be relevant.

Given these two assumptions, only the non-nominal arguments of unaccusative verbs can be as "close" to the EPP position as the highest nominal argument. In this fashion we derive the distribution of the Locative Inversion Constructions and conjunction agreement.

Chapter 4 is concerned with genitive of negation (see (1c,d)). We offer an analysis of the Russian Case system within which genitive case is treated as a more default realization of "objective case" than accusative. We offer evidence for this analysis based on the morphological behavior of accusative and genitive case, in particular, the accusative-genitive case syncretisms. In our syntactic treatment of genitive of negation, the genitive nominals are seen as lacking abstract Case features and not undergoing raising to a case-checking position at any point in the derivation. Of course, this is only possible if the nominal does not have to

undergo movement to satisfy the EPP. Genitive is the default case provided within the morphological component to a VP-internal nominal lacking abstract Case.

This brings us to the last technical notion important for our analysis: our approach to syntactic features and in particular, to Case features. Categorial features and the phi-features of nominals are assumed to be +Interpretable and not to delete once checked, remaining visible for interpretation at LF. -Interpretable features delete once checked and must be absent at LF. In general, only unchecked -Interpretable features can cause a derivation to crash. We assume that functional categories have to be inserted into the derivation with a full set of features. In contrast, nominals (or, perhaps, substantive categories in general) may be inserted into the derivation with an incomplete feature specification: their -Interpretive features may be absent completely or partially. Here, we follow Marantz (1991) in assuming that "a sentence will never be ungrammatical because no case features are assigned to a CASE affix; there will always be a default case realization". Thus, a nominal is licensed by the EPP or the Principle of Full Interpretation but not by the presence of abstract or morphological case.

In chapter 5 we provide an analysis of Russian verbs of existence, which show some exceptional properties with respect to the three constructions under discussion. We treat these properties as following from the deficient nature of the TP dominating these verbs and the fact that their complement is a Small Clause, rather than an NP.

2. The Extended Projection Principle in Russian

In the next few chapters we will be concerned with developing a precise characterization of the operation of the EPP in Russian syntax, using both word order and constructions in which the subject status of an argument has a clear morphological reflex as evidence for our analysis. We will attempt to differentiate the sentence-initial syntactic positions to which elements may move, describing the syntactic properties of these positions and the conditions that constrain movement into them. Our goal is to show that much order can be found in the chaos of a free word order language like Russian once the syntactic principles operating in it are factored out of the discourse-governed instances of movement. The notion of the EPP we will arrive at is the one that has been proposed in Branigan (1992). It is somewhat broader than the most narrow version typically assumed - as we will argue, both NPs and PPs are able to satisfy it - and it allows us to characterize several syntactic processes of Russian in a very natural fashion. Our view of the EPP will also have the result of predicting the distribution of the Locative Inversion constructions in Russian (and a number of other languages) in a straightforward, non-stipulative manner.

2.1 The Structure of a Russian Sentence

Any syntactic analysis of a free word order language is faced with the same question: how can one tell what the base-generated positions of elements are and what movement operations they have undergone, if no surface ordering of constituents is ruled out? A clear

and often quoted illustration of the problem is the fact that in a Russian transitive sentence, all of the possible permutations of subject, verb, and object are permitted (see (5)).

5 a. Vanja uvidel Petju
Vanya-nom saw-sg-masc Petya-acc
'Vanya saw Petya'
b. Petju uvidel Vanja
c. Vanja Petju uvidel
d. Petju Vanja uvidel
e. Uvidel Vanja Petju
f. Uvidel Petja Vanju

One step towards discovering the structure underlying this apparent freedom can be taken once it is noted that the interpretation of each sentence in (5) is different: the surface position of the constituents correlates with their interpretation as Topics or Foci. There exists a large body of literature investigating the question of how the word order of Russian reflects the discourse functions of the constituents (e.g. Isačenko (1976), Yokoyama (1986), Holloway King (1995), etc.) For our very limited purposes, it will suffice to say that Topics move to a sentence initial position (adjoining to TP or moving into the Spec of CP). Foci move either to the position immediately preceding the verb (adjoining to TP or VP, depending on the analysis of verb movement in Russian) or to the sentence-final position (right-adjoining to VP).[1] The different word order combinations of (5) are produced when one or both of the nominals undergo movement to the Topic or Focus positions.

But what can be done to discover the movement operations that "underlie" the structures produced by discourse function driven movement? If the basic premise of the

[1] This view is overly simplisitic and ignores many important distinctions among the types of Topics and Foci that are observed in Russian. However, since they are not the center of our inquiry, we will not attempt to do them justice here.

syntactic framework of Chomsky (1993, 1995) is correct, a number of relations largely independent of discourse (namely, the feature-checking relations) have to be established between elements in a sentence at some level of the derivation - if this does not happen, the derivation cannot converge. If Russian is constrained by UG, we expect its sentences to behave in this fashion as well.

Thus, another step we can take towards discovering the structure of Russian sentences would consist of identifying the environments where Topic and Focus movement cannot apply, or a set of elements to which it does not apply, and observing the structures that occur in these environments. Unfortunately (for our purposes), the only absolute restriction on the processes of Topic and Focus movement is that they are clause-bound (see (6a,b)).[2] Both processes can occur in embedded clauses (see (6c,d)). This fact has prompted some researchers to assume that Topic movement involves adjunction to TP, rather than movement to the Specifier of CP, although it is also possible that CPs are recursive or have multiple Specifiers in Russian.

6 a. What can you tell me about Petya?
*Petja mne kažetsja čto zabolel
Petya-nom me-dat seems that fell-ill-sg-masc
'It seems to me that Petya fell ill'

b. Who fell ill?
*Mne PETJA kažetsja čto zabolel
me-dat Petya-nom seems that fell-ill-sg-masc
'It seems to me that PETYA fell ill'

c. What can you tell me about this book?
Mne kažetsja čto etu knigu Vanja ne ljubit
me-dat seems that this book-acc Vanya-nom not loves-sg-masc
'It seems to me that Vanya does not like this book'

---

[2] There are also restrictions on moving constituents out of NPs and PPs, which are not relevant for our discussion.

d. Who likes this book?
Mne kažetsja čto etu knigu ljubit Vanja
me-dat seems that this book-acc love-sg-masc Vanya-nom
'It seems to me that VANYA likes this book'

In addition, discourse function driven movement can affect elements base-generated in any position. Thus, arguments and adjuncts of any type can be topicalized or focused (see (7)).

7.a. Etim molotkom Vanja zabival gvozdi
this hammer-instr Vanya-nom drove-in-sg-masc nails-acc
'With this hammer Vanya drove in nails'
b. Za vsju nedeju Vanja ne pobrilsja ni razu
during whole week Vanya-nom not shaved-sg-masc neg one time
'During the whole week Vanya didn't shave even once'
c. Vanja ZA TRI RUBLJA kupil etu knigu
Vanya-nom for three rubles bought-sg-masc this book-acc
'Vanya bought this book FOR THREE RUBLES'
d. Vanja S ENTUZIAZMOM pel pes'nju
Vanya-nom with enthusiasm sang-sg-masc song-acc
'Vanya sang a song WITH ENTHUSIASM'

Another possible approach might be to try to isolate a class of elements which are incompatible with the discourse function of Topic or Focus. To pursue this approach, we have to be somewhat more explicit about what Topics and Foci are. A Topic is what the sentence is about. As Prince (1984) put it, "TOP marks an entity as already being evoked or else in a salient set relation to something evoked". Thus, Topics have to be old information, that is, the referent of phrase moved to the Topic position has to be present in the universe of discourse at the time of the utterance. Because of this, it might be expected that some nominals - namely, indefinites, which introduce a new referent into the universe of the discourse - would not be appropriate as Topics. However, it turns out that no type of a referential or quantified nominal is precluded from acting as a Topic and surfacing in the Topic position. Consider the set of sentences in (8).

8 a. Knigu Vanja poterjal po doroge domoj
book-acc Vanya-nom lost on way home
'As for the book, Vanya lost it on the way home'
b. Vanju ja videla včera.
Vanya-acc I-nom saw-sg-fem yesterday
'As for Vanya, I saw him yesterday'
c .Ni odnogo malč'kia ja ne videla
neg single boy-gen I-nom not saw-sg-fem
'As for a single boy, I didn't' see him'

Because Determiners do not have to be phonologically realized in Russian, the vast majority of unmodified Russian nominals are ambiguous between the familiar or presuppositional reading, in which they have a referent already present in the universe of the discourse, and the non-familiar or non-presuppositional reading, in which they are introducing a referent new to the universe of the discourse. Not surprisingly, such nominals can act as Topics (8a), in which case they are interpreted as familiar. A few nominals have a morphological definiteness specification - these are proper names, pronouns, and nominals appearing with deictic Determiners. They can also be used as Topics (8b).[3] Finally, indefinite nominals, such as those appearing with overt "weak" Determiners[4], are capable of acting as Topics, as well (8c). This is not very surprising: indefinites are ambiguous cross-linguistically (c.f. Diesing (1992)) - on the familiar or presuppositional reading, which they have when they are Topicalized, they refer to a set already established in the universe of the discourse and act as

---

[3] Of course, the status of the proper name as an unambiguous definite nominal does place some restrictions on the contexts in which it can be used felicitously: the referent of the proper name has to be present in the universe of the discourse at the time of the utterance - if the speaker and the hearer do not know of a man named 'Vanya' (8a) will not be appropriate.

[4] Milsark (1974) identifies weak Determiners as those that can appear in the existential consturctions (i), and strong Determiners as those that cannot do so (ii).

(i) There is / are a / some / a few / many / three book(s) on the table.

(ii) *There is / are the / this / every /all / most book(s) on the table.

generalized quantifiers. On the non-familiar or existential reading, which is not available when these nominals are Topicalized, they introduce a new discourse referent and do not have quantificational force.

Let us turn to Foci. Here, we need to distinguish between new information Focus and contrastive Focus. The referent of the phrase acting as new information Focus has to constitute new information in the utterance context to which the sentence is added. The referent of the phrase acting as contrastive Focus is a member of a set pre-established in discourse. It picks out an entity for which the sentence is true, and establishes that the sentence is false of the remaining members of the set. It is easy to see that no type of nominal is precluded from acting as a Focus. Thus, all of the sentences in (9) can be felicitous.

9. a. Vanja knigu poterjal po doroge domoj
Vanya-nom book-acc lost on way home
'Vanya lost A BOOK on the way home (not a magazine)'
b. Ja videla včera Vanju
I-nom saw-sg-fem yesterday Vanya-acc
'I saw VANYA yesterday (not Petya)'
c. Ja ne videla včera ni odnogo mal'čika
I-nom not saw-sg-fem yesterday neg single boy-sg-gen
'I didn't see A SINGLE BOY yesterday (but I saw a few girls)'

An unmodified nominal can act as new information or contrastive Focus (9a). An unambiguously definite nominal, such as a proper name, is also capable of doing so (9b). While the referent of the nominal has to be present in the universe of the discourse, it can still act as new information in the context of the utterance. A morphologically indefinite nominal, such as 'not a single boy', is capable of acting as a new information Focus or a contrastive Focus, as well (9c).

The upshot of this discussion is that there is no morphologically defined class of arguments (corresponding to, for instance, the strong or the weak NPs) that fail to undergo Topic or Focus movement. For the purposes of this work, we can identify Topic with D-linking, and Focus with the absence of it (c.f. Pesetsky (1987)). A nominal may be D-linked by virtue of having a referent pre-established in the universe of the discourse, or by virtue of having a referent belonging to a set pre-established in the universe of the discourse. We can describe the data presented above by saying that D-linking has no morphological realization in Russian, so that any type of element may be D-linked or non D-linked.
In chapter 3 we will be concerned with describing environments that induce a Definiteness Effect. There, it is the familiarity of a nominal, rather than its discourse status as D-linked or non-D-linked, plays a role.

Let us return to the question we started with. How can we tell what syntactic processes occur in Russian sentences in addition to discourse driven movement? We can study sentences with "unmarked word order", where no Topic or Focus movement has taken place. Native speakers have reasonably clear judgements in this respect. Such sentences can occur discourse-initially and can act as answers to questions like "What happened?". In them, no commitment is made with respect to the discourse status of the elements in the sentence - they are "discourse neutral" in the terminology of King (1995). Thus, anticipating the discussion of the next section, we can say that the neutral word order of the transitive sentence in (5) is SVO, as in (5a). No other ordering of constituents is possible unless Focus or Topic movement has taken place.

Sentences with unmarked word order are the subject of this chapter. However, because discourse interpretation of elements is fragile evidence and in some situations the position of an element has implications for its discourse status, even if it has not been Topicalized or Focused, we will also be concerned with constructions in which the position of an element has more tangible morphological consequences.

2.2. Does the EPP Operate in Russian?

Pribežali v izbu deti, vtoropjax zovut otca.
Ran-pl into hut children-nom, in a rush call-pl father-acc
'Children ran into the hut, calling their father in a rush'
(Pushkin)
V lesu rodilas' eločka, v lesu ona rosla
In forest was-born-fem a fir-tree-fem, in forest she grew-fem
'In the forest was born a fir tree, in the forest it grew'
(New Year's song)

The requirement that all clauses must have subjects before Spellout, called the Extended Projection Principle, has been formulated in several different ways over the years. The latest definition, given in Chomsky (1995), is formulated in terms of a strong D-feature of Tense: Tense has a D-feature that must be checked and deleted before Spellout, so that some nominal element must undergo overt movement to the "subject position", namely the Specifier of TP, and check this feature for the derivation to converge. This is the principle responsible for the movement of the subject nominal from its base-generated position to the Specifier of TP in a typical English sentence, as illustrated in (10a). It is also the principle responsible for the appearance of expletives in English structures like (10b), where the movement of the subject does not take place (at least in overt syntax), but some element must still occupy the "subject position" for the sentence to be well-formed.

10 a. [A man]$_i$ appeared t_i in the room
b. There appeared a man in the room.

Importantly, the EPP is not formulated as a requirement that the subject must check its Case or phi-features before Spellout, or as a requirement that the element that heads the "EPP projection" (whether it is AgrS, T, or something else) check its Case or phi-features before Spellout, but , rather, as a requirement that the head of the EPP projection check its strong category feature[5].

Let us say a few words about what these features, responsible for the operation of the EPP, are meant to be within the framework of Chomsky (1995). On the side of the nominals raising to the EPP position, these are their categorial features that do not distinguish between DPs and NPs. Being +Interpretable, they do not delete once checked and can enter other checking relations. The EPP is completely divorced from Case, so that both a finite T and a non-finite T have strong D features that need to be checked by some nominal element. Two types of nominals can do so: a referential nominal, which checks both the categorial D-feature of T and the Case and phi-features of T, or an expletive. Expletives are assumed to be DPs that lack both Case and phi-features, but are capable of checking the strong D-feature of T and, thus, satisfying the EPP. In this construction, the associate of the expletive is forced to raise to T covertly to check its Case and phi-features. It is speculated that the associate is an NP and that the N feature of the associate adjoins to the D feature of the expletive (thus mirroring the normal D-NP structure). If D is assumed to be the locus of specificity, the

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[5] In fact, the first two options are assumed to be impossible in this system: "If F is strong, then F is a feature of a nonsubstantive category and F is checked by a categorial feature" (Chomsky 1995: 232)

general result that the elements that raise overtly to the subject position (or the object position) are definite may (but doesn't necessarily) follow.

Although the EPP has often been assumed to be a universal principle, there is nothing in the current syntactic system that can force any of the features to be strong universally. In fact, the strength of the features is assumed to be one of the major factors responsible for cross-linguistic variation. Thus, it is sensible to ask whether the EPP is operating in a given language. This is a particularly important question to address in any "free word order" language, like Russian. Here, it is difficult to tell whether a pre-verbal element is a Topic, a subject (or both); it is equally difficult to tell whether in the absence of a pre-verbal element the Topic and the subject position is empty or occupied by a phonologically null pro. Clearly, to isolate the effect of the EPP we need to study sentences in their "unmarked word order", where we have no reason to believe that either Topicalization or Focus movement has taken place and possibly obscured the underlying syntactic structure. The most theory-neutral question we could ask, then, is whether any element has to appear pre-verbally in grammatical Russian sentences with unmarked word order?

While the majority of theory-minded authors assume that the EPP is operating in Russian, although this fact may be obscured by the existence of phonologically null pro subjects, other views are possible. Thus, King (1995) produces the verb-initial sentences in (11) as evidence that the base word-order in Russian is VSO. Within her framework, this means that the verb undergoes obligatory movement to T, but its arguments do not move, unless they are topicalized or focused.

11. a. Zvonil telefon
rang-sg-masc phone-sg-masc-nom
'The phone rang'
b. Prislal muž den'gi
sent-sg-masc husband-sg-masc-nom money-pl-acc
'(My) husband has sent (me) money'
c. Posadil ded repku
planted-sg-masc old-man-sg-masc-nom turnip-sg-fem-acc
'An old man planted a turnip'

The author analyzes the sentences in (11) as representing the base word order because they can occur discourse-initially at a point where no topic of conversation has been established, so that the nominals in them are "discourse neutral", i.e. neither focused nor topicalized.

If this characterization of the facts is correct, the EPP cannot be operating in Russian. However, we find it somewhat inaccurate. First of all, all of the sentences in (11) are most natural under a "narrative inversion" interpretation. This construction, which has been discussed extensively for Germanic languages, is typically used in informal narratives, stories, jokes, etc. (it is not an accident that (11b) comes from an oral narrative and (11c) from a folk-tale). The construction has something of the flavor of the English 'he goes ..., I go ...' narratives. According to the analysis of Den Besten (1977, 1989), which has been developed for Dutch, this construction involves V movement to C, without accompanying XP preposing to the Specifier of CP. Zwart (1993) explains the absence of XP movement to this position by positing a phonologically null operator/topic in the Spec of CP (as a result, this construction cannot occur in embedded clauses). [6] This operator is interpreted contextually, and conveys the information that the actions described are contiguous.

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[6] Diesing (1990) analyzes this construction as having a null "then" in the Specifier of CP.

This is exactly the flavor of the verb-initial sentences in (11): a story, a joke, or a folk-tale typically begins (and continues) with such sentences, as the examples in (12) demonstrate.

12 a. Prixodit Vovočka domoj i ...
Come-3rd-sg Vovochka-sg-masc-nom home and
'Vovochka comes home and...'
(The beginning of a Vovochka joke)

b. Stal on xodit' okolo jabloni, daže prisest' boitsja, kaby ne zasnut'. Karaulit čas,
started he walk-inf around apple-tree, even sit-down-inf fears, in-order not
fall-asleep, guards hour.
karaulit drugoj i tretij... Prošla polovina noči. ... Pozval on ix k sebe i skazal...
guards another and third... Passed half night... Called he them to self and said...
'He began to walk around the apple tree, afraid even to sit down, so as not to fall asleep. He stands on guard for one hour, and for another hour, and a third one. Half a night passes. ... He calls them and says...'
(žar ptica)

c. Sidit ona po-prežnemu, kak ni v čem ni byvalo, da smotrit v okošečko
Sits she as before, as if nothing happened, and looks in window
kak narod iz cerkvi rasxoditsja. Prišli i sestry domoj.
how people from church disperse. Came sisters home
'She is sitting just as before, as if nothing happened, and watching out of the window the people go home from church. Then her sisters come home.'
(Peryško Finista Jasna Sokola)

d.#Ja znaju čto prislal muž den'gi
I know that sent husband money

Thus, the contexts in which narrative inversion sentences can occur are very restricted and the interpretation of such sentences is highly idiosyncratic. If the construction involves a specific syntactic process, such as the occurrence of a phonologically null operator/topic, then its special interpretation is expected. However, if it represents the base word order, the occurrence restrictions and the special interpretation are quite mysterious. Another point that should be noted here is that while narrative inversion sentences can occur in discourse initial

positions (to the extent that they can occur in narratives, and the first sentence of a narrative is discourse-initial), they can also occur in non-discourse initial positions (to the extent that they can occur at any point in a narrative). Particularly informative is the relative unacceptability of such constructions in embedded contexts (see (12d)). Once again, this pattern is expected if the verb moves to C in narrative inversion constructions, but it lacks an explanation if the sentences represent the base word order.[7]

We take the discussion above to be sufficient to demonstrate that at least a portion of the verb-initial Russian sentences contain verb movement to C and, as a result, cannot tell us anything about the underlying position of arguments in a clause. In particular, they tell us nothing about whether the EPP is operative in Russian or not. The obvious question to ask at this point is whether the narrative inversion constructions exhaust the class of verb-initial Russian sentences, or, to put it somewhat differently, is a non-narrative interpretation possible for the sentences in (11).

The answer to this question turns out to be very enlightening. Whether a non-narrative interpretation is available to a verb-initial sentence or not depends on the type of the verb contained in it: for transitive verbs, as in (11b,c), no other interpretation is available. For intransitive verbs, the situation is more complex. The sentence (11a), which King quotes as an example of an unmarked word order with an initial verb is, in fact, just that. However, much more needs to be said for this description to become completely accurate. Consider the set of examples in (13):

13 What's happening?
a. zvonit telefon (u menja kvartire)

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[7] The judgement in (12d) corresponds only to the narrative interpretation of the sentence - (12d) is acceptable if the direct object is focused and stressed.

rings phone (in my apartment)
b.?zvonit zvonar' (v kolokol) / zvonar' zvonit (v kolokol).
rings bell-ringer (the bell) / bell-ringer rings (the bell)
c. Svistit čajnik (u menja v kvartire)
Whistles kettle (in my apartment)
d ? Svistit Vanja (sebe pod nos) /Vanja svistit (sebe pod nos)
Whistles Vanya (to himself) / Vanya whistles (to himself)

The acceptability of intransitive verb-initial sentences under a non-narrative interpretation depends on their argument structure. Although judgements are of necessity subtle (all of the sentences in (13) are perfectly acceptable if the post-verbal nominal is focused), only sentences containing unaccusative verbs are felicitous with verb-initial word order and neutral intonation (13a,c). Sentences containing unergative verbs are degraded in this pattern (13b,d).

An additional pattern emerges from the acceptable sentences in (13): when the subject is post-verbal, a specific location of the event described by the predicate is presupposed. Consider the sentences in (14), where the subjects of unaccusative verbs occur both pre-verbally and post-verbally. There is a subtle difference in meaning between the two versions: in (14a), where the nominal appears post-verbally, the guests must be interpreted as dropping by the speaker's apartment. In (14b), the guests came in to some unspecified location.

14 a. Zašli gosti
Came-in guests
'Guests dropped by (my place)'
b. Gosti zašli
Guests came-in
'The guests came in'
c. ??Rastut rozy (v sadu)
grow roses (in garden)

'There are roses growing (in the garden)'

d. Rozy rastut ??(v sadu)
roses grow (in garden)
'Roses are growing (in the garden)'

There seems to be a phonologically null locative/goal argument present in the inverted structure, one that is interpreted definitely and deictically. Note that the interpretation of this argument is that of the PP the verb subcategorizes for (Goal in (14a,b)). This element is not there in the sentences where the subject is occupying the preverbal position. Importantly, the subjects of unaccusative verbs that do not allow their PP argument to be phonologically null, such as the verb *rasti* - 'to grow' - in (14d), do not occur post-verbally under a discourse-neutral interpretation (14c).

The sentences in (14a,c) demonstrate that a verb can occur sentence-initially only if a pro PP argument is present in the sentence. They do not in themselves tell us whether the phonologically unrealized PP is occupying the pre-verbal or the post-verbal position. However, the pattern has a very natural explanation, if we assume that some element must always occupy the pre-verbal (subject) position, so that when the overt nominals fail to do so, a phonologically null pro element must assume this function. Thus, the sentences with post-verbal subjects correspond to English Locative Inversion constructions with a phonologically null PP occupying the subject position.

The pattern described above has been observed in Italian. According to the description of Benincà (1988), subject inversion is possible in Italian only for those verbs that select a PP complement (see (15)): if a verb does not select a locative argument, it cannot occur in an inversion construction.

15 a. e arrivato Gigi/un bambino
is arrived Gigi/a child
b. ha telefonato Gigi/un bambino
has called Gigi/a child
c. *ha riso Gigi/un bambino
has laughed Gigi/ a child
d. *ha rubato la bisutecca il/un gatto
has stolen the steak the/a cat

Moreover, the acceptable "inverted" sentences like those in (15a,b), have an interpretation different from their non-inverted counterparts (15a,b), just as their Russian translations in (14) do: in the inverted sentences the goal of the action is specified (as a deictic location), in the non-inverted sentences the goal of the action is left completely unspecified. Thus, the meaning of (15a) is that Gigi arrived somewhere, in contrast to (15a), the meaning of which is that he arrived at the speaker's place. Similarly, the meaning of (15b) is that Gigi telephoned somewhere, or simply made some phone calls, but the meaning of (15b) can only be that he called the speaker's place.

Note that the appearance of an implied location argument in unaccusative sentences with post-verbal subjects cannot be explained if the verb-inital sentences are taken to represent the base word-order. On the other hand, if we assume that Russian sentences are only well-formed if some element (an NP or a PP) occupies the pre-verbal position, the patterns fall into place. Moreover, the differences in the acceptability of post-verbal subjects of unaccusative and transitive/unergative verbs cannot be explained if these nominals are occupying their base positions. At this point, we have not offered an explanation of this pattern either, but anticipating the discussion of chapter 3, we can say that a very natural analysis of this distinction can be provided, if we assume that the EPP operates in Russian.

To sum up, the cases where the verb appears as the first element in a sentence fall into two easily characterized classes: 1) sentences of any type in which narrative inversion has taken place; 2) sentences where a phonologically null PP argument of the verb with a deictic interpretation is occupying the pre-verbal position. Note that if we take this to be the result of the operation of the EPP in Russian, we have to admit arguments expressing locations and goals to the class of categories that may satisfy this requirement. In the next section, we take up this issue as well as the question of what position the sentence-initial elements are occupying.

2.3 What Categories Can Satisfy the EPP?

U nas s soboj bylo
at us-gen with self was-sg-neut
'We had something to drink with us'
(Rajkin)

To answer the questions raised above we have to examine sentences that contain slightly more phonologically realized material than those of the previous section. In particular, we turn to intransitive sentences that contain both an overt nominal argument and an overt PP argument of the verb.

As in the preceding discussion, we have to be careful to limit our attention to sentences with the unmarked word order, i.e. those not containing focused or topicalized elements. It is obvious that in Russian sentences with unmarked word order a nominal may occupy the pre-verbal position, as (16) illustrates:

16 a. Vanya prišel domoj
Vanya-nom came-sg-masc home
'Vanya came home'

b. Mal'čik nasvistyval s uvlečeniem
boy-nom whistled-sg-masc with enthusiasm
'A boy was whistling with enthusiasm'
c. Devočka rabotala na fabrike
girl-nom worked-sg-fem at factory
'A girl was working at a factory'
d. Deti sobirali griby v lesu
children-nom collected-pl mushrooms-acc in forest
'Children were collecting mushrooms in the forest'

It is usually assumed without discussion that these pre-verbal nominals occupy the "subject position", and with good reason - a nominative pre-verbal nominal is a canonical subject. All the nominals in (16) pass the standard tests of subjecthood: they can act as antecedents of reflexives (17a) and of verbal adverbs (traditionally called gerunds in Slavic literature) (17b), they can be replaced by PRO (17c), they can occur as dative subjects of infinitives (17d), they can undergo raising (17e), and they trigger the that-trace effect (17f).

17 a. Vanya$_i$ privel Svetu$_j$ k sebe$_{i/*j}$ domoj
Vanya-nom brought-sg-masc Sveta-acc to self's home
'Vanya brought Sveta to his house'
b. Vanja$_i$ privel Svetu$_j$ domoj, tak i PRO$_{i/*j}$ ne rešiv čto skazat' sem'e.
Vanya brought Sveta home, without deciding what to say to his family
c. Vanja$_i$ staralsja [PRO$_i$ pridti domoj vo-vremja]
Vanya tried to come home on time
d. Segodnja Vane ne pridti domoj vo-vremja
Today Vanya-dat not come-inf home on time
'It's not meant for Vanya to come home on time today'
e. Vanja prodolžal prixodit' domoj ne vo-vremja
Vanya continued to come home not on time
f. *čelovek, kotoryj$_i$ ty xočeš' čtoby t$_j$ prixodil domoj vovremja
man, who you want that-subjunctive t came home on time
'the man who you want to come home on time'

However, the sentences in (18), where a PP occurs pre-verbally do not appear to be any more "marked" in terms of their word order than the sentences in (16). Here, the nominal

argument occurs post-verbally, but does not have a focused interpretation typical of phrases adjoined to the VP.

18 a. V lesu razdavalsja topor drovoseka
in forest sounded-sg-masc axe-nom-masc wood-cutter-gen
'In the forest sounded the axe of a wood-cutter'
b. U menja zazvonil telefon.
at I-gen rang-sg-masc phone-nom-masc
'The phone rang at my place'
c. U slona byla žena, Matrena Ivanovna.
at elephant-gen was-sg-fem wife-fem-nom, Matrena Ivanovna-nom
'The elephant had a wife, Matrena Ivanovna'

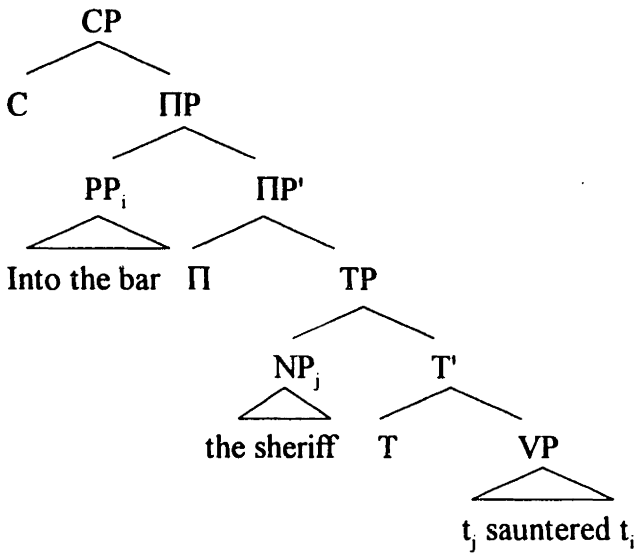
Of course, structures in which PPs occupy the subject position are well-attested cross-linguistically (e.g. Bresnan and Kanerva (1989), Bresnan (1993), etc.). Before we can decide whether this is the correct description for the sentences in (18), we have to make our notion of the "subject position" more precise. A well-articulated analysis compatible with the Russian facts has been developed in Branigan (1992). It is well-known (e.g., Bresnan (1993)) that in the English Locative Inversion constructions, illustrated in (19a-c), the pre-verbal PPs exhibit a number of subject properties: they trigger the that-trace effect (19d), undergo raising (19e), and allow "subject ellipses" to take place (19f). On the other hand, the post-verbal subject also has some typical subject properties: it triggers agreement (19a) and is able to surface with nominative case (19c).

19 a. Every Thursday, into the saloon wander/*wanders three drunken stevadores.
b. In the distance was heard a plaintive howling.
c. Into the bar strolled ?he/*him
d. Into which bar did you say (*that) t sauntered the sheriff?
(Branigan 1992: 78,79)
e. Into the meadow seemed to stroll the basselope.

f. Into the meadow [strolled Rosebud] and [ran Milo]
(Harley, 1995)

Branigan argues that this situation is explained by the fact that there are two possible landing sites for pre-verbal elements in English: the EPP position, which corresponds to the Specifier of the ΠP projection immediately dominating the TP projection, and the Case and agreement checking position, which corresponds to the Specifier of the TP projection. When a PP appears in the preverbal position, as it does in (19), the LF position of the PP and NP arguments is as shown in (20)[8].

20



The PP is occupying the position of the Spec of ΠP at Spellout and the "subject" NP raises to the TP position at LF, checking it Case and phi-features.

The original motivation for Branigan's proposal came from the worry that if both subjects and objects occupied the Specifier of AgrP positions (i.e. A-positions) at LF, they should be expected to behave identically with respect to extraction. Yet, subjects differ from

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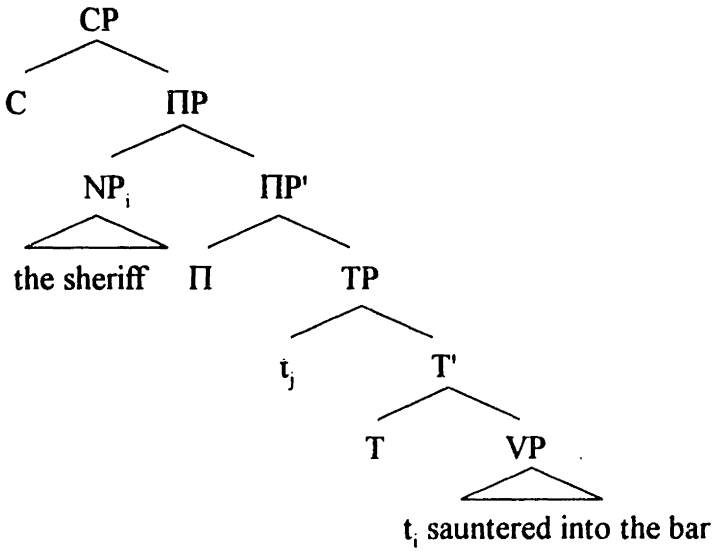
[8] We have translated Branigan's trees into our "Agr-less" framework.

objects in displaying the that-trace effect and producing ungrammaticality when extracted from within islands. For Branigan, these are properties typical of A-bar-positions, which surface because the position that the elements satisfying the EPP occupy (namely, the Specifier of ΠP) is an A-bar position. In the sentences where the nominative subjects appear pre-verbally, they pass through the Spec of TP (where they check their categorial, Case, and phi-features and trigger verbal agreement) and then move onto the Spec of ΠP position. The LF position of the PP and the NP arguments in a subject-initial sentence is illustrated in (21).

21.



Within this analysis, the fronted PP in the Locative Inversion constructions displays "subject properties" to the extent that they characterize the elements occurring in the ΠP projection, and it does not display "subject properties" to the extend that they characterize the elements that have passed through the Spec of TP. Thus, a fronted PP undergoes raising (19e), triggers the that-trace effect (19d), and can be extracted Across-The-Board (19f). However, it does not trigger agreement on the verb or check T's nominative tense (19a,c). It

is an important part of this analysis that the Specifier of the EPP projection is an A-bar position - it is not L-related - while the Specifier of the AgrSP position is an A position - it is L-related.

We will adopt Branigan's approach to the EPP. Note that within a syntactic framework where multiple Specifiers are permitted (e.g. Ura (1994). Koizumi (1995), Chomsky (1995)), the Specifier of the EPP projection may be represented as the outer Spec of TP, understood to be an A-bar, i.e. non L-related, position. Then, the preposed PPs would be seen as occupying the same position as expletives do in Multiple Subject Constructions within Chomsky (1995). If Branigan's idea that NP elements satisfying the EPP occupy the same position as the PP elements is followed strictly, then the preposed NPs would be seen as occupying the outer Spec of TP at Spellout, as well. However, viewing the EPP position as a Spec of TP raises another question: why should we assume that the EPP involves the outer Spec, rather than the inner one? Here, it is rather tempting to explore the similarity between Branigan's analysis and an idea proposed by Diesing (1990), who argues that the Spec of IP in Yiddish is an A-position, when occupied by a subject, and an A-bar-position when occupied by a non-subject (i.e. a topicalized element). Branigan's approach differs from this one in not being concerned with the process of topicalization - the EPP has to be satisfied by an element in the Spec of IP in all sentences, regardless of whether they contain a topicalized element or not. However, the two approaches are in principle compatible. Viewing the EPP position as a dual status position, which can be either A or A-bar, depending on the category of the element that occupies it is and the features that are checked there, is attractive in

Russian, where the two positions - that where the EPP is satisfied and that where Case and agreement features are checked - are never filled simultaneously.

Branigan argues against this analysis on the grounds that the EPP position is always A-bar, not only when it is occupied by a PP or an Operator subject. If the EPP position and the Case-checking position are the same, then the canonical nominal subject occupying it is expected not to show A-bar properties, contrary to fact. Because Branigan's work predates the advent of syntactic frameworks that utilize multiple Specifiers, he does not consider the possibility of treating the EPP position as the second Specifier of the Case-checking projection, rather than as a Specifier of a separate projection. Actually, the two approaches do not seem to have any distinguishable empirical consequences: according to Ura (1994), the existence of multiple A-position Specifiers in a language licenses both multiple subjects and super-raising constructions. However, even if the EPP position is seen as the outer Specifier of TP, these two phenomena are not expected to surface, because the EPP position as A-bar, not A. Similarly, while multiple Specifiers can act as "escape hatches" for A-bar movement in some languages (Koizumi (1995)), the EPP position is not expected to allow any additional A-bar movement, given that is obligatorily filled by Spellout. Positing an A-bar position below the CP projection does have empirical consequences - A-bar movement out of a clause now crosses a potential landing site, the EPP position - but these consequences come up within both analyses.[9] Branigan's original analysis, represented in (20) and (21) will be

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[9] Whether this means that A-bar movement out of a clause with a subject is expected to violate the MLC and be ungrammatical as a result of this, or not, depends on the position to which the element is moving, the position of the EPP element and the definition of the Minimal domain. If movement is to the Spec of CP and the EPP position is the Spec of ΠP, A-bar movement violates the MLC and is expected to be impossible. This is not necessarily an undesirable prediction - A-bar movement does not take place out of embedded tensed clauses in Russian. However, this prediction may be avoided if the EPP position is the outer

adopted here, but the other alternatives are also compatible with the data we will be concerned with.

Let us see how the pre-verbal PPs in Russian sentences behave with respect to the tests for subjecthood that might be expected to single out the elements occupying the Specifier of ΠP position.

First of all, they undergo raising, which has been argued to be possible only for elements that occupy the Specifier of the ΠP projection (the EPP position).
This is demonstrated in (22a,b). It is important to note that the interpretation of the post-verbal nominals in this sentence is not focused or contrasted (corresponding to the interpretation of a nominal that has right-adjoined to the VP) - these sentences have the discourse-neutral interpretation. The interpretation of these sentences contrasts with that of (22c,d), where an adjunct PP appears pre-verbally: in these sentences, the post-verbal nominal must bear contrastive stress (and, presumably, be adjoined to the VP).

22 a. V Vaninoj kvartire žili ego rodstveniki
in Vanya-poss apartment lived-pl his relatives-nom
'In Vanya's apartment lived his relatives'
b. V Vaninoj kvartire prodolžali žit' ego rodstveniki
in Vanya-poss apartment continued-pl live-inf his relatives-nom
'In Vanya's apartment continued to live his relatives'
c. #Sebe pod nos napeval Petja
self under nose sang-sg-masc Petya-nom
'To himself sang Petya'
d. #Sebe pod nos prodolžal napevat' Petja
self under nose continued-sg-masc sing-inf Petya-nom
'To himself continued to sing Petya'

Spec of TP and the definition of a minimal domain is such that both the Spec of CP and the outer Spec of TP are in the minimal domain of the same head - C.

In addition, the pre-verbal PPs trigger the that-trace effect, as (23) shows. The that-trace effect in Russian cannot be demonstrated exactly as in English, because complementizers are obligatory in Russian. However, it is possible to contrast the unacceptable sentences containing an overt complementizer and extraction from the EPP position with the more acceptable sentences containing an overt complementizer and extraction from the object position. Note that extraction out of a tensed clause is always somewhat marginal in Russian, so that all of the sentences in (23) are imperfect.[10]

23 a.*komnata, v kotoroj ty xočeš' čtoby t stojal stol
room in which you want that-subjunctive t stood table
'A room in which you want the table to stand'
b. *Stol, kotoryj ty xočeš' čtoby t stojal v komnate
table which you want that-subjunctive t stood in room
'A table which you want to stand in the room'
c. ?devočka, kotoruju ty xočeš' čtoby ja priglasil t
girl who you want that-subjunctive I invited t
'A girl who you want me to invite'
d. ?? stol kotoryj ty xočeš' čtoby v komnate stojal t
table which you want that-subjunctive in room stood t
'A table which you want to stand in the room'

Both a preverbal PP and a preverbal NP trigger the that-trace effect (23a,b), but a postverbal NP does not (23c), similarly to a direct object (23d).

The evidence we have presented so far demonstrates that the pre-verbal PPs occur in the "subject position", occupied by the nominative pre-verbal NP in the non-inverted sentences. Now let us turn to the evidence that demonstrates that there exist two distinct positions (corresponding to the Spec's of ΠP and TP in (20) and (21)), that is, that the

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[10] Because extraction out of subjunctive clauses is relatively acceptable, we use subjunctives in all our examples.

projection we have been calling "the ΠP projection" is not identical to the L-related position in which nominative case is checked for pre-verbal nominals.

We are concerned with showing that although the preverbal PPs and NPs end up in the same position, the pre-verbal NP passes through TP, but the preverbal PP does not.[11] Of course, one type of evidence for this view is the agreement displayed by the verb in both "inverted" and "non-inverted" sentences (see (25a,b)). The verb agrees with the nominal in both types of sentences and cannot surface with a default 3rd person neuter agreement when a PP is pre-verbal (25c), just as it cannot do so when an NP is pre-verbal (25d).

25 a. U Vani doma žili ego roditeli.
at Vanya-poss home lived-pl his parents-nom
'In Vanya's house lived his parents'
b. Vaniny roditeli žili u nego doma
Vanya-poss parents-nom lived-pl at his home
'Vanya's parents lived in his house'
c. *U Vani doma žilo ego roditeli.
at Vanya-poss home lived-sg-neut his parents-nom
'In Vanya's house lived his parents'
d. *Vaniny roditeli žilo u nego doma.
Vanya-poss parents-nom lived-sg-neut at his home
'Vanya's parents lived in his house'

This is also the agreement pattern observed in English Locative Inversion sentences. Within any version of the Minimalist Syntactic Framework, Case assignment and Agreement are a reflex of a (nominal) element checking its features against those of an appropriate functional head in a Spec-Head structural relationship. Thus, the fact that the nominal in (25a,b) is

[11] In this discussion we are disregarding the possibility that the EPP position can have A-position properties when occupied by an NP and A-bar position properties when occup[ied by a PP.

nominative and triggers agreement means that it occupies the Spec of TP at some point in the derivation. Moreover, the presence of a PP in the "subject" position does not interfere with the ability of the nominal to land in the Spec of TP and trigger agreement. Presumably, this means that the PP is not occupying the Spec of TP, but a Specifier of some higher projection.

However, this is not a strong argument: the PP could be located in the Spec of TP, where it checks the T's EPP feature (but not any of its other features), and the nominal could be adjoined to T at LF, where it checks the Case and phi-features of this element. Thus, to be more convincing we should look for an argument that does not depend on agreement facts.

Binding Theory provides the necessary evidence, demonstrating that pre-verbal PPs, but not pre-verbal NPs, undergo reconstruction at LF. This means that the PPs are occupying an A-bar position (namely, the Specifier of the ΠP projection), and consequently behave as if they were located in their base-generated VP-internal position for the purposes of the Binding Theory. The NPs are occupying an A-position (namely, the Spec of TP) at some point in the derivation and thus do not reconstruct to their original VP-internal position and are able to c-command the material inside the VP. Consider the set of sentences in (26).

26 a. Vanja$_i$ ljubit *ego$_i$ /*ego$_i$ sem'ju / svoju$_i$ semju.
Vanya-nom love-3rd-sg him-acc / his family-acc / self's family-acc
'Vanya loves him / his family'
b. Vaniny$_i$ roditeli ljubjat ego$_i$
Vanya's parents-nom love-3rd-pl him-acc
'Vanya's parents love him'
c.*V Vaninom$_i$ dome živet on$_i$.
In Vanya's house live-3rd-sg he-nom
'In Vanya's house lives he'
d. V Vaninom$_i$ dome živut ego$_i$ roditeli
In Vanya's house live-pl his parents-nom
'In Vanya's house live his parents'

As (26a) shows, canonical subjects can bind pronouns that occupy the direct object (or more neutrally, a VP-internal) position, creating a Principle B violation. Moreover, if a VP-internal NP contains a pronominal possessive, the subject is also capable of binding it, so that the resulting binding configuration is a Principle B violation as well (26a). When the possessive within the direct object NP is a reflexive element, it can be bound by the subject in accordance with Principle A, and the resulting configuration is grammatical (26a). Thus, NPs are not governing categories in Russian. Another point that is important here is that a possessive element does not c-command out of the NP containing it. For instance, in (26b) the possessive element *Vaniny* is contained in the subject NP, but does not bind the direct object *ego*, as witnessed by the grammaticality of the sentence.

Now, let us turn to sentences that contain PPs in the "subject position". (26c) contains an antecedent within the pre-verbal PP and a post-verbal nominative pronoun; the sentence is ungrammatical. This ungrammaticality cannot be due to a Principle B violation, caused by the antecedent *Vaninom* binding the VP-internal pronoun *on*: as the example (26b) has established, the possessive nominal does not c-command out of the NP containing it. The sentence must be ungrammatical because the PP is occupying an A-bar position at Spellout, so that it has to undergo reconstruction at LF. As a result, the VP-internal pronoun is able to bind the r-expression *Vaninom*, creating a Principle C violation. Note that the ungrammaticality of (26c) shows not only that the pre-verbal PP does not have to move through the Spec of TP but also that it cannot do so: if it were possible for the PP to move through this A-position it would not undergo LF reconstruction obligatorily, and (26c) would

be grammatical. The sentence in (26d), where the pronoun 'he' is replaced by 'his parents', is grammatical, as expected: the pronominal element cannot c-command out of the NP, so that it cannot bind the material inside the PP even after LF reconstruction has occurred.

Note that giving the EPP position A-bar status, so that the element occupying it has to undergo reconstruction at LF does not create any problems as far as canonical nominal subjects are concerned. Of course, these elements are able to c-command and bind VP-internal material (27a,b). But this is the expected pattern: while the Spellout position of the nominal subjects is the same as the position of PP subjects (namely, the Specifier of the ΠP projection), the nominal subjects have passed through an A-position (the Spec of TP), and this is the position into which they are reconstructed at LF. From the position within the TP, they are able to c-command and bind the VP-internal material.

27 a.*Vanja$_i$ živet v ego$_i$ dome
Vanya-nom live-3rd-sg in his house
'Vanya lives in his house'
b. Vanja$_i$ živet v svoem$_i$ dome.
Vanya-nom live-3rd-sg in self's house

The discussion above has established that pre-verbal nominals, but not pre-verbal PPs, pass through an A-position (Spec of TP) on the way to their final landing site (Spec of ΠP), which is an A-bar position. It remains for us to show that the post-verbal NP in inversion constructions does raise to the Spec of TP position at some point in the derivation. We expect the elements occupying this A-position at LF to show such properties as the ability to control gerunds and act as an antecedent of reflexives. (28a) shows that post-verbal subject

NPs can control a gerund, in contrast to direct objects (28b). Similarly, post-verbal NPs can act as antecedents of reflexives (28c), in contrast to direct objects (28d).

28 a. Prixramyvaja na odnu nogu, v komnatu vošla Sveta.
PRO$_i$ limping on one foot, into the room came Sveta$_i$
b. *Prixramyvaja na odnu nogu, ja uvidel Svetu
PRO$_i$ limping on one foot, I saw Sveta$_i$
c. Vsled za svoimi druzjami v komnatu vošla Sveta
After self's$_i$ friends into the room came Sveta$_i$
d. *Vsled za svoimi druzjami ja poslal Svetu
After self's$_i$ friends I sent Sveta$_i$

We can conclude that although the post-verbal NP subject remains VP-internal at Spellout, it occupies the Spec of TP position at LF.

Based on the evidence we have presented here, the analysis of the English Locative Inversion constructions developed in Branigan (1992) appears to be entirely appropriate for Russian. In the next section, we investigate the question of which elements may satisfy the EPP and how moving to the EPP position affects their interpretation.

2.4 The Interpretation of the EPP Element

V ogorode buzina, a v Kieve djad'ka
In vegetable-garden weed, and in Kiev a man
'You are violating the Gricean maxim of Relevance'
(proverb)

In section 2.1 we have shown that the elements that undergo Topic movement correspond to old information and are D-linked, and elements that undergo Focus movement correspond to new information and are non D-linked. We have also shown that grammatically indefinite

elements can act be interpreted as D-linked (presumably, when they are identifying some member of a set pre-established in the universe of the discourse) and that grammatically definite elements can be interpreted as non D-linked (presumably, when their referent is present in the universe of the discourse, but is new with respect to the present topic of conversation). We have also hinted at the fact that in some situations the position of a non-topicalized or a non-focused element can have interpretive consequences. Now, we would like to give a more precise characterization of the environments where this occurs.

Given everything we have said so far, the elements that occur in discourse-neutral sentences should be free to be either D-linked or non D-linked. The word order has made no special commitment to their discourse status, so both options should be possible. In particular, the element occupying the EPP position should be free to be D-linked or non-D-linked. This is certainly true of the subjects of transitive verbs and the subjects of unergative verbs, as (29a,b) show.[12]

29 a. Mal'čiki draznjat sobak
boy-pl-nom tease-pl dog-pl-acc
'Boys tease dogs'. 'There are some boys teasing dogs'
b. Mal'čiki kurjat (v rukav)
boy-pl-nom smoke-pl (into sleeve)
'Boys smoke (into their sleeves)', 'There are some boys smoking (into their sleeves)'

This optionality disappears once we consider sentences containing unaccusative verbs, whose subjects can occur in the post-verbal position when the pre-verbal position is occupied by a PP. Of course, this is hardly a new observation: it is often acknowledged in the literature that

[12] Note that for our purposes here, the existential reading of bare plurals is a non-familiar, non-D-linked interpretation, while the generic reading (like the generalised quantifier readings of indefinites) is a familiar, presuppositional, and D-linked interpretation.

Locative Inversion constructions have a special interpretation - they are presentational and the post-verbal NP must correspond to new information (e.g. Bresnan (1994), Levin and Rappaport (1995)). Similar observations have been made with respect to the "inverted" sentences in Russian (e.g. Babby (1980)). While this description is certainly true, at present we are concerned with a slightly different perspective on the same phenomenon.

Let us ask the question of what the interpretation of a non-nominal element satisfying the EPP is. Consider the set of English sentences in (30). These Locative Inversion sentences are perfect only if the preposed PP is definite; the (in)definiteness of the VP-internal nominal argument does not affect their acceptability (30a,b). Moreover, the fact that the construction improves when a number of modifiers are added to the pre-verbal indefinite PP (30c) suggests that the factor relevant to the acceptability of the construction is not precisely definiteness.[13]

30 a. Into the saloon walked the sheriff / John /a new customer
b. ??Into a saloon walked the sheriff /John /a new customer.
c. ?Into a bright, sunny, freshly-painted saloon walked the sheriff.

A similar pattern can be observed in Italian, according to the description of the subject inversion phenomenon provided by Pinto (1992). Recall that with unaccusative verbs and a subclass of unergative verbs, subjects are able to occupy the VP-internal position if a deictic locative pro is present in the sentence (31a,b). With another subclass of unergative verbs that subcategorize for a locative PP argument, the inversion construction is possible

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[13] I am grateful to David Pesetsky for pointing out this contrast to me.

only if the PP is phonologically realized (31c). In addition, the PP has to be preverbal (31d) and it must carry a morphological realization of its definiteness (31e).

31 a. e arrivato Gigi
is arrived Gigi
b. ha telefonato Gigi
has telephoned Gigi
c.*hanno lavorato molte donne straniere / Rita e Anna
have worked many foreign women / Rita and Anna
d.*hanno lavorato molte donne straniere / Rita e Anna in questo albergo
have worked many foreign women / Rita and Anna in this hotel
e. in *(questo) albergo hanno lavorato molte donne straniere / Rita e Anna
in this hotel have worked many foreign women / Rita and Anna

Russian Locative Inversion sentences also place restrictions on the type of Prepositional Phrases that satisfy the EPP, although it is more difficult to demonstrate their existence because Russian Determiners do not have to be phonologically realized and definiteness has no morphological reflex. However, several patterns are very suggestive. For instance, as we have mentioned in section 2.2, when a nominal appears post-verbally in a sentence with unmarked word order, a definite deictic locative argument is implied (32a,b). We interpret this fact as showing that a phonologically null locative pro is occupying the EPP position, and that it must be definite. Similarly, when the pre-verbal PP is phonologically realized, it must be interpreted as definite (32c,d).

32 a. Zazvonil telefon
rang-sg-masc phone-sg-masc-nom
'The phone rang (at my place)'
b. Prisel Petja
came-sg-masc Petya-nom
'Petya came (to my place)'
c. V lesu vodilis' volki
in forest lived-pl wolves-nom

'In the forest lived wolves'
d. Volki vodilis' v lesu
Wolves-nom lived-pl in forest
'Wolves lived in forests / in the forest'

The pattern we are describing is quite general and not restricted to PPs that occupy the EPP position: as a first approximation, we can say that all "non-cannonical" subjects must be definite. The restriction is not based on the category of the EPP element. Thus, nominal predicates can act as subjects in both English and Russian, but when they do so, they must be definite (33a-d). However, as we have already seen once before (see (30c)), some notion slightly different from definiteness is relevant here: thus, (30e), where an indefinite NP predicate accompanied by restricted modifiers is satisfying the EPP is relatively acceptable.[14]

33 a. John is the biggest fool on earth / a fool
b. The biggest fool on earth / *a fool is John
c. Vanja byl samym glupym v klasse / durakom
Vanya-nom was-sg-masc most foolish-masc-instr in class/ fool-instr-masc
'Vanya was the most foolish (one) in class / a fool'
d. Samym glupym v klasse / *durakom byl Vanja[15]
most foolish-masc-instr in class / fool-masc-instr was Vanya-nom
'The most foolish (one) in class / *a fool was Vanya'
e. ?A fool in the court of Ivan the Terrible was Vanya.

The relevant notion has more to do with D-linking than grammatical definiteness. If we consider the adjectives that can occupy the subject position in English, we observe the following contrasts:

34 a. Especially long was the third problem set.
b. Longer still was the third problem set.

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[14] Essentially, (33e) is saying that Vanya was one of the members of the relevant set (that of the fools in the court of Ivan the Terrible).

[15] The sentence is acceptable if the subject is focused.

c. Longest was the third problem set.
d *Long was the third problem set.
e. *Very long was the third problem set.

With comparatives in (34a-c) which pick out a member of a set pre-established in the universe of the discourse and are thus D-linked, the construction is acceptable. With non-comparative adjectives, the construction degrades (34d,e). Thus, the following pattern is emerging: grammatically definite arguments can always be interpreted as D-linked and, as a consequence, they are always acceptable in the subject position. On the other had, grammatically indefinite arguments can be interpreted as D-linked only when they can be seen as referring to some member of a pre-established set. When this strategy works, the indefinite arguments are acceptable in the subject position, as well. When it does not, they are not acceptable in the subject position.

To sum up, we have seen that "non-canonical subjects", i.e. elements other than the nominative nominal that occupy the EPP position, must be D-linked. One way of looking at the pattern is that in order to become "nominal-like" enough to move to the EPP position, non-nominals have to be definite. This description is reminiscent of the Locative Inversion construction in Bantu languages, like Chichewa (Bresnan & Kanerva, 1989), where prepositional arguments can act as subjects and become "nominalized" to such a degree that they trigger verbal agreement (see (35)).[16]

35 a. Ku-mu-dzi ku-li chi-tsîme
17-3-village 17-sb-be 7-well

[16] While we have not made an in-depth study of the interpretation of the pre-posed locative phrases in Chichewa, all the examples appearing in (Bresnan & Kanerva, 1989) have the PP translated as definite and the meanings of the sentences containing this construction either force a definite reading of the PP or allow it.

'In the village is a well'
b.Chi-tsîme chi-li ku-mu-dzi
7-well 7-sb-be 17-3-village
'The well is in the village'
(Bresnan & Kanerva, 1989: 4)

Now let us examine the interpretation of the nominative NPs occurring in sentences with unaccusative verbs that have a locative argument. Here, if an unmodified singular nominal appears pre-verbally, it is interpreted as D-linked or specific (36b), and if it appears post-verbally, its preferred interpretation is non-D-linked or existential (36a).

36 a.V klasse pojavilsja noven'kij
In class appeared-sg-masc new-sg-masc-nom
'An unspecified new boy entered our class'
'It was THE NEW BOY that entered the class'
b.Noven'kij pojavilsja v klasse
new-sg-masc-nom appeared-sg-masc in class
'The new boy entered the class'
c. Mal'čiki nikogda ne pojavljajutsja na uroke penija
boy-pl-nom never not appear-pl at class-prep singing-gen
'Boys never come to the singing class'
d. Na uroke penija nikogda ne pojavljajutsja mal'čiki
at singing-prep class-gen never not appear-pl boy-pl-nom
'It is BOYS that never come to singing class'
'There are some boys that never come to singing class'

(36c,d) shows that bare plural nouns appearing in the EPP position are most natural with a generic interpretation (a generalized quantifier or presuppositional reading in our terms). On the other hand, bare plural nouns appearing post-verbally are most natural with an existential interpretation, although a generic interpretation is also available. This pattern fits in with the generalization that post-verbal NPs must be non-D-linked: a non-familiar NP with an existential reading is non-D-linked because it corresponds to new information in the

discourse, and a familiar NP with a generic reading can be non-D-linked when it corresponds to new information in the context of the utterance.

Let us sum up the picture that has emerged. For nominals that have the option of appearing in the pre-verbal or the post-verbal position (subjects of unaccusative verbs with a PP argument), the pre-verbal position corresponds to a D-linked interpretation and the post-verbal position corresponds to a non-D-linked interpretation. For nominals that do not have the option of appearing in either the pre-verbal position or the post-verbal position (subjects of transitive and unergative verbs), both a D-linked and a non-D-linked interpretation is available in the pre-verbal position. "Non-canonical" subjects, that is, PPs, APs, and NP predicates that satisfy the EPP, have the D-linked interpretation when they appear in the pre-verbal position.

Note that the pattern we have described has some similarities to Focus and Topic movement: in both constructions, the movement operations the arguments undergo are optional from the point of view of syntax - the derivation can converge even if they do not take place.[17] When an argument undergoes such an optional movement operation, it is interpreted as D-linked when it occurs in a sentence-initial position (i.e. the Topic or the EPP position), and it is interpreted as non-D-linked when it occurs in a sentence-final position (i.e. the direct object or the VP-adjoined position).

Let us see how this pattern may be formalized. It is ill-suited for expression in terms of feature-driven movement: if we claim that the head of the EPP projection has a set of features that can only be checked by a D-linked element, we will not be able to account for

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[17] I am assuming that the the topicalised (or focused) element does not have some special feature like +Top (or +Foc) that needs to be checked in the Topic (or Focus) position.

the unconstrained interpretation of subjects of unergative and transitive verbs. Similarly, a reconstruction approach (c.f. Diesing (1992)), within which the nominals with D-linked interpretation are viewed as occupying VP-external positions at LF and the nominals with non-D-linked interpretation are viewed as occupying VP-internal position at LF, cannot explain why the non-D-linked interpretation is not available for pre-verbal subjects of unaccusatives: some mechanism must be assumed to prevent these nominals, but not the pre-verbal subjects of unergative and transitive verbs, from undergoing reconstruction.

Thus, it seems best to view the correlation between the position of elements and their interpretation not as a consequence of the operation of some syntactic mechanism, but as the result of the operation of discourse principles, which interpret the output of a syntactic derivation. At the points where syntax "had a choice" of performing a movement operation or not performing a movement operation, the discourse principles will interpret the sentence-initial (pre-verbal) material as D-linked, and sentence-final material as non-D-linked. At the points where syntax "did not have a choice" of performing or not performing a movement operation, the discourse principles will not be constrained in any way in interpreting material within a sentence. Note that on this view, the non-canonical subjects, that is, non-nominal elements that can satisfy the EPP, will always be interpreted as D-linked, because whenever they are used as the "subject" element, there is always another element that could satisfy the EPP from the point of view of syntax, namely, the canonical, nominal subject.

At this point we should clarify what formal properties have to be attributed to the head of the ΠP projection in light of the facts discussed in this chapter. Recall that under the

standard version of the EPP, the functional projection implicated in the EPP has a strong categorial feature (a D-feature), which only NPs and DPs are able to check. We have argued that other categories in addition to the nominal ones can satisfy the EPP, and as a result we are no longer able to view the EPP feature as a categorial nominal feature. Predicates of all categories with the exception of Verbs must be allowed to check the relevant feature (c.f. Moro (1989)). Note that extending the EPP to PPs (and possibly other categories) is not as problematic under the current version of the EPP, as it would have been had the EPP been formulated in terms of Case features, which PPs and other "non-canonical" subjects clearly lack.

Whether we will be able to view the feature that triggers the EPP as a categorial feature or not depends on which categories we take to be capable of satisfying the principle. Clearly, we will have to expand the notion of "categorial feature" somewhat to accommodate the data considered here, and the obvious way of doing that is to formulate the notion in terms of more basic features. Within 'Remarks on Nominalization', the [+/- N] and the [+/-V] features specified the four basic categories in the following fashion: N = [+N, -V], V = [+V, -N], A = [+N, +V], and P = [-N, -V]. There was no particularly compelling reason for the featural specification of the categories A and P, although it was important for P and V to form a natural class (of [-N] categories) that excluded As and Ns. Within this system, it is easy to describe NPs and PPs as a natural class - they are the [-V] categories within the original features specification. These are the two category types that typically act as arguments, while APs and VPs do not. In addition, in many languages with a well-developed system of morphological case (e.g. Japanese), the distinction between NPs and PPs is

notoriously murky and difficult to make. Thus, if we take PPs and NPs to be the core cases of "subjects", we can assume that major categories are decomposed into more basic features which syntactic operations may refer to, and that NPs and PPs share one such feature, namely [-V].

However, if we include APs (and other categories) in the class of elements that can be "subjects", it becomes impossible to describe this class in terms of the basic categorial features. Then, we must assume that no categorial feature of any kind is implicated in the EPP, and the principle simply states that some element (of any category) must fill the Specifier of the EPP projection in overt syntax. We will not try to decide which of the two approaches is right: the cases crucial for the remainder of this work concern NP and PP "subjects", so we will make recourse to the term "EPP feature" meant to be neutral between the two options outlined above.

Note that given the interpretation of elements in the Locative Inversion constructions, we have lost one of the tools that can be used to determine what the structure of a sentence is: we cannot tell if a pre-verbal PP is Topicalized or not based on its interpretation, since both the PPs in the Topic position and the PPs in the Spec of ΠP position have to be interpreted as D-linked. One rather fragile tool that can be used to decide that an element is not Topicalized is the intuition that a sentence has "the unmarked word order", in which no elements have undergone Topic or Focus movement. Fortunately, there is another way to discover whether the pre-verbal D-linked element occupies the Topic position or the Spec of ΠP position. As we will show in the next two chapters, when some element occupies the EPP

position, no other category in the sentence has to undergo movement there; when the pre-verbal element is topicalized, the EPP still has to be satisfied in some fashion.

In the next chapter we take up the issue of the exact position of the pre-verbal elements, along with another issue that remains unresolved by the discussion above, namely, how the principles that determine the legitimacy of movement operations (such as the Minimal Link Condition) treat the non-nominal elements that may satisfy the EPP. Given that these are very general principles, which are part of the definition of Move/Attract, we expect them to govern movement of PPs, just as they govern movement of NPs. Thus, PPs and NPs should "compete" for movement to the EPP position.

3. The Minimal Link Condition and the EPP Element: Conjunction Agreement in Russian

Kogda stalo sovsem temno, Koštankoj
ovladelo otčajanie i užas
when became completely dark, Koshtanka-instr
overcame-sg-neut despair-neut-nom and terror-masc-nom
'When it became completely dark, despair and terror overcame Kashtanka'

(Chekhov, Kashtanka)

In this chapter, we examine the question of which positions the elements that satisfy the EPP may originate in. We will argue that the principles of economy of movement that constrain the movement of subjects and objects in transitive sentences are also relevant for the movement of PPs. This should certainly be the null hypothesis: movement to the Spec of the EPP projection is feature-driven. Within our syntactic framework, it is assumed that only the closest element may undergo movement to check a given feature (e.g. Chomsky (1995)). Once we have admitted the possibility that either an NP or a PP may satisfy the EPP, we have to ask when a PP is "closer" to the EPP position than the subject NP. We will show that extending the notions of movement economy to PPs gives us a natural way to account for the distribution restrictions of the "locative inversion-like" constructions.

As an illustration, we will develop an analysis of the phenomenon within Russian syntax that we term "conjunction agreement". This refers to the exceptional agreement shown by some verbs whose subjects are conjoined NPs, illustrated in (37a).

37 a. Na stole stojali / stojala pepel'nica i pustoj stakan.
On table stood-pl / stood-sg-fem ashtray-fem-nom and empty-masc-nom glass-masc-nom

'On the table stood an ashtray and an empty glass'

b. Vo dvore stojali / *stojala Valja i Nina
In yard stood-pl / stood-sg-fem Valya-fem-nom and Nina-fem-nom
'In the yard stood Valya and Nina'

Russian verbs are traditionally described as showing obligatory agreement with their subjects (the nominative argument in the clause). However, there is a well-defined class of exceptions, for which the verb may appear in a singular form when the nominal "subject" that follows it is a conjunction of two or more NPs (37a,b). Below, we will demonstrate that conjunction agreement is a syntactic phenomenon that can take place in locative inversion constructions, where a PP moves to satisfy the EPP and the nominal argument remains within the VP at Spellout. Because in this construction there is a tangible morphological reflex of the NP argument's position in addition to word order, studying it will give us an opportunity to strengthen our conclusions on the operation of the EPP in Russian.

3.1 The Distribution of Conjunction Agreement

In this section we begin with a characterization of the phenomenon of conjunction agreement and proceed to describe its distribution in syntactic terms. It will turn out that conjunction agreement is restricted to sentences containing unaccusative verbs. In fact, it constitutes an unaccusativity diagnostic that has escaped the attention of Slavicists.

First, let us say a few words about the status of the construction we will be concerned with. Traditional grammars, as well as language textbooks for Russians and foreigners, typically claim that a predicate obligatorily agrees with its subject, i.e. the nominal within the sentence that bears nominative case. Verbs agree with their subjects in person and

number features in the present and future tenses and in number and gender features in the past tense. This pattern is taken to be exceptionless and independent of the features of the subject, its structure (i.e. whether it is a conjunction or not), and its position in the sentence. (38) demonstrates the truth of these generalizations for singular and plural subjects.

38 a. V komnatu vošli / *vošla molodye ženščiny
Into room entered-pl / entered-sg-fem young women-fem-pl-nom
'Into the room entered the young women'
b. Molodye ženščiny vošli / *vošla v komnatu
young women-fem-pl-nom entered-pl / entered-sg-fem into room
'The young women entered into the room'
c. V komnatu vošla / *vošel / *vošlo / *vošli molodaja ženščina
Into room entered-sg-fem / entered-sg-m / entered-sg-neut / entered-pl young woman-sg-nom-fem
'Into the room entered a young woman'
d. Molodaja ženščina vošla / *vošli / *vošel / *vošlo v komnatu
young woman-sg-fem-nom entered-sg-fem / entered-pl / entered-sg-m / entered-sg-neut into room
'A young woman entered into the room'

Yet, when the subject of a sentence is a conjoined NP, these generalizations are no longer completely accurate, as (39a) demonstrates. As can perhaps be expected, the issue is heavily prescriptivized. Peškovkij (1956) states that the pattern is due to lack of premeditation (that is, that the second NP is added as an afterthought) or to the fact that the second NP is used to amplify the first one. Within a thorough discussion of the construction, Crockett (1976) argues against this analysis, producing examples like (39b), where the conjoined NP is clearly meant to give an exhaustive listing, and (39c), where the conjunction is anticipated by a preposed plural nominal predicate, to show that conjunction agreement is possible in other contexts.[18]

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[18] Of course, this pattern of agreement does surface in the sentences where the second

39 a. V komnatu vošla / vošli molodaja ženščina a malen'kij mal'čik
Into room entered-sg-fem / entered-pl young-fem-nom woman-fem-nom and little-masc-nom boy-masc-nom
'Into the room entered a young woman and a small boy'

b. Ot konstrukcij s priloženijami ix otličaet naličie v nix odnogo (a ne dvux!) osnovnyx udarenij, otsutstvie sintaktičeskix otnošenij meždu sostavljajuščimi ix častjami i svojstvennaja im smyslovaja cel'nost'
From constructions with appositions them-acc differentiate-3rd-sg presence-nom in them one-gen (and not two-gen!) primary stress-gen, absence-nom syntactic relations-gen between composing them parts and characteristic them-dat meaning unity-nom
'The presence of one rather than two primary stresses, the absence of syntactic relations between their components, and their special semantic unity differentiates them from appositive constructions clearly and definitely'

c. Učebnymi posobijami na takix zanjatijax služilo vederko s abrikosami i kubiki raznoj veličiny
teaching aid-pl-instr at such classes served-sg-neut bucket-sg-neut-nom with apricots and block-pl-nom different sizes-gen
'The teaching aids at such lessons was (sg-neut) a bucket with apricots and blocks of various sizes'

Throughout this section, we will use the examples provided in Crockett (1976), which come from Russian literature of the 20th century, Soviet scientific publications and periodicals, and textbooks and manuals on Russian language. Using such heavily edited sources with their deliberate choice of constructions and words ensures that "lack of premeditation" is absent and avoids the prescriptive issues involved. Of course, all of the examples quoted here are also grammatical in my dialect of Russian.

So far, we have shown that 'irregular' verbal agreement is possible only when the nominative nominal in the sentence is a conjoined NP. The second important property of the construction is that 'irregular' agreement may surface only when the nominal appears

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NP within the conjunction is added as an afterthought.

post-verbally. Thus, even though such agreement is acceptable in (39a), it is not acceptable in (40a).

40 a. Molodaja ženščina i malen'kij mal'čik vošli / *vošla / *vošel v komnatu
young woman-fem-nom and little boy-masc-nom entered-pl / entered-sg-fem / entered-sg-masc into room
'A young woman and a small boy entered into the room'

Finally, the agreement shown by the verb in this construction is not the default 3rd person singular neuter, but rather the agreement corresponding to the features of the first NP in the conjunction. Thus, only (41a), in which the verb agrees with the first nominal within the conjunction, but not (41b), which contains a verb with the default agreement, is grammatical. (41c), in which the verb shows masculine agreement, triggered by the second NP in the conjunction, is impossible as well.

41 a. Na stole stojali / stojala pepel'nica i pustoj stakan.
on table stood-pl / stood-sg-fem ashtray-fem-nom and empty-masc-nom glass-masc-nom
'On the table stood an ashtray and an empty glass'
b. *Na stole stojalo pepel'nica i pustoj stakan.
on table stood-sg-neut ashtray-fem-nom and empty-masc-nom glass-masc-nom
'On the table stood an ashtray and an empty glass'
c. *Na stole stojal pepel'nica i pustoj stakan.
on table stood-sg-masc ashtray-fem-nom and empty-masc-nom glass-masc-nom

At this point the conjunction agreement might appear to be very similar to the agreement pattern within the English expletive constructions. In this construction it is possible to use the singular, rather than the plural form of the verb 'be' (42a), even though the "subject" NP is plural. Moreover, when the subject is a conjunction, the number shown by the

copula is determined by the first of the NPs (Green (1984), Sobin (1996)), as the contrast in (42b,c) demonstrates.

42 a. There's two men/a man and a woman in the garden
b. There are/*is two men and a woman in the garden
c. There is a woman and two men in the garden

In English, the phenomenon is not very pervasive and, as a result, it is often characterized as marginal or extra-syntactic. This is the position that Chomsky (1995) takes, describing the construction as a superficial "frozen option" because such processes as Subject-Aux inversion and negation make singular agreement impossible (43a). It is also very restricted, not occurring in locative inversion constructions (43b) and other environments where it might be expected to take place. However, the process may have a more deeply syntactic explanation than being "marginal" or "exceptional", as demonstrated, for instance, by its connection to the case-marking on the subject, pointed out by Schutze (1996): when the subject is nominative, agreement is obligatory, when the subject appears in the default accusative case, the agreement does not have to take place (43c,d).

43 a *Is there a man and a woman in the garden?
b.*Every Friday into the sallon walks a cowboy and a sheriff.
c. There am ?I/*me
d. There's me/*I

Note that while the Russian singular agreement phenomenon appear to be like the English one in being determined by the "closest" NP of the conjunction, it does not share the other properties of the English construction, exemplified in (43): it can occur with a wide range of

verbs and pre-verbal phrases, it participates in verb-raising constructions, and the verbal agreement is not default in any sense.

Let us turn to the task of describing the environments in which the conjunction agreement may surface. The conclusion that we will come to is that only the sentences containing unaccusative verbs allow this construction.[19] Because Russian does not have object agreement, it is not possible to draw a parallel between the direct objects of transitive verbs and the sole arguments of unaccusative verbs, thus showing that the process encompasses all NPs base-generated in the direct object position. However, several other arguments can be made.

First, when conjoined NPs appear in the subject position of transitive verbs, the verbs may not bear singular agreement (44). This is significant, because the subjects of transitive verbs are clearly base-generated in the subject position.

44 a. Stixi pišut /*pišet Svetlov i Romanov
poems write-pl / write-sg Svetlov-nom and Romanov-nom
'Svetlov and Romanov write poems'
b. Ob etom často govorjat /*govorit Andrej i Kolja
about this often talk-pl / talk-sg Andrey-nom and Kolya-nom
'Andrey and Kolya often talk about this'
c. Platja š'jut /*š"et Maša i Saša
dresses sow-pl/sow-sg Masha and Sasha
'Masha and Sasha sow dresses'

Note that the word order of the sentences in (44) is similar to that of the acceptable (39), that is, that the conjoined NPs surface in the post-verbal position in both sets of sentences. This is a very important point, which we will emphasize again in the discussion of unergative verbs:

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[19] Crockett (1976) comes to a similar, but not identical, conclusion: she argues that conjunction agreement cannot occur with agentive predicates and can occur with non-agentive predicates.

the impossibility of conjunction agreement in (44) shows that the construction requires more specific conditions than the existence of some pre-verbal element in the sentence and a post-verbal position of the subject. Of course, these transitive sentences are acceptable with normal plural agreement, on the interpretation of the post-verbal subject as focused and the pre-verbal direct object as topicalized.

The second relevant generalization is that conjunction agreement cannot take place in sentences containing unambiguously unergative verbs. The pattern is impossible with the unergatives whose argument structure is signaled by the presence of the *-sja* morpheme (45a,b).[20] In addition, it is not allowed with the agentive intransitives that do not bear a morphological reflex of their unergativity, but clearly ought to be analyzed as unergatives on semantic grounds (45c,d).

45 a. V eto vremja podralis' / *podralsja Robert i Grisa
At that time fought-pl / fought-sg Robert-nom and Grisha-nom
'Robert and Grisha had a fight'
b. Iz vsex sobak kusajutsja / *kusaetsja etot pudel' i ta ovčarka
Out-of all dogs bite-pl / bite-sg this poodle-nom and that German shepard-nom
'Out of all the dogs, this poodle and that german shepard bite'
c. Na večere igrali / *igral Andrej i Kolja
At party played-pl / played-sg-masc Andrey-masc-nom and Kolya-masc-nom
'Andrey and Kolya played at the party'
d. Peli / *pel d'jačok i pis'movoditel'
Sang-pl / sang-sg sexton-masc-nom and clerk-masc-nom
'Those singing were the sexton and the clerk'

This fact reinforces the notion that for conjunction agreement to occur, specific syntactic conditions have to be met, other than (or in addition to) the word order observed in (45).

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[20] These verbs are either symmetrical predicates (45a) or unergatives formed from transitives by the addition of the *-sja* suffix (45b), whose meaning is something like "perform the action X that advesely affects some unspecified object deliberately and maliciously".

More specifically, since subject-verb agreement is a reflection of these two elements occurring in a specific structural relationship (Spec-Head), and the verbs occupy the same positions in the acceptable and the unacceptable sentences, we can conclude that the positions of the subjects are different. That is, the post-verbal subjects in the sentences that do not allow conjunction agreement (those containing unergative and transitive verbs) do not occupy the same position as the post-verbal subjects in the sentences that do allow conjunction agreement.

Let us turn to the task of determining which intransitive verbs may appear with conjunction agreement. The first class of such verbs is obviously unaccusative: it consists of passive verbs. They uniformly allow the pattern, as (46a) shows for a *-sja* imperfective passive and (46b) shows for a participal perfective passive.

46 a. Okončivšim universitet vručaetsja diplom i nagrudnyj značok
completing university handed-pass-sg diploma-sg-nom and badge-sg-nom
'A diploma and a badge are handed to the graduates of the university'
b. Sozdan studenčeskij teatr, akademičeskij xor, internacional'nyj studenčeskij teatr
created-pass-sg student-sg-nom theater-sg-nom, academic-sg-nom
chorus-sg-nom, international-sg-nom student-sg-nom theater-sg-nom
'There have been formed a student theater, an academic chorus, and an international student theater'

The second class of verbs that allows conjunction agreement to take place consists of verbs of existence, also typical unaccusatives (see chapter 5). For some of them, singular verbal agreement even appears to be preferable to the plural one, which is quite marginal (47c).

47 a. U tebja byla kosa i rozovoe plat'je v beluju kletočku
at you-gen was-sg-fem braid-fem-nom and pink-fem-nom dress-fem-nom in white check
'You had a braid and a pink dress with a white check pattern'

b. V universitete imeetsja institut povyšenija kvalifikacii prepodovatelej vuzov, podgotovitel'nyj fakul'tet dlja inostrannyx graždan, podgotovitel'nye kursy.[21]
In university exist-sg institute-masc-nom improvement-gen qualification-gen teachers-gen institutions-of-higher-education-gen, preparatory-masc-nom department-masc-sg for foreign citizens, preparatory-pl-nom course-pl-nom
'At the universtiy there is an institute for improving the quality of teachers at instituions of higher education, a preparatory school for foreign citizens, and preparatory courses'

c. ??U tebja byli kosa i rozovoe plat'je v beluju kletočku
At you was-pl braid-sg-nom and pink-sg-nom dress-sg-nom-fem with white checks

The conjunction agreement pattern is also possible with other unaccusative verbs, as (48) shows.

48 a.Na dvux dlinnyx grjadkax rastet luk i rediska
on two long rows grow-3rd-sg onion-masc-nom and radish-fem-nom
'In two long rows there grow onions and radishes'

b. V 30-e gody načinaetsja ukreplenie i stabilizacija norm litreraturnogo jazyka
In 30 years begin-sg strengthening-neut-nom and stabilization-fem-nom norms-gen literary-gen language-gen
'In the 30's there began the consolidation and stabilization of the norms of the literary language'

c. U menja bolela golova i gorlo
at I-gen hurt-sg-fem head-fem-nom and throat-neut-nom
'My head and throat hurt'

There are rather striking parallels between the distribution of conjunction agreement and genitive of negation, which has been argued to be an unaccusativity diagnostic in Russian (Pesetsky, 1982). The verbs that allow one construction to take place, allow the other one as well (see (48a,c) and (49)). This is, of course, expected, if both processes are dependent on the unaccusativity status of the predicates involved.[22]

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[21] Note that in this sentence one of the conjoined NPs is plural, yet the verb still appears with singular agreement.

[22] Actually, the distribution of the genitive of negation is somewhat more restricted, in particular it may not occur in two environments that allow conjunction agreement: the "composite" unaccusatives (i,ii) and small clauses with nominal or adjectival predicates (iii,

49 a. Zdes' ne rastet gribov
here not grow-3rd-sg mushroom-pl-gen
'No mushrooms grow here'
b. U menja ničego ne bolit
at I-gen neg-what-gen not hurt-sg
'There is nothing hurting me'

The patterns we have seen so far show that conjunction agreement is able to take place in sentences containing unaccusative verbs and is not able to take place in sentences containing unergative verbs and that the distribution of conjunction agreement is similar to that of the genitive of negation.

Another striking piece of evidence that the ability of conjunction agreement to surface depends on the unaccusativity of the verb contained in the sentence comes from sentences with verbs of motion and a goal PP (50a-c). In many languages (for instance, Dutch and Italian), VPs containing a verb of motion together with a goal Prepositional Phrase that delimits the scope of the action described behave as unaccusatives, even though they may not do so when the PP is absent (Hoekstra (1984), Levin & Rappaport (1988)). This appears to

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iv). We will return to these differences in chapter 4.
(i) K beregu bežal Kolja i Vanja
To shore ran-sg-masc Kolya-sg-nom and Vanya-sg-nom
'To the shore ran Kolya nad Vanya'
(ii)*K beregu nikogo ne bežalo
To shore nobody-gen not ran-sg-neut
'Nobody ran to the shore'
(iii)??Ja ni odnoj devočki ne sčitaju idiotkoj
I neg single-gen girl-gen not consider idiot-sg-fem-instr
'I don't consider a single girl an idiot'
(iv) Glavnoj zabotoj byla kuxnja i obed
Main-instr concern-instr was-sg-fem kitchen-sg-nom-fem and diner-sg-nom-masc
'The kitchen and the dinner were the main concern'

be true of Russian, as well. Importantly, the presence of a non-delimiting PP that does not express the goal of motion (e.g. a locative phrase) does not license conjunction agreement on the verb (50d).

50 a. K beregy bežal Vanja i Kolja
Towards shore ran-sg-masc Vanya-masc-nom and Kolya-masc-nom
'Towars the shore were running Vanya and Kolya'
b. V komnatu vošla molodaja ženščina i malen'kij mal'čik
into room entered-sg-fem young-fem-nom woman and little-masc-nom boy-masc-nom
'Into the room entered a young woman and a little boy'
c. Vmeste so mnoj na kosmodrom letel German Titov, ešče neskol'ko kosmonavtov, gruppa naučnyx rabotnikov i vrač.
Together with me to launching-site flew-sg-masc German Titov-masc-nom, also several cosmonaut-pl-gen group-sg-fem scientist-pl-gen and doctor-sg-nom
'With me to the launching site flew German Titov, several other cosmonauts, a group of scientists, and a doctor'
d. *V komnate begal Vanja i Kolja
In room ran-sg-masc Vanya-sg-nom and Kolya-sg-nom
'In the room were running Vanya and Kolya'

The behavior of ambiguous verbs, which have both an unaccusative and an unergative interpretation (presumably corresponding to an unaccusative and an unergative lexical entries), provides another opportunity to verify the connection between conjunction agreement and unaccusativity. The verb *stojat'* - 'to stand' - has (at least) two meanings - a non-agentive, unaccusative meaning, in which it describes the position of its subject with respect to some location and an agentive, unergative meaning, in which it describes the maintenance of a particular spatial configuration (Levin & Rappaport-Horvat, (1995)). Similarly, the verb *plavat'* - 'to swim' has a non-agentive meaning (corresponding to 'float') and an agentive meaning (corresponding to 'swim'). When the agentive reading is forced for these verbs, they may only surface with plural agreement (51a,b). On the other hand, when

the non-agentive meaning is forced, the conjunction agreement pattern is fine (51c,d). Note that this pattern mirrors the distribution of genitive of negation with these ambiguous verbs.

51 a. Vo dvore stojali/*stojala Varja i Nina
In yard stood-pl /stood-sg-fem Varya-fem-sg-nom and Nina-fem-sg-nom
'In the yard stood Varya and Nina'
b. V bassejne plavali /*plaval mal'čik i devočka
In pool swam-pl/swam-sg-masc boy-masc-sg-nom and girl-fem-sg-nom
'There were a boy and a girl swimming in the pool'
c. Devuška sidela na čemodane, vozle nee stojal ešče odin čemodan, pletenaja korzina iz prut'ev.
Girl sat on suitcase, next her stood-sg-masc also one suitcase-sg-nom-masc, woven basket-sg-nom-fem from twigs.
'A girl was sitting on a suitcase, and next to her there stood another suitcase and a woven basket made of twigs'
d. V supe plaval luk, kartoška, i morkov'.
In soup floated-sg-masc onion-sg-masc-nom, potato-sg-fem-nom, and carrot-sg-fem-nom
'In the soup there floated onions, potatoes, and carrots'

Another area that is very revealing in terms of restrictions on the distribution of conjunction agreement is the behavior of psych verbs. Not all psych predicates are acceptable in this construction, as the contrast between (52a,b) and (52c,d) demonstrates.

52 a. Valentinu Ivanovnu uvažali/*uvažal predsedatel' kolxoza i sekretar' rajkoma
Valentina-acc Ivanovna-acc respected-pl/respected-sg-masc chairman-sg-nom kolkhoz-gen and secretary-sg-nom district-committee-gen
'The kolkhoz chairman and the secretary of the district committee respected Valentina Ivanovna'
b. Poexat' na jug xotjat/*xočet Saša i Kolja
go-ing to south want-pl /*want-sg Sasha-sg-nom and Kolya-sg-nom
'Sasha and Kolya want to go to the south'
c. Kogda stalo temno, Kaštankoj ovladelo otčajanie i užas
When became dark, Kashtanka-fem-instr overcame-sg-neut despair-sg-nom and terror-sg-nom
'When it became dark, despair and terror overcame Kashtanka'

d. Ix tomila tišina i monotonnost' dorogi
They-acc opressed-sg-fem silence-fem-sg-nom and monotony-fem-sg-nom road-gen
'The silence and monotony of the road oppressed them'

Is this a problem for our analysis? The psych-verbs in (52c,d) appear to be transitive, and yet they are able to show conjunction agreement, contrary to our claim in the beginning of this section. However, once we examine the pattern in (52) carefully, it becomes apparent that psych-verbs are behaving as expected: the 'fear' type verbs that have an experiencer nominative 'subject' and a theme accusative 'object' behave as regular transitive verbs and do not allow conjunction agreement to surface, whereas the 'frighten' type verbs that have a theme nominative 'subject' and an experiencer accusative (or inherently cased) 'object' do not behave as transitive verbs and allow conjunction agreement to surface. Such a split as typical of psych-predicates and well-attested cross-linguistically. Based on an analysis of these verbs in Italian, Beletti & Rizzi (1988) argue that the 'frighten' type verbs are unaccusative (that is, have their surface subject base-generated in the direct object position), but the 'fear' type verbs are not (that is, they have their surface subject base-generated in the subject position). Once we adopt this analysis, (52) can be seen as revealing the familiar pattern: unaccusative verbs do, and all other verbs do not, allow conjunction agreement.

The discussion above raises the question about the behavior of the third type of psych verbs discussed by Beletti & Rizzi, the 'piacere' verbs that have a nominative theme argument and an experiencer dative argument, which they show to be unaccusative. The typical members of this psych-predicate type in Russian are short-form adjectives that express modal or perception meanings, illustrated in (53)

53 a. Izvestna ee emblema i ee deviz: "Progress i garmonija dlja čelovečestva'
well-known-sg-fem her emblem--fem-sg-nom and her slogan-masc-sg-nom:
"Progress and harmony for mankind"
Its emblem and its motto are well-known (to us): "Progress and harmony for mankind."

b. V okno byl viden kusoček neba i mercajuščij sklon sopki
In window was-sg-masc visible-sg-masc piece-masc-sg-nom sky-gen and glimmering-masc-nom slope-masc-sg-nom mountain-gen
'Through the window a piece of the sky and the glimmering slope of a mountain were visible (for an observer)'

c. Im dlja raboty nužen stol, stul, i černila
They-dat for work necessary-sg-masc table-masc-sg-nom, chair-masc-sg-nom and ink-pl-nom
'A table, chair, and ink are (all that is) necessary for their work'

As expected, conjunction agreement is possible with these unaccusative predicates. Note that the dative experiencer argument may not be overtly expressed, as in (53a,b), but it is always implied, either as the contextually salient participant of the discourse (53a) or as an arbitrary experiencer (53b).

In connection with the pattern discussed above, we should note that 'regular' short- and long-form adjectives always show full agreement with conjunctions, that is, they appear only in the plural form (54a,b).

54 a. V klasse u nas bol'ny/*bol'na Varja i Lena
In class at us sick-pl/sick-sg-fem Varya-sg-nom and Lena-sg-nom
'In our class, Varya and Lena are sick'

b. V klasse u nas vysokie /*vysokaja Varja i Lena
In class at us tall-pl/tall-sg-fem-nom Varya-sg-nom and Lena-sg-nom
'In our class, Varya and Lena are sick'

This fact once again confirms the general pattern we have expressed: these predicates, whose subject is not base-generated in the direct object position, do not allow conjunction agreement.

As a final point in our description, we would like to note that such processes as verb-raising to C do not affect the (un)availability of conjunction agreement. Regardless of whether the verb raises to C as a result of narrative inversion, as in (55a,b), or as a result of yes-no question formation (55c,d), conjunction agreement remains acceptable with unaccusative verbs (55a,c) and unacceptable with unergative verbs (55b,d).

55 a. Potom zabolela mat', ona tože ne vstala s posteli. Zabolel staršij syn i staršaja doč' - mat' dvux malen'kix detej.
Then fell-sick-sg-fem mother-nom, she also not got-up-fem from bed.
Fell-sick-sg-masc older son-masc-sg-nom and older daughter-fem-sg-nom - mother two-gen little children-gen
'Then the mother became sick, she too did not rise from her bed. (Then) the older son and the older daughter - a mother of two small children - became sick'

b. *Slušaet menja korrespondent i sekretar'
listen-3rd-sg me-acc correspondent-masc-sg-nom and secretary-mascs-sg-nom
'The correspondent and the secretary are listening to me'

c. Stojala li lampa i pustoj stakan na stole?
Stood-sg-fem if lamp-fem-sg-nom and empty-nom glass-sg-masc-nom on table
'Did the lamp and the empty glass stand on the table?'

d. Stojali li/*stojal li Saša i Kolja vo dvore?
stood-pl if / stood-sg-masc if Sasha-sg-nom and Kolya-sg-nom in yard?
'Were Sasha and Kolya standing in the yard?'

This fact re-emphasizes the point that it is not the relative ordering of constituents of a sentence that licenses conjunction agreement, but the syntactic position of the subject, which is different in sentences (55a,c) and (55b,d).

3.2 An Analysis of Conjunction Agreement

In the previous section we have demonstrated that conjunction agreement distinguishes sentences like (56a), which contain unaccusative verbs, and sentences like (56b), which

contain unergative verbs, even if their word order is identical and an argument PP precedes the verb and a nominative NP follows it.

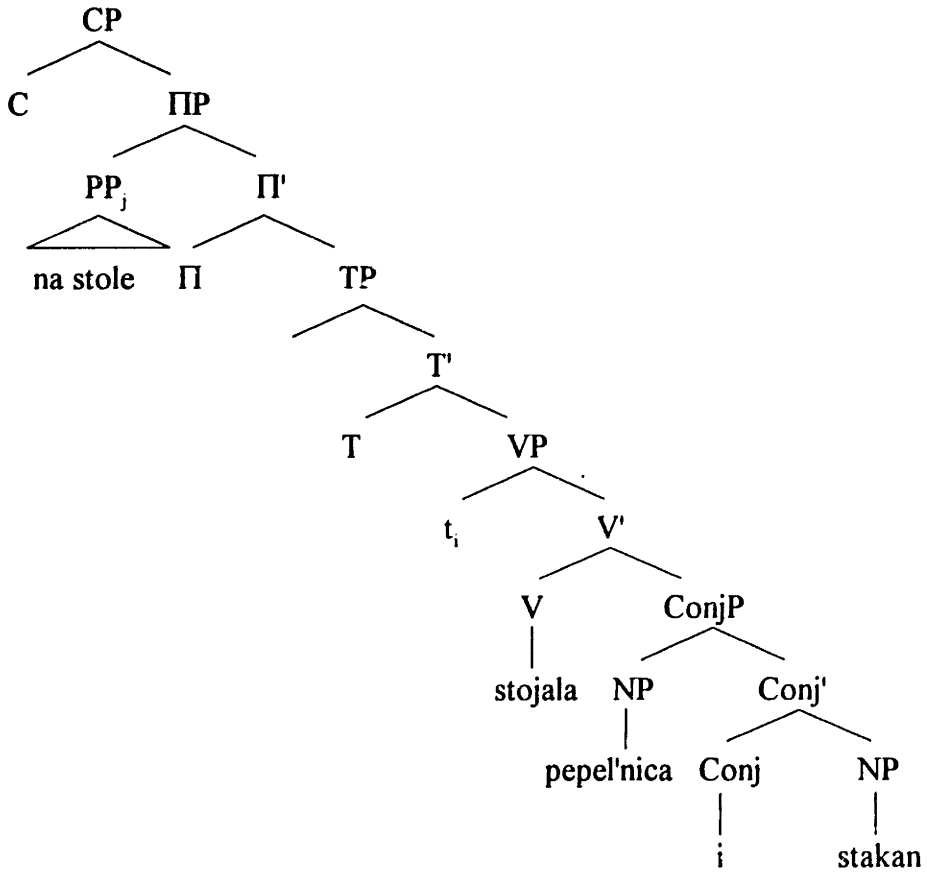
56 a. Na stole stojala pepel'nica i pustoj stakan
on table stood-sg-fem ashtray-sg-nom-fem and empty glass-sg-nom-masc
'On the table stood an ashtray and an empty glass'
b. *Na večere igral Vanja i Kolja.
on party played-sg-masc Vanya-sg-nom-masc and Kolya-sg-nom-masc
'Vanya and Kolya played at the party'

Note that the class of verbs that can appear with conjunction agreement is the same as the class of verbs that allow a PP to occupy the EPP position under discourse-neutral conditions (see chapter 2). In the next section, we will argue that this is not accidental. For now, let us simply say that the facts presented above show that although the surface ordering of the elements in sentences like (56a) and (56b) is the same, the syntactic structures underlying this ordering have to be different: in a reasonably constrained syntactic system, such as the one in which we are operating, two nominals passing through the same syntactic positions and entering the same feature checking relationships in the course of a derivation cannot systematically surface with different agreement patterns. Thus, the structural position of the NP or the structural positions of the NP and the PP must be different in the two types of sentences. Let us give the analysis of the conjunction agreement phenomenon within the sentences where it is acceptable and then go on to explain why the necessary conditions for its application are not met in the sentences where it is not.

In Chapter 2, we have shown that PPs may act as "subjects", i.e. as elements that satisfy the EPP, in Russian, just as they do in a number of other languages. The structure of

such Locative Inversion sentences was argued to be as in (57). At Spellout, the PP occupies the A-bar position of the Specifier of the ΠP projection, and the NP remains in its base-generated position of the V complement.[23] This is the structure of the sentence in (56a), in which an unaccusative verb shows conjunction agreement with the post-verbal subject.

57



At LF, the features of the Verb and the features of the subject NP have to be checked within the TP for the derivation to converge. When the subject is a simple non-conjoined NP, there is only one way in which this can happen: the features of this NP raise to the Spec of T and

[23] We do not take a stand on the issue of whether the Verb raises to T at Spellout in Russian - see Holloway King (1995) for arguments that it does, and Bailyn (1995) for arguments that it does not. The question does not become crucial at any point in our discussion.

the feature-checking proceeds in the usual fashion. This option is also available for a conjunction composed of two NPs: the features of the whole ConjP may move to the Spec of TP and check the features of T. This, of course, results in "normal" plural agreement, the pattern that surfaces when the ConjP is preverbal (i.e. passes through the Spec of TP in overt syntax).

Let us say a few words about the structure and the features of conjunctions. As (57) indicates, we take conjunctions to be asymmetrical structures that obey the format of X-bar Theory. The conjunction (whether overt or null) heads the phrase and forms a constituent with the second NP (for arguments on both of these points see Collins (1989)). Clearly, the features of the ConjP and those of the conjoined phrases have to match (at least to some extent): ConjPs have the same distribution as the categories they dominate and are able to fulfill the same syntactic functions. The exact mechanism that ensures that the features of a ConjP and the features of the categories dominated by it match is not important for our purposes here (the features of the conjoined categories may percolate up to the ConjP, or the ConjP may receive an arbitrary set of features, with some Filter-like mechanism ruling out the constructions where its features and the features of conjoined phrases do not match). We are interested only in the results of this mechanism's operation. Thus, we can observe that the categorial features of conjoined phrases and the categorial features of ConjP, as well as the person and gender features of the conjoined phrases and the person and gender features of the ConjP, typically match.[24] In addition, the number feature of a ConjP is +Plural, regardless of the number specification of the conjoined NPs.

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[24] In the cases where the features of conjoined phrases conflict, various strategies of resolution are employed - see Corbett (1983) for a thorough description.

But what about Case features? Here, the relationship between the features of the ConjP and those of the conjoined NPs is not entirely straightforward. Consider the English sentences in (58). While the ConjP clearly enters into a feature-checking relationship with T (as evidenced by the plural agreement on the verb) and, more specifically, checks nominative Case features, the conjoined NPs are able to surface with the default (accusative) case (58b-g). The conjoined nominals can bear nominative case or accusative case; moreover, when the conjunction contains two pronouns, for which abstract Case has a morphological realization, the conjunction is absolutely acceptable only when both pronouns appear in the accusative case (58c).

58 a. John and I are friends
b. John and me are friends.
c. Him and me are friends
d. ??Him and I are friends
e. *Me and he are friends
f. *I and him are friends
g. ??I and he are friends.
h. Me, I like beans.
i. Who's there? Me.

Recall that we are assuming that nominals can be inserted into syntax with or without Case features: Case features are -Interpretable and are not required for the sentence to be interpreted at LF. In most situations, if an NP lacks Case features, the derivation containing it will not converge, because the verbal elements will not be able to check their Case features. However, in some positions - those without a case-assigner - a nominal without Case features can survive the derivation. This is the situation with the left-dislocated nominals (58h), and nominals standing in isolation (58i). The patterns in (58b-g) suggest that this is also true of

nominals appearing in ConjPs. Nominals lacking abstract Case features are supplied with them only in the morphological component of grammar, where various redundancy rules fill out the missing feature specifications. Thus, the conjoined NPs are able to surface with the default case in (58).

With this more explicit description of the features within ConjPs in place, we can turn to sentences where conjunction agreement occurs. We suggest that conjunction agreement surfaces in the derivations where not the features of the whole ConjP, but only the features of the NP that occupies the Specifier position in this projection, undergo movement to the Spec of TP and check the features of T.[25] There are several questions that we need to answer: first, we must make sure that the derivation in which only the features of the NP in the Spec of the ConjP move does converge.

Let us consider the features that an NP and a Π-T-V complex have[26]. The NP has a categorial (D) feature, as well as phi-features and Case features. Of these, the categorial and phi-features are +Interpretable and do not have to be checked and deleted for convergence. Case features are -Interpretable and have to be eliminated for the derivation to converge. Within the Π-T-V complex, the categorial (D) features, phi-features, and a Case feature are all -Interpretable and have to be checked for the derivation to converge. When the set of

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[25] Perhaps this can be considered a consequence of the notion of economy of movement advocated in Chomsky (1995): "F <the feature undergoing movement> carries along just enough material for convergence" (p. 262). That is, a convergent derivation in which a part of an element, rather than the whole element, moves is the prefered option. However, it is not clear that the set of features of the whole category is in any meaningful way "larger" than the set of features of a part of this category. Thus, this notion may not be applicable in this instance of covert movement.

[26] We describe the full verbal complex as Π-T-V, but it could actually be T-V, if the verbal complex does not raise to adjoint to Π or if the EPP position is the outer Spec of TP (see chapter 2).

features of the higher NP within a conjunction raises to the Spec of TP at LF, the Case, phi- and D features of the Π-T-V complex are checked. Thus, the only element in the sentence that may cause problems is the remainder of the ConjP, namely, the lower NP within it. Its D and phi-features are +Interpretable, and so can remain unchecked. But what about its Case features? We would like to suggest that it has none.

Recall that in our discussion of Case in English conjunctions, we have shown that nominals within ConjPs can, but do not have to, bear abstract Case. The derivation containing a ConjP will converge if some nominal element checks the features of the verbal functional complex. Two elements can fulfill this function: either the ConjP or one of the NPs contained within it may raise to check the features of the verbal complex. If one of the NPs undergoes raising, the other nominal is not implicated in the feature-checking process. Thus, if this nominal is inserted into the derivation with Case features, the features will fail to be checked and the derivation will not converge. If this nominal is inserted into the derivation without Case features, the derivation will converge.

The morphological case-marking with which a nominal without abstract Case features surfaces is determined by the morphological component of the grammar. In Russian, the morphological component contains a mechanism that ensures that elements occurring within Noun Phrases agree in Case; in the analysis of Russian Case in Halle (1993), this mechanism is realized as a Case Concord Rule that copies the Case features from the element that bears them within syntax (i.e. the head noun) onto the elements that do not bear them within syntax (such as the adjectival modifiers). We suggest that the conjoined NP lacking abstract Case features is subject to the Case Concord Rule, just as adjective modifiers are: the Case

Concord Rule copies the features of the Cased conjoined NP onto the conjoined NP that lacks them, thus ensuring that it surfaces with a morphological realization of Case.[27]

Another question that we need to answer is why the first of the two NPs in a conjunction undergoes movement at LF and triggers agreement. Or, to put it somewhat differently, why can't the second conjunct undergo this movement operation - after all, raising it to the Spec of TP would not cause the derivation to crash, provided the first conjunct were base-generated without Case features.

Recall that we are assuming the definition of Move formulated in Chomsky (1995):

59 a. (Minimal Link Condition) α can raise to target K only if there is no legitimate operation Move β targeting K, where β is closer to K. (296)
b if β c-commands α and τ is the target of raising, then β is closer to K than α unless β is in the same minimal domain as a) τ or b) α. (356)

Within the structure of ConjP we are assuming (see (57)), the first conjunct c-commands the second one, but it is not closer to the target of movement because both NPs are in the same minimal domain - that of ConjP. However, the first conjunct's relative prominence may be responsible for the fact that it is the one that undergoes movement. In general, in Russian the first NP in a conjunction is "more prominent" than the second one for the purposes of agreement. This is demonstrated by adjectives that modify both nominals within conjunctions. In casual speech, such adjectives may appear in the singular, agreeing in gender and number features with the first NP in the conjunct (60).

60 a. On osobenno gorditsja talantlivymi/talantlivym/*talantlivoj synom i dočerju

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[27] It is possible to imagine other ways of formalizing the process of agreement within NPs as it occurs in morphology - the exact mechanism is not important here, what is crucial is that the same process that affects adjectival modifiers affects the Caseless NP conjuncts.

He especially prides-self talanted-pl/talanted-sg-masc/*talanted-sg-fem son and daughter
'He is especially proud of his talented son and (talented) daughter'

b. Ona uspela ešče pozvonit' moskovskoj/?moskovskim rodne i znakomym
She managed also call-inf moscow-sg-fem/moscow-pl relative-fem and acquiantances-pl
'She had enough time to call her Muscovite relatives and (Muscovite) acquaintances'

While it is not clear that the mechanisms of agreement between an adjective and the nominal it modifies are identical to those of agreement between a subject and a predicate, the pattern in (60) does show that the first NP in a conjunct is more accessible to agreement than the second one. Note that it is difficult to determine whether 'irregular' agreement in Russian obeys a constraint based on adjacency, so that agreement takes place with the closest element in the string, regardless of its structural position, or a constraint based on the hierarchical position of the conjoined elements, so that agreement takes place with the highest one. In Russian adjectival modifiers precede nouns, so that the element that is string-adjacent to them is the one that is the highest hierarchically. With verbs and other predicates which may follow the subject, creating a situation in which the string adjacent element is not the highest one hierarchically, plural agreement is obligatory. This leaves us without constructions from which we could conclude whether it is adjacency or c-command that determines 'irregular' predicate and modifier agreement. However, this is not important for our purposes: what is important is that some principle in Russian grammar determines that agreement occurs with the first of two conjoined NPs in situations where there is a choice.

The final question we need to answer is why are both agreement options possible in the structure in (57), i.e. why can the features of the higher NP contained within the ConjP, as well as those of the whole ConjP, raise. First of all, it is important to note that the

formulation of Move in (59) allows both operations to take place. Because it is not the case that NP1 c-commands ConjP or that ConjP c-commands NP1, the two elements are equally close to the target of movement (TP), and both movement operations are legitimate. Thus, both should be equally available. However, the option of moving one of the conjuncts is clearly ruled out in overt syntax, as (61a,b) demonstrates.[28]

61 a. *Vanja igral / igrali na vecere i Kolja
Vanya-nom played-sg-masc / played-pl at party and Kolya-nom
'Vanya played at the party and Kolya'
b. *Pepel'nica na stole stojala / stojali i pustoj stakan
ashtray-fem-nom on table stood-sg-fem / stood-pl and empty glass-masc-nom
'An ashtray on the table stood and an empty glass'
c. *Kogo on uvidel t i Vanju?
who-acc he-nom saw t and Vanya-acc
'Who did he see and Vanya?'
d. *Kogo on uvidel Vanju i t?
who-acc he-nom saw Vanya-acc and t
'Who did he see Vanya and?'
e. ?John who I bought a picture of t and a glass of water
f. ?O kom on kupil knigu t i kilogram ogurcov
about who-prep he-nom bought a book-acc t and a kilogram-acc cucumbers-gen
'About whom did he buy a book and a kilogram of cucumbers?'

This operation has a "marked" character: it is generally the case that extracting one of the conjuncts out of a coordinate structure is ungrammatical in overt syntax (61c,d). But it is also generally the case that extracting a subpart of one of the conjuncts is much more acceptable (61e). The acceptability of conjunction agreement is an instance of the same phenomenon: covert movement, which moves only the features of a category, not the category itself, is in effect extracting a subpart of a conjunct, and is acceptable as a result.[29] In general, at LF the

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[28] Of course, this construction is possible when the second conjunct is "an afterfthought" and occurs after a pause.

[29] I am thankful to David Pesetsky for pointing out the relevance of these patterns.

requirements on how much material must be carried along when features move are relaxed, so that various movement operations that would violate "pied-piping" constraints in overt syntax are allowed to take place.

As the last point, we would like to demonstrate that the conjunctions that do not trigger plural agreement are in fact subjects, i.e. elements that occupy the Spec of TP at some point in the derivation. This is something that is taken for granted in traditional approaches to Russian grammar, where a subject is defined as the nominal that bears nominative Case in the sentence. There are also good theory-internal reasons for assuming that some part of the conjunction must move to the Spec of TP at some point in the derivation: the features of the Π-T-V complex (which are -Interpretable) need to be checked for the derivation to converge. More tangible evidence for this conclusion can also be found.

Consider the pair of sentence in (62a,b), which contain a gerund phrase. They show that a gerund phrase is fully acceptable when it is controlled by both NPs in a conjunction that occupies the pre-verbal subject position (62b), and degrades slightly when it is controlled by only one of the NPs within the conjunction (62a). The same pattern holds for a post-verbal conjunction when the verb exhibits plural agreement (62c,d).

62 a. ?PRO$_i$ prixramyvaja na odnu nogu, [molodaja ženščina]$_i$ i malen'kij mal'čik vošli v komantu.
'PRO$_i$ limping on one foot, [a young woman]$_i$ and a small boy entered (pl) the room'

b. PRO$_i$ perešeptyvajas' drug s drugom, [molodaja ženščina i malen'kij mal'čik]$_i$ vošli v komnatu.
'PRO$_i$ whispering to each other, [a young woman and a small boy]$_i$ entered (pl) the room'

c. ?PRO$_i$ prixramyvaja na odnu nogu, v komnatu vošli [molodaja ženščina]$_i$ i malen'kij mal'čik.

'PRO_i limping on one foot, into the room came (pl) [a young woman]$_i$ and a small boy'

d. PRO_i perešeptyvajas' drug s drugom, v komnatu vošli [molodaja ženscina i malen'kij mal'čik]$_i$.
'PRO_i whispering to each other, into the room came (pl) [a young woman and a small boy]$_i$'

e. ?PRO_i prixramyvaja na odnu nogu, v komnatu vošla [molodaja ženščina]$_i$ i malen'kij mal'čik.
'PRO_i limping on one foot, into the room came (sg) [a young woman]$_i$ and a small boy'

f. *PRO_i perešeptyvajas' drug s drugom, v komnatu vošla [molodaja ženščina i malen'kij mal'čik]$_i$.
'PRO_i whispering to each other, into the room came (sg) [a young woman and a small boy]$_i$'

g. *PRO_i prixramyvaja na odnu nogu, ja uvidel [moloduju ženščinu]$_i$.
'PRO_i limping on one foot I saw [a young woman]$_i$'

However, once we consider the sentences where the verb exhibits conjunction agreement, the pattern changes dramatically: while a gerund controlled by the first NP, which also controls the verbal agreement, remains somewhat degraded (62e), a gerund controlled by both NPs within the conjunction becomes completely ungrammatical (62f). This pattern is showing two things. First of all, the higher NP within the conjunction does raise to TP at LF, as demonstrated by its ability to control the gerund phrase. Second, the whole ConjP does not raise to TP at LF, as demonstrated by its inability to control a gerund phrase. The slightly degraded status of (62e) should be attributed to a very general restriction on gerund phrases - they are never absolutely perfect when controlled by one, rather than both, of the NPs within a conjunction.[30] Note that although (62e) is not perfect, it is much more acceptable than (62g) where a gerund phrase is controlled by a direct object.

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[30] This restriction is reasonably strong - thus, some speakers find that their first interpretation of (62a) and (62c) is one in which both the young woman and the small boy enter limping on one foot, even in the face of the implausibility of such an interpretation. It is significant that this reading is not available in (62e).

There is also another test for the subject status of a nominal in Russian that leads us to the same conclusions. In a sentence with plural agreement, the post verbal nominal can act as an antecedent of a reflexive element (recall that reflexives are subject-oriented in Russian) (63a). In a sentence with conjunction agreement, the post-verbal nominal can act as an antecedent of a reflexive as well (63b). The fact that (63b) is as acceptable as (63a) demonstrates that at least some part of the Conjunction is occupying the Spec of TP position at the level of the derivation relevant for anaphor interpretation. In addition, we find that the most natural interpretation of the anaphor is different in (63a) and (63b): in (63a), the anaphor most naturally refers to both NPs within the conjunction (the friends are those of the young woman and the small boy), but in (63b) the anaphor most naturally refers to the higher NP alone (the friends are those of the young woman).

63 a. Vsled za svoimi druzjami v komnatu vošli molodaja ženscina i malen'kij mal'čik.
after self's friends into room entered-pl young woman-nom and small boy-nom
'After their friends, into the room entered a young woman and a small boy'
b. Vsled za svoimi druzjami v komnatu vošla molodaja ženscina i malen'kij mal'čik.
after self's friends into room entered-sg-fem young woman-nom and small boy-nom
'After her friends, into the room entered a young woman and a small boy'

Once again, it is clear that the higher NP within the post-verbal conjunction exhibits subject properties. This is expected within our analysis, where this NP undergoes covert movement to the subject position, i.e. the Specifier of TP.

3.3 An Explanation of the Distribution of Conjunction Agreement

With an analysis of conjunction agreement in place, we are in a position to explain its

distribution. The basic question we should answer is why the derivation described in the previous section is possible only in sentences containing unaccusative verbs, but not in sentences containing unergative or transitive verbs (64a,b). After all, all of the mechanisms we have proposed are very general: we have suggested that the highest NP within a conjunction can move to the Spec of TP, in place of the whole conjunction, if the operation takes place at LF. Nothing in our analysis refers to the argument structure of the verb, so why are the subjects of transitive and unergative verbs excluded from this construction?

64 a. Na stole stojala pepel'nica i pustoj stakan.
On table stood-sg-fem ashtray-fem-nom and empty glass-masc-nom
'On the table stood an ashtray and an empty glass'
b. *Na večere igral Vanja i Kolja.
On party played-sg-masc Vanya-nom and Kolya-nom
'Vanya and Kolya played at the party'

We have already suggested what the answer should be at several points of our discussion of the phenomenon: the structure of (64b), which contains an unergative verb, is not the same as the structure of (64a), which contains an unaccusative verb. The position of the subject is different, which leads to the difference in the agreement patterns. The position of the pre-verbal PP in (64b) is different from that in (64a), as well: the pre-verbal PP in sentences like (64b) is not occupying the EPP position. Moreover, it cannot do so, given the positions in which the subject NP and the PP originate. Before we explain what syntactic principles rule this derivation out, let us show what the structure of sentences like (64b) is, and why conjunction agreement cannot occur in it.

The first point we should make is that a sentence with the surface word order of (64b), where a PP precedes an unergative verb and a nominative nominal follows it, does not have a discourse-neutral interpretation. The sentence is most felicitous in answer to a question, such as the one in (65a), where the pre-verbal PP is presented as old information and the post-verbal NP is presented as new information. Of course, a sentence in which a PP precedes an unaccusative verb and a nominative nominal follows it can also have this interpretation, as described in section 2.4. Thus, a sentence with this word order is also felicitous as an answer to a question which presents the pre-verbal PP as new information and the post-verbal NP as old information (65b). However, a distinction can be made between the two sentence types. In a discourse-neutral environment, where no Topic or Focus movement can take place, the PP-V-NP word order is acceptable only if the sentence contains an unaccusative verb (65c,d).

65 a. Who played at the party?
Na večere igrali Vanja i Kolja.
at party played-pl Vanya-nom and Kolya-nom
'At the party, Vanya and Kolya played'
b. What stood on the table?
Na stole stojala pepel'nica i pustoj stakan
on table stood-sg ashtray-nom and empty glass-nom
'On the table stood an ashtray and an empty glass'
c. What happened?
#Na večere igrali Vanja i Kolja.
at party played-pl Vanya-nom and Kolya-nom
d. What happened?
Na stole stojala pepel'nica i pustoj stakan
on table stood-sg ashtray-nom and empty glass-nom

What is this pattern telling us? The word order of PP-V-NP in a sentence containing an unergative verb can be produced only if the pre-verbal PP is a Topic and the post-verbal NP

is the Focus. In other words, the PP has undergone Topic movement (adjoining to ΠP) and the NP has undergone Focus movement (right-adjoining to VP). Note that this has been argued to be the position of Russian Focused post-verbal subjects (King (1995), Bailyn (1995)). If we examine sentences containing verbs with two or more arguments, the subject representing new information appears in the sentence-final position, where it might be expected to occur if it adjoined to the VP (66a,b), rather than in the post-verbal position, where it might be expected to occur if it remained in its base-generated position (66c,d).[31]

66 a. Who played cards in the corner?
V uglu igral v karty Vanya
in corner played in cards Vanya
'Vanya played cards in the corner'
b. Who met a friend in the store?
V magazine vstretil druga Vanja
in store met friend Vanya
'Vanya met a friend in the store'
c. Who played cards in the corner?
#V uglu igral Vanja v karty
in corner played Vanya in cards
d. Who met a friend in the store?
#V magazine vstretil Vanja druga
in store met Vanya friend

The conclusion we must draw is that sentences like (65a), in which a PP precedes an unergative verb and a nominative subject follows it, have the structures shown in (67a): the subject nominal moves through the Spec of TP and undergoes VP-adjunction. Note that for the purposes of agreement, this is equivalent to the subject occupying the Spec of TP position, as in (67b). Thus, the impossibility of conjunction agreement in sentences with

[31] This word order becomes more acceptable if the subject receives heavy stress. However, then it must be interpreted as contrastive Focus, which is not appropriate in answer to the questions in (66).

post-verbal subjects of unergative verbs reduces to the impossibility of conjunction agreement with pre-verbal subjects (67c,d).

67 a. $[_{ПР}$ Na večere $[_{ПР}\ t_i\ [_{TP}\ t_i\ [_{VP}\ [_{VP}\ t_i$ igrali] $[_{NP}$ Vanja i Kolja$]_i$]]]].
at party played-pl Vanya-nom and Kolya-nom

b. $[_{ПР}\ [_{NP}$ Vanja i Kolja$]_i\ [_{TP}\ t_i\ [_{VP}\ [_{VP}\ t_i$ igrali]]]]].
Vanya-nom and Kolya-nom played-pl

c. *Na večere igral Vanja i Kolja
at party played-sg-masc Vanya-sg-nom and Kolya-sg-nom

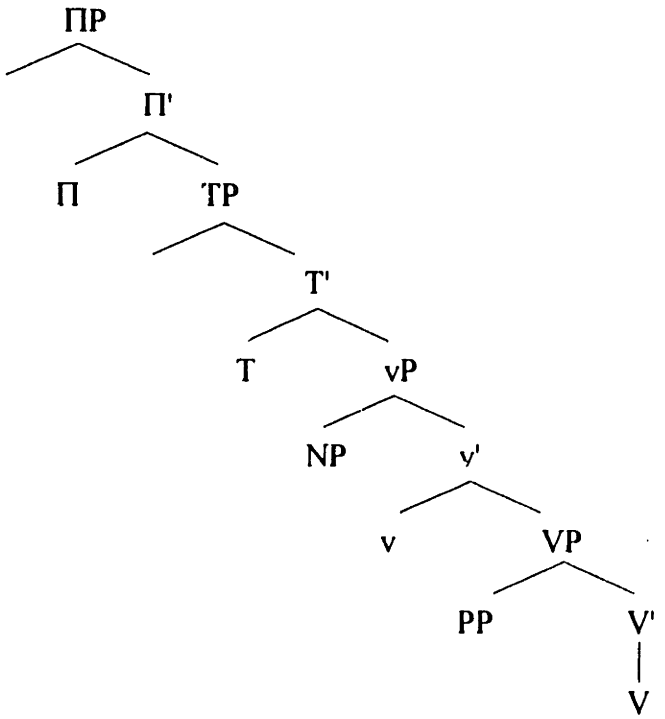
d. *Vanja i Kolja igral na večere.
Vanya-nom and Kolya-nom played-sg at party

This agreement pattern is impossible because the features of the element that moves into the Spec of TP (or another functional projection) are checked automatically - it is impossible for the TP to "ignore" the features of ConjP once it has moved into its Specifier. Because the number feature of ConjP is plural, this is the feature that must be present on the T if the derivation is to converge. Thus, only plural agreement may surface when the whole conjunction moves to the TP. Singular conjunction agreement is a consequence of the same automatic process, within which the features of the category in the Spec of T are checked against those of T, the only difference being that a part of the ConjP undergoes movement in this case.

Now we must explain why the derivation that produced conjunction agreement in sentences containing unaccusative verbs is impossible in sentences containing unergative and transitive verbs. To be more specific, we must show that the subject of an unergative verb cannot remain in its base-generated position at Spellout, as the subjects of unaccusative verbs can. If that were possible, then the features of the highest NP within the conjunction could

undergo covert movement and conjunction agreement would be able to surface. Recall that we have argued that some element must satisfy the EPP in overt syntax. In sentences containing unaccusative verbs, a PP argument can do so, allowing the subject nominal to remain in its base-generated position. With this in mind, we can formulate the restriction we are seeking to explain somewhat differently: a PP argument of an unergative verb cannot move to the EPP position, thus allowing the subject nominal to remain VP-internal at Spellout. To understand why this is so, we must consider the structure of such sentences before movement has taken place, paying more attention to the relative prominence of the NP subject and PP argument. As (68) illustrates, the subject occupies the Specifier of vP position, and the PP occupies the Specifier of VP position.

68



Recall that within the definition of Move, which we have adopted (see (59)), only the element closest to the target can undergo the movement operation. The definition of "closeness", repeated in (69) for convenience, uses the notions of c-command and equidistance. Crucially, only trivial chains and their minimal domains play a role in this system.

69. If β c-commands α and τ is the target of raising, then β is closer to K than α unless β is in the same minimal domain as a) τ or b) α.

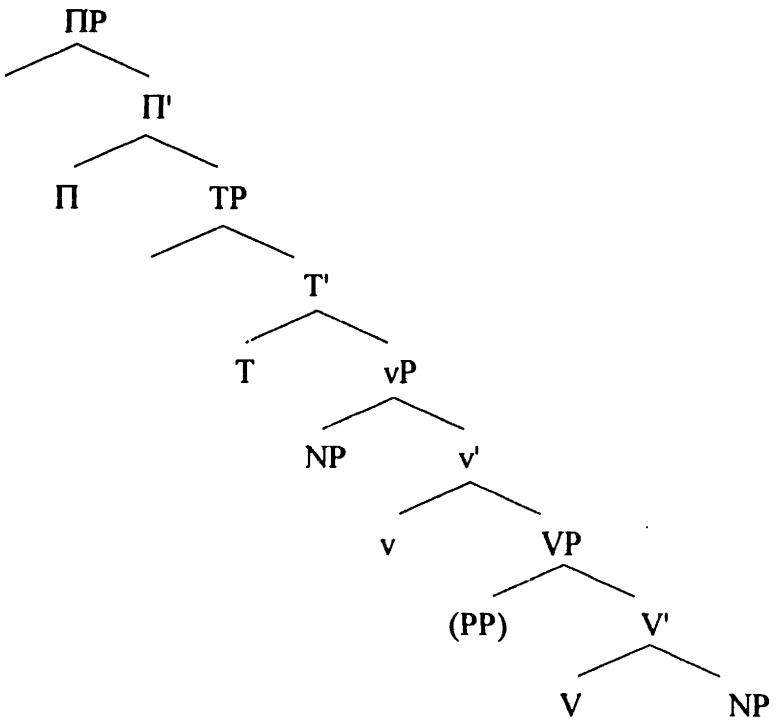
The EPP is the requirement that the functional head Π check its features against some element (an NP or a PP) in overt syntax. According to the definition of Move within our system, only the closest element may raise to check them. Clearly, the subject NP c-commands the PP argument in (68), thus it will be considered closer to the target than the PP, unless 1) the base-generated position of the subject NP and the Spec of ΠP are in the same minimal domain or 2) the base-generated positions of the subject NP and the PP are in the same minimal domain. The first condition is not met: the Spec of ΠP is in the minimal domain of Π and the Spec of vP occupied by the subject is in the minimal domain of v. The second condition is not met either: the minimal maximal projection containing the subject NP is the vP, and the minimal maximal projection containing the PP is the VP.

Let us consider the case of a transitive verb, which does not allow conjunction agreement (70a,b), regardless of the order of the elements in the sentence. [32]According to our analysis, this must mean that no element other than the subject is capable of satisfying the EPP. The subject must move to the Spec of ΠP in overt syntax, and may not remain

[32] As with unergative verbs, the order XP-V-Subject corresponds to the pre-verbal element being topicalized and the post-verbal subject being focused.

VP-internal at SPellout, giving rise to conjunction agreement. The structure of (70a) before movement has occurred is given in (70c).

70 a. Stixi pišut/*pišet Svetlov i Danilov
poems-acc write-pl/write-sg-masc Svetlov-masc-nom and Danilov-masc-nom
'Svetlov and Danilov write poems'
b. Ob etom často govorjat/*govorit Andrej i Kolja
about this often talk-pl/talk-sg-masc Andrey-nom and Kolya-nom
'Andrey and Kolya often talk about this'
c.



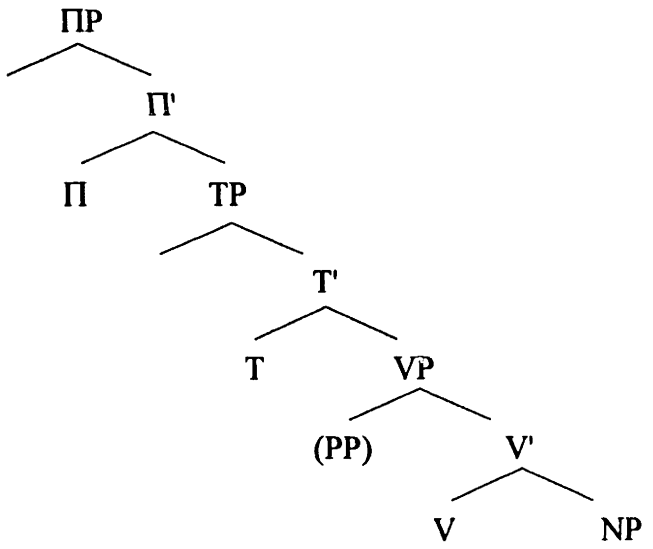
Note that since the direct object NP and the PP argument are in the same minimal domain (that of V or the trace of V) this case is essentially identical to that of (68). As before, the element in the VP - the direct object or the PP - cannot move to the EPP position directly, because the subject NP is closer: the subject c-commands the elements, and it is not in the same minimal domain with the target of movement (Spec of ΠP) or the other candidates for

movement. As a result, neither the direct object nor the PP argument can move directly to the EPP position across the subject.

Movement of direct object to the TP (and the ΠP) projections through an intermediate A-position (the outer Spec of vP) is also disallowed. Note that this option is not available for the PP argument in (68). The derivation in which the direct object moves to these higher positions through the outer Spec of the vP is excluded as not the most economical derivation possible: within it, the subject would have to raise to the Spec of TP, because the object would not be able to check the Case features of T, having already checked its Case features in the outer Spec of vP. As a result, the derivation is blocked by economy conditions - it requires three raising operations (object moving to the Spec of vP and to the Spec of TP and subject moving to the Spec of TP), where two (object moving to the outer Spec of vP and subject moving to the Spec of TP) would suffice for convergence.

Finally, we should make sure that the derivation we have assumed to take place when conjunction agreement surfaces with unaccusative verbs does not involve any illegitimate movement operations, that is, that a PP argument of an unaccusative verb can raise to the EPP position, in preference to the NP argument. The relevant structure is repeated in (71).

71



On the definition of closeness adopted here, the PP and the NP are considered equally close to the target of movement: the PP c-commands the NP, but it is in the same minimal domain (that of V) as the NP is. As a result, both elements can undergo movement out of the VP.

Thus, we have a satisfactory analysis of the distribution of the conjunction agreement phenomenon: it may arise only as a result of covert movement, and so, may surface whenever the subject nominal does not have to move out of the VP in overt syntax, i.e. whenever the PP argument of the verb can satisfy the EPP. This, in turn, is possible only if the verb in the sentence is unaccusative. In all other sentence types, the subject is closer to the EPP position than the PP argument or the direct object NP argument, and this fact renders the operation that raises the PP (or the direct object) to the EPP position illegitimate. Given the fact that movement to the EPP position is feature-driven and that both PPs and NPs may satisfy the EPP, extending the notion of "closeness" to PPs in addition to NPs (such as subjects and direct objects) is a very natural move - in fact, we would have to make some arbitrary

stipulation to exclude PPs from such considerations. Once this approach is adopted, the distribution of Locative Inversion constructions, as well as other processes that depend on it, such as the conjunction agreement, is explained by the system without any additional assumptions or stipulations being necessary.

4. The Genitive of Negation

4.1 A Description

> ...i vse splosnoe uničtoženie i
> ...and everything (is) complete destruction and
> uničiženie. "Vas zdes' ne stojalo".
> humiliation. "You-gen here not stood-sg-neut"
> (Akhmatova, in conversation.
> Chukovskaya, *Zapiski ob Anne Axmatovoj*)

In this chapter, we turn to a description of another pattern that distinguishes the arguments of unaccusative and unergative verbs: the genitive of negation phenomenon. Once again we will demonstrate that viewing the construction from the point of view of restrictions on which elements may satisfy the EPP leads to a very natural analysis. This time, the equation will be somewhat more complex: the construction has not only a clear morphological reflex (genitive case-marking), but also interpretive consequences (the indefinite interpretation of the genitive argument).

We start with a description of the phenomenon and the environments that allow it to surface. Nominal arguments may appear with a genitive case marker under sentential negation. (72) illustrates the pattern for transitive verbs: (72a) contains a "normal" accusative direct object, while (72b) contains a genitive direct object. Genitive case may surface on a direct object only when sentential negation is present (72c). Assignment of this genitive case - the genitive of negation - is traditionally described as optional. This is not completely accurate: the interpretation of the nominals appearing with the genitive case-marking differs

from that of the nominals appearing with accusative case-marking. Only the accusative nominal may have a definite, referential interpretation.

72. a. Ja ne polučil 'pis'ma
I not received letter-pl-acc
'I didn't receive the letters'
∃ x, letters x, (~I received x);
b. Ja ne polučil (nikakix) 'pisem
I not received (neg-kind-pl-gen) letter-pl-gen
'I didn't receive any (kind of) letters'
~∃ x, letters x, (I received x)
c. Ja polučil 'pis'ma/*'pisem
I received letter-pl-acc/*letter-pl-gen
'I received the letters/ (some) letters'

In (72a), where the direct object under negation bears accusative case-marking, the most natural interpretation of the nominal is definite, with a wide scope over negation. On the other hand, in (72b), where the direct object bears genitive case-marking, its interpretation is indefinite, with a narrow scope with respect to negation. Note that the accusative nominal in (72c), where no sentential negation is present, is ambiguous between a definite and an indefinite reading.

Let us now give a more precise characterization of the syntactic domain of the application of genitive of negation. The process cannot apply to nominals base-generated in the subject position, as (73a,b) shows for the subjects of transitive verbs, and (74c,d) shows for the subjects of unergative verbs.

74. a. Nikakie mal'čiki ne polučali pis'ma iz doma
neg-kind-pl-nom boy-pl-nom not received letter-pl-acc from home-gen
'No boys/ none of the boys received-pl letters from home'
b. *Nikakix mal'čikov ne polučalo pis'ma iz doma
neg-kind-pl-gen boy-pl-gen not received-sg-neut letter-pl-acc from home-gen
'No boys received letters from home'

c. Nikakie devočki ne tancevali val's
neg-kind-pl-nom girl-pl-nom danced-pl waltz-acc
'No girls/none of the girls danced the waltz'
d. *Nikakix devoček ne tancevalo val's
neg-kind-pl-gen girl-pl-gen danced-sg-neut waltz-acc
'No girls danced the waltz'

The generalization illustrated above was first formulated by Pesetsky (1982), who showed that genitive of negation may apply only to the nominals base-generated in the direct object position. As (75) shows, the nominal argument of a passive verb and the nominal argument of an unaccusative verb may occur with the genitive case-marking under negation.

75. a. (Vragom) ne bylo vzjato ni odnogo goroda
(enemy-instr) not was-sg-neut taken-sg-neut neg single-gen town-masc-sg-gen
'Not a single town was taken (by the enemy)'
b. Ni odin gorod ne byl vzjat (vragom)
neg single-nom town-masc-sg-gen not was-sg-masc taken-sg-masc (enemy-instr)
'Not a single town was taken (by the enemy)'
c. Ne rasstajalo ni odnoj snežinki
not melted-sg-neut neg single-gen snowflake-fem-sg-gen
'Not a single snowflake melted'
d. Ni odna snežinka ne rasstajala
neg single-nom snowflake-sg-fem-nom snowflake-fem-sg-nom not melted-sg-fem
'Not a single snowflake melted'

There are several points that should be noted about the genitive "subjects" in (75). First, in (75a,c), where the single argument appears in the genitive case, the verbs do not agree with it, but bear the default agreement (3rd person singular neuter) instead. Second, in the sentences with unmarked word order the genitive nominals are most natural in the post-verbal position, although their occurrence in the pre-verbal position is by no means unacceptable (we will have more to say about this later). The genitive arguments behave unlike canonical subjects in these two respects. In addition, they lack some of the properties

which we have taken to identify the elements that occupy the Spec of TP at some point in the derivation. They are unable to act as antecedents of reflexives or to control gerund phrases (76). All of these facts suggest that the genitive nominals appearing with unaccusative verbs do not occupy the subject position at any point - a view that Pesetsky (1982) adopts in his analysis.

76 a. *Ni odnogo mal'čika$_i$ ne bylo ubito u sebja$_i$ doma
neg single-gen boy-gen not was-sg-neut killed-sg-neut at self's house
'Not a single boy was killed in his house'
b Ni odin mal'čik ne byl ubit u sebja doma
neg single-nom boy-nom was-sg-masc killed-sg-masc at self's house
c.*Vozvraščajas' domoj, ni odnogo mal'čika$_i$ ne bylo ubito
returning home, neg single-gen boy-gen not was-sg-neut killed-sg-neut
'Not a single boy was killed while returning home'
d. Vozvraščajas' domoj, ni odin mal'čik$_i$ ne byl ubit
returning home, neg single-nom boy-sg-nom-masc not was-sg-masc killed-sg-masc
'Not a single boy was killed while returning home'
(Pesetsky, 1982:142-143)

Another important generalization concerns the interpretation of accusative and nominative nominals under negation. While the interpretation of genitive "subjects" is identical to the interpretation of genitive direct objects - they have to have an indefinite interpretation and narrow scope with respect to negation - the interpretation of nominative subjects under negation differs from the interpretation of accusative objects. For accusative objects under negation, the narrow scope indefinite interpretation is nearly unavailable. For nominative subjects of unaccusative verbs under negation, this interpretation is much more readily available (77a,b). This pattern is noted as a puzzle in Pesetsky (1982).

77 a.V klasse ne pojavilis studenty
in class not appeared-pl student-pl-nom
'The students did not appear in class', 'No students appeared in class'

b. Ja ne polučila žurnaly
I not received magazine-pl-acc
'I didn't receive the magazines', ??'I received no magazines'

Another point that should be mentioned here is the behavior of verbs of existence under negation. As expected, these typical unaccusatives allow their nominal argument to appear with the genitive case-marking (78a). However, as (78b) demonstrates, with these verbs the genitive of negation applies obligatorily whenever sentential negation is present, regardless of whether their nominal argument is definite or indefinite.

78. a. V gorode ne bylo vrača
in town not was-sg-neut doctor-masc-sg-gen
'There was no doctor in town/ the doctor was not in town'
b. *V gorode ne byl vrač
in town not was-sg-masc doctor-masc-sg-nom
'The doctor was not in town/ there was no doctor in town'

To put this somewhat differently, the Definiteness Effect associated with genitive case for most unaccusative verbs is absent for the verbs of existence, so that nominals with unambiguous definiteness specification, such as proper names, may occur with genitive case-marking under negation (79).

79 a. *V klass ne prišlo Vani
to class not came-sg-neut Vanya-masc-sg-gen
'Vanya did not come to class'
b. Vani netu doma
Vanya-masc-sg-gen not-be home
'Vanya is not home'

So far, we have seen that genitive case may be assigned to all nominals (with the appropriate interpretation) that are base-generated in the direct object position. There is also

another type of an element that may surface with the genitive case-marking under negation - a time adjunct or a measure phrase (80a,b). Note that in non-negated contexts these expression appear with accusative case-marking (80c).

80 a. Vanja ne spal odin čas / odnogo časa
Vanya not slept one-sg-acc hour-acc-sg / one-sg-gen hour-sg-gen
1. acc: 'There was an hour during which Vanya did not sleep'
2. gen: 'Vanya did not sleep for a single hour'
b. Eta kniga ne stoit dva rublja /dvux rublej
this book not costs two-acc rouble-sg-gen / two-gen rouble-pl-gen
1. acc: 'The price of this book is not two roubles'
2. gen: 'This book is not worth two roubles'
c. Vanja spal odin čas
Vanya slept one-acc hour-sg-acc
'Vanya slept for an hour'

Pesetsky (1982) analyzes such sentences as instances of the genitive of negation assignment. Within his framework, this rule applies to all elements dominated by a VP, regardless of whether they are theta-marked by the V or not. The ability of time adjuncts to surface with genitive of negation is used as an argument in favor of treating it as a structural, rather than an inherent, Case: as (80) shows, it does not have to be assigned in conjunction with a theta-role. However, this analysis has been disputed: Franks and Dziwirek (1993) argue that the source of the genitive case-marking on the adjunct phrases is different from that on the direct object - according to them, adjuncts bear partitive Case, whose morphological realization is identical to the morphological realization of genitive Case for the majority of Russian nouns. Based on a survey of a number of Slavic languages, Franks and Dziwirek come to the conclusion that the use of partitive Case in a language is a necessary condition

for the ability of genitive to surface on adjuncts, while the use of genitive Case on direct objects under negation is not.[33]

The final property of the genitive of negation that we should describe is its inability to occur in the positions to which lexical case is assigned. A number of Russian verbs assign lexical (non-accusative) case to their complements, as (81a) illustrates for the verb *pomoč'* - 'to help' - whose object must appear with dative case-marking in non-negated environments. Note that a dative direct object may be ambiguous between a definite and an indefinite interpretation, just as an accusative object. When a verb that assigns lexical case occurs under sentential negation, genitive case-marking cannot surface on its direct object regardless of its interpretation (81b). As a consequence, a direct object bearing lexical case is ambiguous between a definite and an indefinite interpretation under negation unless an overt quantifier is supplied, as in (81b).

81. a. Ja pomogala etomu stariku / *etogo starika
I helped this-dat old-man-dat / *this-acc old-man-acc
'I was helping this old man'
b. Ja ne pomogala *ni odnogo starika/ ni odnomu stariku
I not helped neg single-gen old-man-gen / neg single-dat old-man-dat
'I was not helping any old men'

As we have already mentioned (section 3.1), the distribution of genitive of negation with intransitive verbs is very similar to the distribution of conjunction agreement. However, there are two environments where conjunction agreement does, and genitive of negation does not, occur. Specifically, genitive of negation cannot surface on the subjects of small clauses,

[33] The accuracy of this cross-linguistic generalization (and the partitive analysis in general) has been disputed in Borovikova (1996).

while conjunction agreement is possible with predicates that take small clauses as complements (82c,d). In addition, genitive of negation cannot surface in sentences containing "composite unaccusatives", where conjunction agreement is possible as well (82a,b).

82. a. K beregu bežal Kolja i Vanja
to shore ran-sg-masc Kolya-sg-nom and Vanya-sg-nom
'To the shore ran Kolya nad Vanya'
b.*K beregu nikogo ne bežalo
to shore nobody-gen not ran-sg-neut
'Nobody ran to the shore'
(c)??Ja ne sčitaju ni odnoj devočki idiotkoj
I not consider neg single-gen girl-gen idiot-sg-fem-instr
'I don't consider a single girl an idiot'
(d) Glavnoj zabotoj byla kuxnja i obed
main-instr concern-instr was-sg-fem kitchen-sg-nom-fem and dinner-sg-nom-masc
'The kitchen and the dinner were the main concern'

Let us briefly outline the analysis of the genitive of negation phenomenon developed by Pesetsky (1982), which we take as the starting point for our own analysis. First of all, the genitive nominals in the genitive of negation construction are analyzed as NP complements of a phonologically null Quantifier, as illustrated in (83a). The null Quantifier assigns genitive case to its complement NP, as all non-adjectival quantifiers in Russian do. The relationship between negation and the genitive case-marking on the object is rather indirect - negation does not assign this Case, but, rather, "identifies" the null Quantifier under c-command, supplying it with the features necessary to act as a Quantifier at LF.

83 a. Ja ne čitaju $[_{QP}\ [_{Q'}\ [_{Q}\ e\ ]\ [_{NP}$ knig $]]]$
I not read book-pl-gen
'I don't read books'
b. $[_{IP}\ [_{QP}\ [_{Q'}\ [_{Q}\ e\ ]\ [_{NP}$ pis'ma $]]_i\ [_{IP}\ e\ [_{VP}$ ne prišlo $[_{NP}\ t_i\ ]]]]]$
letter-gen not came-sg-neut
'No letter came'

c.* [$_{IP}$ e [$_{VP}$ ne prišlo [$_{QP}$ [$_{Q'}$ [$_{Q}$ e] [$_{NP}$ pis'ma]]]]]
not came-sg-neut letter-gen
'No letter came'

The properties of the genitive of negation constructions stem from the fact that in sentences like (83a) a non-NP (a QP in this case) is base-generated in a position where an NP is categorially selected[34]. It is assumed that c-selection does not have to hold at all levels of representation, but only at LF. Unless the QP raises from its base-generated position at LF, the sentence will be ungrammatical (see (83c)): it violates c-selection because a QP, rather than an NP, is occupying the direct object position. Thus, the QP must undergo QR, producing the structure in (83b). It is assumed that traces of movement may be of any category, as long as the resulting configuration satisfies all the relevant principles of grammar. In particular, a QP may leave an NP trace when it moves. In fact, it must do so when it moves from the direct object position, where an NP is c-selected: a trace of any other category (including QP) would violate c-selection, and the resulting configuration would be ungrammatical, in the same way that (83c) is. Of course, since QR is forced for QPs base-generated in the direct object position, only the quantificational (non-referential, narrow scope) interpretation is available for them.[35]

With the help of the machinery described above, it is possible to explain why QPs may only be base-generated in the direct object position. The traces of the QPs that have

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[34] Subcategorization is treated as consisting of two components: positional selection and categorial selection. A verb like 'read' has a subcategorization frame of +[_NP], positionally selecting an object, and categorially selecting an NP.

[35] Note that for this argument to work, QR must be the only movement operation available for the QPs. In particular, movement to the subject position (to which c-selection does not apply) must be ruled out. This is done with the help of a mechanism that we will not describe for reasons of space.

undergone QR at LF fall within the domain of the ECP and must be properly governed. It is argued that a chain is a legitimate syntactic object only if the antecedent and the trace contribute non-conflicting categorial features. As a result, a chain consisting of a QP antecedent and an NP trace cannot be formed, and an NP trace left by QR cannot be antecedent-governed. Thus, if the NP trace of a QP is to obey the ECP, it must be lexically governed. This is the desired conclusion: the trace is lexically governed in (84a), where it occurs in the direct object position, but not in (84b), where it occurs in the subject position.

84 a. $[_{IP}\ [_{QP}\ [_{Q'}\ [_{Q}\ e\ ]\ [_{NP}$ pis'ma $]]_i\ [_{IP}\ e\ [_{VP}$ ne prišlo $[_{NP}\ t_i\ ]]]]$
letter-gen not came-sg-neut
'No letter came'

.c. *$[_{IP}\ [_{QP}\ [_{Q'}\ e\ [_{NP}$ pis'ma $]\ ]]_i\ [_{IP}\ [_{NP}\ t_i\ ]\ [_{VP}$ ne tancevalo $]]]$
letter-gen not danced-sg-neut
'No letter danced'

One more assumption is necessary to explain the inability of QPs to occupy lexically Cased positions, namely, the assumption that they cannot bear Case-features and are not subject to the Case Filter. Assignment of structural Case (i.e. nominative, accusative, and genitive) is optional in this system[36], while assignment of lexical case is obligatory. Because there exists a close connection between lexical case and theta-marking, it is assumed that for predicates that assign lexical case, theta-assignment and lexical case-assignment are one process: if lexical case is not assigned to the complement, a theta-role cannot be assigned to it either. As a result, an element unable to bear Case, such as a QP, may occur as a complement of a standard transitive verb (in the sentences where the verb fails to assign accusative Case),

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[36] Of course, NPs not bearing case-features will violate the Case Filter, so in most environments assignment of structural Case is still forced.

but it may not occur as a complement of a transitive verb that assigns lexical case (if the verb fails to assign it, the Theta Criterion is violated, and if the verb assigns it, the QP has to bear Case-features).

Finally, the behavior of the small class of verbs of existence, whose argument always bears genitive case, regardless of its interpretation (see (85a,b)), is explained in the following way: these verbs are unaccusatives and, just like all other unaccusative verbs, they do not assign Case to their complement position; they differ from all other verbs in Russian in not co-occurring with Agreement, so that nominative Case cannot be assigned to their "subject" (85b). Thus, only the elements that do not require Case, namely QPs, may occur as arguments of these verbs.

85 a. Vani netu doma
Vanya-gen not-be home
'Vanya is not home'
b. *Vanja netu doma
Vanya-nom not-be home

The non-quantificational (definite, wide scope) interpretation of the argument of these verbs is possible because they do not to c-select any category. In the absence of c-selection, nothing forces a QP base-generated in the direct object position to undergo QR and be interpreted quantificationally. However, because QR is assumed to occur freely, it may still apply to an argument of a verb of existence, producing the quantificational (indefinite, narrow scope) interpretation for the genitive nominal.

An important feature of the analysis we have summarized above is that genitive of negation is seen as only one instance of a more general phenomenon: a number of other constructions are viewed as non-NPs base-generated in the positions where an NP is

c-selected. As a result, they have the properties characteristic of the genitive of negation: they occur only in the direct object position, have "quantificational" interpretation, and cannot bear lexical Case. According to Pesetsky, this is true of no-agreement numeral phrases (86a), *po*-phrases (86b), free infinitival relatives (86c), and Secondary Predicates (which are analyzed as Small Clauses in this system) (86d).

86 a. Mne prišlo pjat' pisem
I-dat came-sg-neut five-nom letter-pl-gen
'Five letters came for me'
b. V mesjac prixodilo po pis'mu
in month came-sg-neut *po* letter-sg-dat
'One letter came each month'
c. Mne prišlo [čto$_i$ čitat' t$_i$]
I-dat came-sg-neut what read-inf
'I got what to read'
d. Maša$_i$ prišla [t$_i$ pjanoj]
Masha-nom-fem came-sg-fem drunk-sg-fem-instr
'Masha came drunk'

In the next section, we begin the process of developing and justifying our treatment of genitive of negation. Our goal is to produce a unified analysis of the behavior of genitive Case in morphology and syntax: within both modules of grammar, abstract Cases will be viewed not as atomic units, but as sets of more basic case features. Within syntax, these basic features will be manipulated by familiar processes such as feature-checking, giving rise to the genitive-accusative case alternations. Within morphology, these features will be the units on which Redundancy Rules and Impoverishment Rules operate, giving rise to case syncretism. We begin with a description of the morphological component in Russian.

4.2 Genitive Case in Morphology and Syntax[37]

In this section we provide an explicit morphological analysis of the Russian Case system formulated within the Distributed Morphology framework. In a sense, this is a digression from the syntactic plot of this work. Therefore, the reader who is interested neither in morphology nor in the intricacies of Russian Case is invited to read to the end of this paragraph and skip to the beginning of the next section. In our analysis the six "abstract Cases" of Russian are viewed as bundles of more basic syntactically meaningful features, in a spirit similar to that of Jacobson (1958). Informally speaking, genitive and accusative case are treated as two distinct manifestations of a more general "objective" case, with genitive case acting as its default realization, and accusative case acting as its more marked realization. Anticipating our discussion of Case feature manipulation within syntax, we can say that the set of case features representing accusative Case has to be present on a nominal that moves through an "agreement" position in the course of a derivation. The more default set of case features representing genitive Case surfaces in all situations when this "extra step" has not taken place. Within the realm of morphology, the pervasive accusative-genitive syncretisms are the result of the operation of Impoverishment Rules, which delete one (or more) of the features in a feature matrix entering the morphological component of the grammar. The resulting "impoverished" feature specification is spelled out as a more default, general morpheme. Thus, when one of the features within an accusative Case specification is deleted, a genitive Case specification is produced and genitive case-marking surfaces.

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[37] This section owes much to the ideas and suggestions of Morris Halle, Alec Marantz, David Pesetsky, and the participants of July 1996 MorphBeer.

Within the framework of Distributed Morphology, developed in Halle & Marantz (1993), a sharp distinction is made between the feature specifications of nodes within syntax and the feature specifications of vocabulary items. Within syntax, nodes are assumed to be fully specified for all the features that play a role in syntactic operations.[38] For instance, in a syntactic framework that utilizes Agr Phrases, each Agr node must be assumed to have a number, gender, and person specification, even though some of these features may end up not having a morphological realization. An important property of this morphological theory is late insertion of vocabulary items (morphemes). That is, in contrast to the Minimalist Framework, where vocabulary items (such as verbs and nouns) are drawn from the lexicon fully inflected, and check their features against the features of phonologically null functional heads, Distributed Morphology claims that vocabulary items are inserted after Spellout, so that syntactic operations manipulate the bundles of features dominated by terminal nodes, rather than vocabulary items. The complexes of terminal nodes produced in the course of the syntactic derivation serve as input to the morphological component, where vocabulary items are inserted into the terminal nodes. For instance, the verb stem, the tense marker, and the agreement marker are discrete units within syntax (corresponding to the V, T, and Agr nodes), which may have been concatenated into a V-T-Agr head as a result of head movement; within the morphological component, separate vocabulary items will be inserted into each of the terminal nodes.

In contrast to syntactic nodes, vocabulary items in the Lexicon may be underspecified for any of the features relevant within syntax. Consider the example of Russian nominals[39].

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[38] This means that all the features, whose presence is required by general principles or necessary for convergence, are present. As we have already mentioned, -Interpretable features may be absent on nominals if the derivation may converge without them.

The complex head that serves as the input for the morphological component has (at least) the features given in (87a). This input undergoes some modification before the process of vocabulary insertion takes place. For instance, a Theme morpheme that has no syntactic function is inserted and the Number and Case nodes are fused, so that the nominal confirms to the morphological template of Russian nominals and adjectives, given in (87b).

87 a. $[_N$ Gender] + $[_{Num}$ Number] + $[_{Case}$ Case]
b. [[stem + Theme] + [Number-Case]
c. /stol/ [-animate, Class II, masc] + /o/ Theme + [+Pl, Nominative]
d. /o/ = [Class II, neut,-Pl, Nom]; /a/ = [Class I, -Pl, Nom]; /y/ = [+Pl, Nom] ; 0 = [ ]
e. /stol/ + /o/ + /y/

A nominal stem is drawn from the lexicon and inserted into the N node of (87b). In Russian, nominal stems are specified for animacy, gender, and Declension Class features. An example of the configuration that may arise as a result of stem and Theme vowel insertion is given in (87c). (87d) lists the lexical entries for a subset of the Russian case-number morphemes (namely, those that may serve as the realizations of nominative case). The first thing to note about these lexical entries is that none of them contain a specification of all the features that are present in the environment into which they will be inserted (87c). The number and the type of the features that are present in the lexical entries differ: the vocabulary items have anywhere from four to zero features present in their lexical entries. In general, within Distributed Morphology, the least number of features necessary to ensure correct vocabulary insertion is used.

Let us give a more explicit description of the process of vocabulary insertion within

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[39] In this discussion I follow the analysis of the Russian declension developed in Halle (1993).

this framework. A vocabulary item is inserted into a node if it matches all or a subset of the grammatical features specified in that node. Insertion cannot take place if the vocabulary item contains any feature not present in the node.[40] When more than one vocabulary item meets the insertion conditions above, the item matching the greatest number of features present in the node is chosen.[41] In our example, the vocabulary items /o/ and /a/ do not match the features present in the environment into which they are to be inserted (87c). However, both the morpheme /y/ and the morpheme /0/ do meet the insertion conditions: they contain no features that are not present in the input node. The morpheme /y/, which has two features that match the features of the insertion site, is more highly specified than the morpheme /0/, which has no features that match the features of the insertion site (being the default case-morpheme). As a result, /y/ is chosen for insertion, producing (87e).

A morphological process that is central to our analysis of Russian Case is the operation of Impoverishment Rules, which may delete the specification of a given feature in a node that serves as the environment for vocabulary insertion. The process of impoverishment may result in the marked value of a feature changing to the unmarked value, or it may result in the value of a feature deleting altogether. However, it cannot result in the unmarked value of a feature changing to the marked value. For instance, in a language where [+feminine] is the marked value of the gender feature and the Redundancy Rule in (88a) and the Impoverishment Rules in (88b,c) operate, a [+fem] feature value may be changed to a [-fem] feature value (this happens if the Impoverishment Rule (88b) applies before the Redundancy

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[40] Note that some features play no role within syntax and are never present on the nodes entering morphology. This is true of the phonological features, animacy features, and Declension Class features. The presence of these features on the vocabulary items does not prevent them from being inserted into a node that lacks them.

[41] Actually,

Rule (88a)), or a [+fem] feature value may be changed to a null gender specification [ ] (this happens if the Impoverishment Rule (88b) applies after the Redundancy Rule (88a)). A [-fem] feature value may be changed to a null gender specification [ ] as well (this happens in the Impoverishment Rule (88c) applies after the Redundancy Rule (88a)). However, no ordering of (88a), (88b), and (88c) can produce the change from a [-fem] feature value to the [+fem] feature value. In what follows, we will informally describe the operation of Impoverishment Rules as changing a marked value of a feature to an unmarked value, but it should be remembered that such a change is the result of the operation of an Impoverishment Rule followed by the operation of a Redundancy Rule.

88 a. [ ] -> [-fem]
b. [+fem] -> [ ] / in env ...
c. [-fem] -> [ ] / in env ...

No further restrictions are placed on the operation of Impoverishment Rules. As a result, they are an extremely powerful device. Based on our discussion of Russian Case, we will suggest that there may be restrictions not only on the operations which Impoverishment Rules may perform, but also on the environments in which they may apply.

Let us turn to the underlying feature specifications for the Russian Case system. The analysis we propose is given in (89a). Note that these combinations of features correspond to the representation of syntactic nodes, not to the representation of vocabulary items (which may be underspecified). The six abstract Cases of Russian are represented using three basic features: +/- Structural, +/- Objective, and +/-Agreement. However, the resulting system has

only six Cases, not eight - some feature combinations do not occur. This fact is expressed with the feature co-occurence restriction rule in (89b).

89 a.

	Nominative	Accusative	Genitive	Dative	Instrumental	Prepositional
structural	+ STR	+STR	+STR	-STR	-STR	-STR
objective	-OBJ	+OBJ	+OBJ	+OBJ	-OBJ	+OBJ
strong agr	+AGR	+AGR	-AGR	+AGR	+AGR	-AGR

b. * [-OBJ, -AGR]

The unmarked values of the case features are given by the Redundancy Rules in (90).

90 a. [ ] -> [+STR]
b. [ ] -> [-OBJ]
c. [ ] -> [-AGR]

Note that for the Agreement feature, the value [+AGR] is unmarked in the presence of a [-OBJ] feature, and the value [-AGR] is unmarked in all other environments.[42]

Within our analysis, the notion of "nominative" or "accusative" case, which we have used up to this point, is an abbreviation: within syntax and morphology, a particular case IS the combination of the more basic features, specified in (89). This is entirely parallel to the situation in Phonology, where a particular phoneme of a given language is a bundle of (hierarchically arranged) features.[43]

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[42] (90c) cannot apply in the environment _ [-OBJ], given the co-occurence restriction rule in (89b). Because nodes have to be fully specified for Case features in this framework, [+AGR] will be supplied in this environment.

[43] There is an alternative way of looking at the system in (89), which comes closest to the view of morphology advocated in Lumsden (1992): we could have the underlying representation of the cases underspecified, as in (i), with the features in (i) corresponding to the bundles that can be present on a base-generated nominal node.

There are several points that should be noted about the analysis given above. First, the redundancy rules of (90) ensure that a nominal without a case feature specification will be interpreted as [+STR, -OBJ, +AGR], that is, as nominative, by the morphological component. This gives the correct result that nominative case is the syntactic default in Russian, that is, that nominals that occur in syntactic environments that lack case-assigners are realized as nominative. Second, while our primary concern here is with morphologically conditioned alternations, the basic features are intended to be syntactically meaningful as well: they should define not only the natural classes that exist in morphology, but also the natural classes that exist in syntax.

With this in mind, let us explain what syntactic notions the basic features represent. Dative, prepositional, and instrumental cases share the feature [-STR], which roughly corresponds to the notion of inherent case, that is, case assigned to elements that bear a specific theta-role (e.g., the dative case typically born by Goal arguments in Russian, instrumental case typically born by Instrument arguments, etc.). Nominative, accusative, and genitive cases share the feature [+STR], which roughly corresponds to structural cases, that is, case assigned not to elements bearing a specific theta-role, but to elements occurring in a specific structural position. Note that genitive case belongs to this group - it may surface on

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(i)

	Nominative	Accusative	Genitive	Dative	Instrumental	Prepositional
structural				-STR	-STR	-STR
objective		+OBJ	+OBJ	+OBJ		+OBJ
agreement		+AGR			+AGR	

Only the features that cannot be supplied by the redundancy rules in (90) are present in such an underlying specification. Redundancy rules would apply to these feature specifications within syntax, producing the full feature sets given in (89). The two ways of approaching the featural specification of nodes within syntax are equivalent for our purposes here.

nominals with any theta-role, provided they occupy the appropriate position. For instance, Theme, Agent, and Experiencer arguments receive genitive case when they occur as complements of Nouns.

Accusative, genitive, dative, and prepositional cases share the feature [+OBJ], which loosely corresponds to the notion of case that can surface on a nominal base-generated as a complement of some head (verbal, nominal, or prepositional). Nominative and instrumental are identical in terms of their features ([-OBJ, + AGR]), except for the [-STR] specification of the instrumental case. This captures the similarity of the distribution of the two cases, both of which may surface on nominal and adjectival predicates. Similarly, accusative and dative are identical in terms of their features ([+OBJ, +AGR]), except for the [-STR] specification of dative case. The existence of dative Goal objects occurring with ditransitive verbs suggests that dative has a [+OBJ] feature. The plausibility of analyses in which indirect objects raise to the Spec of AGrIOP, just as direct objects raise to the Spec of AgrOP, suggests that dative has an [+AGR] feature.

The central issue for us is the morphological (and syntactic) representation of the three structural cases; however, it is important to note that the feature specifications we have assumed for them produce sensible representations of the remaining (non-structural) cases, as well. Recall that we have defined [+STR] cases as those that are not assigned in conjunction with a specific theta-role. Accusative and genitive cases have a [+OBJ] feature, that is, they may surface on nominals base-generated as complements of lexical heads. In addition, nominative and accusative Cases have a [+AGR] feature that distinguishes them as the cases that may move through "agreement" positions in syntax. If a nominal lacking a [+AGR]

feature moves through an agreement position, the derivation will not converge. At this point, we have not justified the syntactic "translations" of the case features. For now, our task is to show that the natural classes we have created and the relative markedness of feature sets we have described have morphological reality.

Let us see how the feature specification of Russian Cases proposed here accounts for the instances of case syncretism found in Russian. The case paradigms for the nominals of Class I, Class II, and Class III are given in (91).

91 a. Singular

	Class I	Class II	Class II	Class II	Class III
	'lip'	'reason'	'tsar'	'chisel'	'bed'
Nom	gub+a	um+0	car'+0	dolot+o	krovat'+0
Acc	gub+u	um+0	car'+a	dolot+o	krovat'+0
Gen	gub+y	um+a	car'+a	dolot+a	krovat'+i
Dat	gub'+e	um+u	car'+u	dolot+u	krovat'+i
Prep	gub'+e	um'+e	car'+e	dolot'+e	krovat'+i
Instr	gub+o+j+(u)	um+o+m+0	car'+o+m+0	dolot+o+m	krovat'+j+u

b. Plural (same for all declensions)

	Class I	Class II	Class II	Class II	Class III
	'lip'	'reason'	'tsar'	'chisel'	'square'
Nom	gub+y	um+y	car'+i	dolot+a	krovat'+i
Acc	gub+y	um+y	car'+e+j+0	dolot+a	krovat'+i
Gen	gub+0	um+o+v+0	car'+e+j+0	dolot+0	krovat'+e+j+0
Dat	gub'+a+m+0	um+a+m+0	car'+a+m+0	dolot+a+m+0	krovat'+a+m+0
Prep	gub'+a+x+0	um'+a+x+0	car'+a+x+0	dolot'+a+x+0	krovat'+a+x+0
Instr	gub+a+m+i	um+a+m+i	car'+a+m+i	dolot+a+m+i	krovat'+a+m+i

Note that the phonological segment following the stem of a nominal is not a single morphological unit, but decomposes into a Theme vowel (see (87b,c)), which has different phonological realizations depending on the gender and Declension Class of the stem,[44] an additional "augment" suffix, present in certain cases and Declension Classes, and the case-number morpheme. The zero case-marker, represented as /0/ above, is actually the abstract vowel Yer, which has a phonological realization only if another Yer is present in the following syllable.

The patterns we are primarily interested in accounting for are the accusative-genitive syncretism and the accusative-nominative syncretism. A pre-theoretical description of the two patterns appears extremely complex: in the singular, nominals of Class I (the majority of which are feminine) have distinct nominative, accusative, and genitive case-markers; nominals of Class II (which are masculine and neuter) lack a distinct accusative case-marker - if the nominal is animate, its accusative case-marker is identical to its genitive case-marker, if the nominal is inanimate, its accusative case-marker is identical to its nominative case-marker; nominals of Class III (the majority of which are feminine) have an accusative case-marker that is identical to the nominative case-marker regardless of their animacy specification. In the plural, nominals of all declensions lack a distinct accusative case-marker: it is identical with the nominative case-marker for the inanimate nominals, and identical with the genitive case-marker for the animate nominals. For pronouns, the accusative case-marker is always identical to the genitive case-marker. Feminine adjectives follow the pattern of Class I

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[44] Recall that the Theme vowel is deleted if it is followed by another vowel, i.e. if no augment suffix is inserted and the case-marker begins with a vowel. There are further phonological processes that affect the case suffixes, which we will not attempt to deal with here.

nominals and masculine and neuter adjectives follow the pattern of neuter and masculine Class II nominals. The patterns of accusative-genitive syncretism and accusative-nominative syncretism are summarized in (92).

92 a. all singular Class I nominals, all feminine singular adjectives:
Nom - Acc - Gen
b. singular Class II animate nominals, singular masculine animate adjectives, pronouns, plural animate nominals of all declensions, plural animate adjectives:
Nom - {Acc/Gen}
c. singular Class II inanimate nominals, singular masculine inanimate adjectives, all singular Class III nominals, plural inanimate nominals of all declensions, plural inanimate adjectives:
{Nom/Acc} - Gen

Within the framework of Distributed Morphology there are two distinct ways in which case syncretism may come about: it may be the result of the operation of an Impoverishment Rule that deletes the marked value of a given case feature in the input to lexical insertion, or it may be the result of underspecification of vocabulary items that compete for insertion into the input node. Vocabulary underspecification is advantageous from the point of view of learnability: a child's task is easier if fewer lexical items (or rules) have to be learned. If a given case-marker is underspecified with respect to a feature that distinguishes two abstract Cases (as the feature [+/-OBJ] distinguishes the Russian nominative and accusative case), it will not be necessary for a child to learn two separate lexical items with their feature specifications - only one will do. Impoverishment Rules have no such learnability "bonus": the morpheme corresponding to the original feature specification and the morpheme corresponding to the "impoverished" feature specification ma exist in the language and have to be learned.

The two approaches embody very different notions of paradigm deficiency: if syncretism is caused by vocabulary underspecification, it is an accidental property of the system - had the lexical items in the language had a slightly different feature specification, the syncretism would not be observed. On the other hand, if syncretism is caused by the operation of an Impoverishment Rule, it is not accidental in any sense, but represents a meaningful generalization about the morphology of the given language. The generalization concerns morphology alone: Impoverishment Rules do not have interpretive consequences - their operation occurs after Spellout and consists in manipulating formal features, rather than changing the meaning of utterances in any way.

With respect to the accusative-genitive syncretism in Russian, it is fairly clear that it is caused by the operation of a general Impoverishment Rule. With respect to the accusative-nominative syncretism, both an Impoverishment Rule explanation and a vocabulary underspecification explanation are possible. We will present both approaches, discussing their relative merits.

Let us spend a moment to examine how the feature specification of the Russian Cases given in (89) allows us to account for both the case syncretism under discussion and the other instances of case syncretism observed in Russian. As with the syntactic interpretation of the case features, our concern is that the feature analysis proposed here permits a natural treatment of the processes that affect the -Structural cases, as well as those that affect the +Structural ones. Whatever the mechanism responsible for case syncretism, the two (or more) cases involved in the process have to form a natural class. Thus, the syncretism of accusative ([+STR, +OBJ, +AGR]) case and genitive ([+STR, +OBJ, -AGR]) case can be

seen as a process that (in one way or another) neutralizes the [+/-AGR] specification. Similarly, the syncretism of accusative ([+STR,+OBJ, +AGR]) and nominative ([+STR, -OBJ, +AGR]) case can be seen as a process that neutralizes the [+/-OBJ] specification.

But what about the other instances of syncretism? One fairly common type of case syncretism is that of the dative ([-STR,+OBJ, +AGR]) and prepositional ([-STR,+OBJ,-AGR]) cases, which occurs with Class I nominals. This process can be viewed as the neutralization of the [+/-AGR] feature specification, a parallel of the accusative-genitive syncretism. Another instance of case syncretism observed in Russian is that of the genitive ([+STR,+OBJ,-AGR]) and the prepositional ([-STR,+OBJ,-AGR]) cases, which occurs in the declension paradigm of plural adjectives. It can be characterized as the neutralization of the [+/-STR] specification for these two cases. Within the declension paradigms of the singular Class III nominals, the genitive, dative, and prepositional cases are collapsed. This process can be characterized as taking place in two steps: first, the dative ([-STR,+OBJ,+AGR]) is collapsed with the prepositional ([-STR,+OBJ,-AGR]) case, as a result of losing its [+ AGR] value, and then the prepositional case is collapsed with the genitive ([+STR,+OBJ,-AGR]) case, as a result of losing its [-STR] value. This is in effect a combination of two separate syncretism processes we have already described.[45] Finally, within the declension paradigm of feminine adjectives genitive, dative, instrumental, and prepositional cases are collapsed. Such massive syncretism is best characterized in terms of vocabulary items' underspecification. Thus, the three case-markers of this paradigm would be

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[45] Note that we have described the process in term of the operation of impoverishment rules. Alternatively, we could say that for this declension paradigm (where nominative and accusative cases are also collapsed) there are three case morphemes: a nominative case-marker [+STR,+AGR], an instrumental case-marker [-STR -OBJ], and an "elsewhere" case marker, not specified for any case features

analyzed as accusative - [+STR,+OBJ,+AGR], nominative - [+STR,-OBJ], and an elsewhere case-marker with no case features present in its lexical entry. As the discussion above shows, the feature system proposed here does not lead to problems in analyzing the instances of syncretism that affect the -Structural cases.

Before we can proceed to characterize the accusative-genitive case syncretism, we need to provide a more articulated description of the other features present in the lexical entries of Russian nominals. We assume that the lexical entries of the nominal stems have a specification for gender, animacy, and Declension Class. Note that both gender and animacy are syntactic, rather than semantic, in Russian because they are not entirely predictable from the meaning of a nominal. Number is specified for a nominal stem only if the nominal is exceptional in being obligatorily plural. The grammatical features that play a role in the morphology of Russian nominals are given in (93).

93 a. Number: [+/-Pl]
b. Gender: fem = [+fem, -neut]; masc = [-fem, -neut]; neut = [-fem,+neut];
c. Animacy: [+/- animate]
d. Declension Class: Class I, Class II, Class III
e. *[+fem,+neut]

Of these, number and gender are the features that play a role both in syntax and morphology, and animacy and Declension Class are the features that are relevant in morphology only.[46] The fact that there are only three, not four, genders in Russian is expressed by the feature co-ocurrence restriction rule in (93e), which rules out the possibility of a feminine and neuter

[46] We do not discuss the person specification, because it is not relevant to the Case system of nominals, but for the sake of expliciteness we can assume that the default (3rd person) specification is supplied to the nominals by Redundancy Rules of the form similar to that of (94).

gender specification. The unmarked feature values are provided by the Redundancy Rules given in (94).

94 a. [ ] -> [-Pl]
b. [ ] -> [-fem]
c. [ ] -> [+neut]
d. [ ] -> [-animate]

The gender, number, and animacy of Russian nominals are represented with the basic features in (93). Thus, the "neuter" gender is the combination of features [-fem, +neut], just as the "nominative" Case is the combination of features [+STR,-OBJ,+AGR]. The feature analysis in (93) and (94) correctly predicts that neuter, singular (inanimate) is the default feature specification in Russian. That is, if a nominal without a phi-feature specification enters the morphological component, it will be interpreted as an inanimate, neuter, singular nominal. This is of course the morphological form of the default verbal agreement in Russian, as well as the features of such elements as arbitrary *pro* and expletive-like elements *eto* and *to*.

One other property of the system that deserves mention is the treatment of the value [-animate] as the unmarked specification of syntactic animacy. This represents an asymmetry noted by Jacobson: syntactically inanimate nominals may refer to both animate and inanimate entities, but syntactically animate nominals may only be used to refer to animate entities. For instance, the nominals *suščestvo* 'being' and *nasekomoe* 'insect' are syntactically inanimate, but refer to animate entities.

Now, we are in a position to give a description of the accusative-genitive case syncretism, as well as the accusative-nominative case syncretism. We will utilize Impoverishment Rules as the mechanism for accomplishing this task. Since the

accusative-genitive syncretism is such a wide-spread and general phenomenon in Russian morphology, it seems highly desirable to characterize this pattern with one general rule that applies in a single environment. Let us first provide this general Impoverishment Rule and then discuss the mechanisms that ensure that the environment of this Impoverishment Rule is met only in the appropriate cases. The rule is stated in (95a).

95 a. [+AGR] -> [ ] / [+animate] [+STR,+OBJ] _.
b. [+fem] -> [ ] / _ [+Pl]
c. [+animate] -> [ ] / _ [+fem]

There are two things that should be noted about the Impoverishment Rule in (95a). First, as a result of its operation, the marked value of one of the case features [+AGR] is changed to the unmarked value [-AGR]. Thus, the accusative case specification - [+AGR, +STR, +OBJ] - becomes the genitive case specification - [-AGR, +STR, +OBJ]. Second, the environment of the rule's application is the marked value of one of the nominal grammatical features (+animate). Note that in analyzing this instance of syncretism as Impoverishment we are claiming that the accusative-genitive syncretism is a general property of Russian nominal morphology, rather than an epiphenomenon arising from the way case-markers happen to be represented in the lexicon.

Let us explain why only the appropriate forms (those listed in (92b)) undergo the Impoverishment Rule responsible for the accusative-genitive syncretism. The environment of the rule's application is a [+animate] feature specification. The set of Impoverishment Rules in (95b,c) neutralizes the [+animate] feature in all nominals, except those that display the syncretism. Let us go through these Impoverishment Rules in more detail. (95b) states that

the marked value of one of the gender features (+fem) reverts to the unmarked value (-fem). Note that the environment of this rule's application is the marked value of one of the nominal grammatical features (+Pl). As with the rule in (95a), this Impoverishment Rule states that it is not an accident that feminine nominals (+fem,-neut) have the same case-markers as masculine nominals (-fem, -neut) throughout the plural case paradigm.

(95c) states that the marked value of the animacy feature (+animate) reverts to the unmarked value (-animate) in the environment of the marked value of the gender feature (+fem). Again, this rule makes the claim that it is not an accidental property of the Russian lexicon that the case-markers that attach to feminine stems never vary depending on the animacy of the nominals.

Let us see how the Impoverishment Rules in (95) operate on the relevant types of nominals. Put simply, they prevent a plural nominal from being specified as feminine, and a feminine nominal from being specified as animate. As a result, only the appropriate forms have the [+animate] feature specification, required for the application of rule (95a). (96) shows how the block of impoverishment rules operates on accusative animate nominals of each Declension Class in the singular and plural.

96 a. /mam/ [-Pl, +fem, +animate, Class I] + [+STR, +OBJ, +AGR] **<Acc>**
(95b) does not apply;
(95c) applies - [-Pl, +fem, -animate, Class I] + [+STR,+OBJ,+AGR]
(95a) does not apply - [-Pl, +fem, -animate, Class I] + [+STR,+OBJ, +AGR] **<Acc>**

b. /mam/ [+Pl, +fem, +animate, Class I] + [+STR, +OBJ, +AGR] **<Acc>**
(95b) applies - [+Pl, -fem, +animate, Class I] + [+STR,+OBJ,+AGR],
(95c) does not apply;
(95a) applies - [+Pl, -fem, +animate, Class I] + [+STR,+OBJ, -AGR] **<Gen>**

c. /otec/ [-Pl, -fem, -neut,+animate, Class II] + [+STR, +OBJ, +AGR] **<Acc>**
(95b) does not apply;
(95c) does not apply;
(95a) applies - [-Pl, -fem, -neut, +animate, Class II] + [+STR,+OBJ, -AGR] **<Gen>**

d. /otec/ [+Pl, -fem, -neut,+animate, Class II] + [+STR, +OBJ, +AGR] **<Acc>**
(95b) does not apply;
(95c) does not apply;
(95a) applies - [+Pl, -fem, -neut, +animate, Class II] + [+STR,+OBJ, -AGR] **<Gen>**

e. /lošad'/ [-Pl, +fem, +animate, Class III] + [+STR, +OBJ, +AGR] **<Acc>**
(95b) does not apply;
(95d) applies - [-Pl, +fem, -animate, Class III] + [+STR,+OBJ,+AGR]
(95a) applies - [-Pl, +fem, -animate, Class III] + [+STR,+OBJ, -AGR] **<Gen>**

f. /lošad'/ [+Pl, +fem, +animate, Class III] + [+STR, +OBJ, +AGR] **<Acc>**
(95b) applies - [+Pl, -fem, +animate, Class III] + [+STR, +OBJ, +AGR]
(95d) does not apply;
(95a) applies - [+Pl, -fem, +animate, Class III] + [+STR,+OBJ, -AGR] **<Gen>**

Let us turn to the accusative-nominative case syncretism. Here, two possible approaches to syncretism seem almost equally attractive. Note that while all nominals have a distinct genitive case-marker, only nominals of Class I have a distinct accusative marker (/u/) - for the remaining nominals there is no morpheme that can be identified as "accusative". This eliminates much of the motivation for positing an Impoverishment Rule to deal with the process. Let us, therefore, present an analysis within which the accusative-nominative syncretism is viewed as a result of vocabulary items being underspecified for the feature [+/-OBJ] that distinguishes nominative and accusative case. Under this approach, the

morphemes corresponding to the nominative and accusative case specifications have the lexical entries shown in (97).

97 a. /a/ [Class I, +STR, -OBJ, -Pl]; /u/ [Class I, +STR, +OBJ, +AGR, -Pl]
b. /o/ [-fem, +neut, +STR, +AGR, -Pl]
c. /y/ [+STR, +AGR, +Pl]
d. /a/ [-fem, +neut, +STR, +AGR, +Pl]
e. /0/ [ ]

Consider the feature specifications of the underlyingly accusative nominals of the three Declension Classes after the block of impoverishment rules in (95) has applied to them:

98 a. Class I animate: /mam/ [-Pl, +fem, -animate, +STR,+OBJ, +AGR] : /u/ **<Acc>**
b. Class I inanimate: /lamp/ [-Pl, +fem, -animate, +STR, +OBJ, +AGR]: /u/ **<Acc>**
c. Class II animate: /brat/ [-Pl, -fem, -neut, +animate, +STR, +OBJ, -AGR] **<Gen>**
d. Class II inanimate: /stol/ [-Pl, -fem, -neut, -animate, +STR, +OBJ, +AGR] : /0/ **<Acc>**
/okn/ [-Pl, -fem, +neut, -animate, +STR, +OBJ, +AGR] : /o/ **<Acc>**
e. Class III animate: /losad'/ [-Pl, +fem, -animate, +STR, +OBJ, +AGR] : /0/ **<Acc>**
f. Class II inanimate: /ploscad'/ [-Pl, +fem, -animate, +STR, +OBJ, +AGR]: /0/ **<Acc>**
g: Class I animate plural
/mam/ [+Pl, -fem, +animate, +STR, +OBJ, -AGR] - gen **<Gen>**
Class I inanimate plural
/lamp/ [+Pl, -fem, -animate, +STR, +OBJ, +AGR]: /y/ **<Acc>**

As (98) demonstrates, the appropriate case-markers can be chosen in all the relevant cases, given the impoverishment rules in (95) and the vocabulary item (under)specification in (97).

There is one very suggestive pattern that the account given above treats as an accident: namely, the fact that Class I nominals, which are the only ones that have a distinct accusative morpheme, participate neither in the accusative-genitive, nor in the accusative-nominative syncretism. Under this approach, we could imagine a situation in

which a Declension Class that undergoes the accusative-genitive syncretism for its animate stems, has an accusative-specific morpheme that surfaces for its inanimate stems. If the behavior of Class I nominals is taken not to be accidental, we need to formalize the accusative-nominative syncretism in terms of Impoverishment Rules.

The relevant rule is given in (99a). Note that it applies in the environment of [-animate] nominal stems. To ensure that only the appropriate forms undergo this rule (see (92c)), we need to change of one of the other Impoverishment Rules we have adopted, namely (95c), which states that the marked [+animate] feature value reverts to the unmarked [-animate] feature value in the environment of [+feminine] stems. Now, we state it as two separate rules, given in (99b) and (99c). For convenience, the remaining Impoverishment Rule (95b) is repeated here as well (see (99d)).

99 a. [+OBJ] -> [ ] / [-animate] [+STR,+AGR] _.
b. [+animate] -> [ ] / [+fem, Class III] _.
c. [+animate] -> [ ] / [+fem, Class I] _.
d. [+fem] -> [ ] / [+Pl] _.

Crucially, the result of the operation of (99c) is that the animacy specification is absent for Class I nominals.[47] The function of Impoverishment Rules in (99b) and (99d) is already familiar to us: they ensure that no plural nominal may be specified as [+feminine], and that no feminine nominal may be specified as [+animate]. As a result, only the appropriate forms (namely, the singular inanimate nominals of Class II, all singular nominals of Class III, and all plural inanimate nominals) meet the environment of Impoverishment Rule (99a) and undergo

[47] Note that a nominal without an animacy specification will fail to undergo the Impoverishment Rule in (95a) (just like a [-animate] nominal), and will not exhibit the accusative-genitive syncretism, as desired.

accusative-nominative syncretism. This process is illustrated in (100) for the inanimate accusative nominals of all Declension Classes in the singular and plural.

100 a. /lamp/ [-Pl, +fem, -animate, Class I] + [+STR, +OBJ, +AGR] **<Acc>**
(99d) does not apply;
(99c) applies - [-Pl, +fem, Class I] + [+STR,+OBJ,+AGR]
(99a) does not apply - [-Pl, +fem, Class I] + [+STR,+OBJ, +AGR] **<Acc>**

b. /lamp/ [+Pl, +fem, -animate, Class I] + [+STR, +OBJ, +AGR] **<Acc>**
(99d) applies - [+Pl, -fem, -animate, Class I] + [+STR,+OBJ,+AGR]
(99c) does not apply,
(99a) applies - [+Pl, -fem, -animate, Class I] + [+STR,-OBJ, +AGR] **<Nom>**

c. /stol/ [-Pl, -fem, -neut,-animate, Class II] + [+STR, +OBJ, +AGR] **<Acc>**
(99d) does not apply;
(99b,c) does not apply;
(99a) applies - [-Pl, -fem, -neut, -animate, Class II] + [+STR,-OBJ,+AGR] **<Nom>**

d. /stol/ [+Pl, -fem, -neut,-animate, Class II] + [+STR, +OBJ, +AGR] **<Acc>**
(99d) does not apply;
(99b,c) does not apply;
(99a) applies - [+Pl, -fem, -neut, -animate, Class II] + [+STR,-OBJ, +AGR]**<Nom>**

e. /krovat'/ [-Pl, +fem, -animate, Class III] + [+STR, +OBJ, +AGR] **<Acc>**
(99d) does not apply;
(99b) does not apply;
(99a) applies - [-Pl, +fem, -animate, Class III] + [+STR,-OBJ, +AGR] **<Nom>**

f. /[illegible]ovat'/ [+Pl, +fem, -animate, Class III] + [+STR, +OBJ, +AGR] **<Acc>**
(99d) applies - [+Pl, -fem, -animate, Class III] + [+STR, +OBJ, +AGR]
(99b) does not apply;
(99a) applies - [+Pl, -fem, -animate, Class III] + [+STR,-OBJ, +AGR] **<Nom>**

Thus, both a vocabulary underspecification approach and an Impoverishment Rule approach to nominative-accusative case syncretism are capable of accounting for the relevant data. Perhaps it might be possible to determine which of the two approaches is correct by studying the way children acquire the pattern: for instance, a systematic failure to use the accusative-specific /u/ morpheme and the use of the nominative morpheme instead in the

inanimate Class I environments might suggest that a general Impoverishment Rule like that in (99a) is operating in the language.

In the discussion above we have concentrated on nominal paradigms. Let us say a few words about the adjectival paradigms as well. Recall that feminine adjectives behave as nominals of Class I in not undergoing either of the two case syncretisms and having a distinct accusative morpheme, while masculine adjectives and piural adjectives behave as Class II nouns and plural nouns in undergoing both of the syncretisms and lacking a distinct accusative morpheme. This pattern is easily captured within the system we have developed. Adjectives are not specified for such grammatical features as gender, number, case or animacy within syntax or within lexicon. Instead, they undergo the rule of Noun-Adjective Concord, as a result of which the features of a Noun are copied onto its Adjectival modifier[48]. Under the most natural assumptions, the Noun-Adjective Concord rule applies before any of the Impoverishment Rules have operated. Thus the adjective gains a complete set of case, number, gender, and animacy features. Now, the Impoverishment Rules we have developed apply to both the adjective and the nominal from which it has copied its features. The pattern observed for adjectives is somewhat simpler than the nominal one, because the paradigm corresponding to Class III nominals is absent, but the results of the Impoverishment Rules' operation are identical for the two categories: accusative-genitive syncretism occurs when a [+animate] feature is present, and accusative-nominative syncretism occurs when a [-animate] feature is present (or when the vocabulary items are appropriately underspecified). It is also easy to extend the analysis to pronouns, none of which have an accusative form that is

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[48] Recall that we have suggested in section 3.2 that a nominal within a ConjP that lacks Case features is subject to this rule as well.

distinct from the genitive form. We need to make the rather plausible assumption that pronouns are inherently [+animate] and so always meet the environment of the rule responsible for the accusative-genitive syncretism.[49]

Let us discuss the general picture of Russian morphology that emerges from our approach to case syncretism. We can describe the observed patterns by saying that a feature matrix can contain only a limited number of marked values of grammatical features: if the number feature has the marked value (+Pl), the marked value of the gender feature (+fem) cannot be maintained; if the gender feature has the marked value (+fem), the marked value for the animacy feature (+animate) cannot be maintained; if the animacy feature has the marked value (+animate), the marked value for the Agreement case feature (+Agr) cannot be maintained. It is not the case that at most two marked values for any of the features can be present in the feature matrix, as (101) demonstrates.

101 a. [+Pl, -fem, +/-animate, -AGR]; *[+Pl, +fem, -animate, - AGR];
b. [-Pl, +fem, -animate, +/-Agr]; *[-Pl, +fem, +animate, -AGR];
c. [-Pl, -fem, +animate, -Agr]; * [-Pl, -fem, +animate, +Agr];

The unacceptable feature combinations in (101) all involve not more than two marked values of the features, yet this does not seem to yield acceptability.

Note that this is not a pattern that would be produced if the marked values which cannot be combined competed for the same slot in the feature representation: the [+fem]

[49] We would have to say that as a result of being inherently [+animate] pronouns cannot undergo the Impoverishment Rule that deletes the [+animate] feature in [+fem] environments. The assumption that pronouns are obligatorily animate might be problematic from the point of view of the existence of deficient 3rd person pronouns that can refer to both animate and inanimate entities, i.e. do not have an animacy specification, as Cardinaletti & Starke (1994) argue.

specification, which seems to be excluded by the [+Pl] specification, excludes the [+animate] specification in its turn. If this fact were expressed by saying that the [+fem] and the [+Pl] specifications compete for a single spot, then the [+animate] specification would have to compete for that spot as well (being incompatible with the [+fem] specification). Yet, this cannot be right, because the [+Pl] and the [+animate] specifications are compatible.

We will leave this fascinating issue without an adequate resolution. One point that we should make before doing so is that the pattern discussed above, i.e. the incompatibility of the marked values of certain features, surfaces in several other areas of Russian nominal morphology not directly relevant to accusative case syncretism. If we examine the nominal declension paradigms given in (91), two more instances of this pattern become apparent. First, the masculine-neuter distinction, which corresponds to the [+/-neut] specification of the gender feature, is maintained only for the least marked case, nominative ([+STR,-OBJ,+AGR]), in the singular and plural paradigms. While this does not necessarily have to be described with Impoverishment Rules - the lexical entries of the relevant case-markers may be underspecified for the [+/-neut] feature - the generalization is a familiar one: the marked value for the neuter feature cannot be maintained in the presence of the marked value of any of the case features. Second, the fact that the differences between Declension Classes are maintained only in the singular can be seen in the same vein: in the presence of the marked feature specification for number ([+Pl]) the featural distinctions that produce the different Declension Classes are neutralized. An interesting generalization about the organization of grammatical features seems to be lurking in the depths of the Russian nominal morphology.

There is a pattern in the operation of the Impoverishment Rules we have proposed: each of them deletes the marked specification of a feature in the environment of the marked specification of another feature[50]. This is certainly very suggestive. Within Distributed Morphology, no restrictions are placed on the environment of the Impoverishment Rules' operation. The data presented here suggests one possible formulation of such a restriction (see Harley (1995) for a different proposal on this topic). Within Russian nominal morphology, no Impoverishment Rule applies in the environment of an unmarked value of some feature. If this is a general, rather than a Russian-specific, pattern, we might be getting a glimpse of the function of Impoverishment Rules, which are otherwise a very mysterious phenomenon. If the informational content of a feature matrix is a function of the number of marked values of features contained in it, and dealing with a matrix that is too highly specified causes difficulty, Impoverishment Rules can be seen as devices that reduce the informational content to "manageable" size. Under this view, Impoverishment Rules are used to avoid the morphological equivalent of processing overload: within morphology, just as within syntax, dealing with a structure that has "too many" elements that need to be kept track of is impossible for the human computational systems, and in morphology, where such structures are encountered frequently, there are mechanisms that reduce their complexity.

Let us sum up what we have done in this section. We have proposed an explicit analysis of the Russian Case system, which makes it is possible to account for the wide-spread accusative-genitive and accusative-nominative syncretism in a natural fashion. The basic case features of our system are syntactically meaningful, that is, they play a role in

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[50] This discussion assumes that the accusative-nominative syncretism is not handled by an Impoverishment Rule.

the derivation and are accessible to syntactic operations. We have shown that within Russian morphology, accusative and nominative form a natural class (that of [+STR,+AGR] cases in our terms), with accusative as the more marked member. In addition, we have shown that accusative and genitive form a natural class as well (that of the [+STR,+OBJ] cases), within which accusative is also acting as a more marked member. Thus, genitive is seen as a more default realization of Structural Objective Case, one that surfaces on nominals if "nothing special" happens to them. In the next section, we show how the case feature analysis developed here fits into syntactic derivations.

4.3 The Syntactic Analysis of Genitive of Negation

In this section we provide an analysis of the syntactic properties of genitive of negation. Our goal will be to show that the syntactic principles that we have already discussed explain the distribution of the genitive of negation construction without any additional stipulations. The building blocks of our analysis will be 1) our formulation of the EPP together with the Minimal Link Condition that restricts legitimate movement operations, 2) the morphological analysis of genitive case in Russian, and 3) a version of the Mapping Hypothesis that produces the Definiteness Effect in this environment.

First we should note that the Russian genitive of negation phenomenon closely resembles object shift as well as "Diesing effects" in Germanic languages. Roughly, if a nominal can occur both in a VP internal position (where it was generated) and in a VP-external position (where it has moved), the interpretation of the VP-internal nominal is non-familiar and non-specific and the interpretation of the VP-external nominal is familiar and specific. The behavior of Turkish indefinite objects is a fairly representative example of this pattern:

102 a. ben dûn akşam [$_{VP}$ çok gûzel bir biftek [$_{VP}$ yedim]]
I yesterday evening very nice steak ate
'Yesterday evening, I ate a very nice steak'
b. *ben çok gûzel bir biftek dûn akşam [$_{VP}$ yedim]]
I very nice steak yesterday evening ate
'Yesterday evening, I ate a very nice steak'
c. Ben bifteg-i [$_{VP}$ dûn akşam [$_{VP}$ yedim]]
I steak-acc yesterday evening ate
'Yesterday evening I ate the steak'
(de Hoop 1992)

(102c) contains a direct object marked with accusative case which appears to the left of the adverbial phrase adjoined to the VP - both considerations point to it occupying a Case-checking position outside of the VP, namely the Spec of vP. (102a) contains a direct object not marked with accusative case and occurring to the right of an adverbial phrase adjoined to the VP, occupying its base position. (102b) demonstrates that a non-case-marked object cannot occur in the Case-checking position at Spell-out. Crucially, the object in the VP-external position is interpreted as familiar, and the object in the VP-internal position as non-familiar. Adger (1994) describes the same pattern occurring in many other languages, such as Porteño Spanish, Dutch, German, French, Scottish Gaelic, and Hindi: a nominal occupying an agreement and case-checking position at Spell-out (diagnosed by word order, the appearance of structural case-marking, and the appearance of overt agreement) is interpreted as familiar, an object occupying a VP internal position at Spell-out (diagnosed by word order, the absence of accusative case-marking, and the absence of overt agreement) is interpreted as non-familiar.

Note that the pattern described above can be reproduced for subjects, as well as objects. For instance, in the pair of German sentences in (103) taken from Diesing (1992), the interpretation of the subject differs depending on its position.

103 a. weil Linguisten ja doch Kammermusik spielen
since linguists indeed chambermusic play
'Since linguists indeed play chambermusic'
b. weil ja doch Linguisten Kammermusik spielen
since indeed linguists chambermusic play
'Since there are indeed some linguists playing chambermusic'

If the subject precedes the VP-adjoined adverb 'indeed', i.e., occupies a VP-external position at Spellout, it has a generic (familiar) reading. If the subject follows the VP-adjoined adverb, i.e. occupies a VP-internal position at Spellout, it has an existential (non-familiar) reading.

There are several ways in which the correlation between the position of nominals and their interpretation can be analyzed. Within the analysis of Diesing (1992), sentences containing generalized quantifiers are mapped into a tripartite quantificational structure (104a), in accordance with the Mapping Hypothesis (104b). Nominals that occur within VP (at the relevant level of the derivation) are mapped into the nuclear scope and bound by existential closure, so that they receive an existential interpretation. Nominals that occur outside of the VP are mapped into the restrictive clause and bound by the appropriate operator, so that the existential interpretation is not available for them.

104 a. Q [Restrictive Clause] [Nuclear Scope]
b. The Mapping Hypothesis:
1. Material from VP is mapped into the Nuclear Scope
2. Material from IP is mapped into a Restrictive Clause

Languages differ in whether or not the nominals occurring in the VP-external position have an unambiguous interpretation: thus, in the pair of German sentences in (103), the overt position of a nominal determines its interpretation, but in the pair of English sentences in (105), the nominal in the VP-external position is ambiguous between a familiar (proportional) and an non-familiar (cardinal) reading (105a), while the nominal in the VP-internal position has only a non-familiar (cardinal) reading (105b). Within Diesing's framework, this means

that in English, but not in German, the interpretation of nominals corresponds to their LF position. The non-familiar, cardinal reading of the VP-external nominal in (105a) is derived when the nominal lowers to its base-generated VP-internal position at LF, where it is bound by existential closure.

105 a. Many man arrived
b. There arrived many man.

Other authors advocate somewhat different analyses of positional interpretive effects. Thus, Adger (1994) argues convincingly that viewing all VP-internal material as subject to existential closure and all external material as not subject to existential closure cannot be correct - not all VP-external positions allow nominals occurring in them to have a definite interpretation. Thus, in Catalan, nominals adjoined to IP exhibit an "anti-definiteness effect". Adger proposes that only agreement and case-checking positions induce a familiar presuppositional interpretation.

Another issue open to debate is whether or not interpretive effects associated with the syntactic positions of elements should be formalized in terms of mapping and generalized quantifiers or not: for instance, Adger characterizes the distribution of definite and indefinite nominals as well as that of ambiguous weak quantifiers in terms of their familiarity (having a referent that is pre-established in the universe of the discourse).

The object (and subject) shift phenomena described above are tantalizingly similar to the Russian genitive of negation. However, a closer examination shows that the two phenomena are based on (somewhat) different semantic notions. Object shift in Germanic

languages affects nominals that correspond to old information - typically, these are definite nominals and indefinite nominals on a presuppositional, familiar reading. The elements that do not undergo the movement correspond to new information - typically, these are indefinite nominals on an existential, non-familiar reading and definite nominals with referents that are new information in the context of the utterance. This is the type of positional interpretive effect we have described in section 3.4: for the nominal argument of unaccusative verbs, the pre-verbal position is associated with an "old information", D-linked reading (106a,b) and the post-verbal position is associated with a "new information", non-D-linked reading (106c,d). The interpretive distinction relevant in this construction is not based on the morphological definiteness of the nominal - a nominal with unambiguous definite specification, such as a proper name, can be treated as "new information" and can occur post-verbally. A nominal with an unambiguous indefinite interpretation can be treated as "old information" and can occur pre-verbally.

106 a. Lampa stojala na stole.
lamp-fem-sg-nom stood-sg-fem on table
'The lamp was standing on the table'
b. Vanja vošel v komnatu
Vanya-nom entered-sg-masc into room
'Vanya entered the room'
c. Na stole stojala lampa
on table stood-sg-fem lamp-sg-fem-nom
'On the table stood the lamp'
d. V komnatu vošel Vanja
into room entered-sg-masc Vanya-sg-nom
'Into the room entered Vanya'

Importantly, the interpretive effect of genitive of negation is not based on the D-linked (old information) or non-D-linked (new information) status of a nominal, but on its

grammatical definiteness. Thus, an unambiguously definite nominal may not occur with genitive case-marking, even when it appears in the post-verbal position and the discourse is manipulated so that it corresponds to new information (107a,b).

107 a. What didn't Vanya read?
*Vanja ne pročital 'Vojny i Mira'
Vanya-nom not read-sg-masc 'War and Peace-gen'
'Vanya did not read 'War and Peace'
b. Who didn't come to class?
*V klass ne prišlo Vani
In class not came-sg-neut Vanya-gen
'It was Vanya that did not come to class'

Genitive of negation creates a Definiteness Effect similar to the one encountered in the English existential constructions: definite nominals cannot occur there under any interpretation. We propose to view this restriction as a result of existential closure that applies in the two constructions. According to Heim (1982), existential closure is subject to a Novelty Condition, which requires that the referent of a nominal bound be existential closure be unfamiliar. This makes it impossible for definite nominals, whose referent must be present in the universe of the discourse, to occur within the domain of existential closure. The status of the definite nominal as new or old information within the context of the utterance does not play any role here.[51]

The pattern described above fits the formulation of the Mapping Hypothesis in (104): we suggest that all nominals that occupy their base-generated VP-internal positions are existentially bound. Crucially, in Russian existential closure applies at LF, that is, only those

[51] Adger (1994) makes a similar distinction between the environments that induce a Definiteness Effect (such as the existential construction in English) and environments that induce a familiar interpretation of a nominal (such as the agreement positions).

nominals that do not move out of the VP at LF are subject to existential closure. If their interpretation is incompatible with existential binding, the configuration is ungrammatical. Note that in claiming that the interpretation of elements corresponds to their LF positions, we are keeping to the standard assumptions of our syntactic framework, where movement operations that occur in overt syntax (and violate Procrastinate) can be triggered only by the necessity of checking strong features. The alternative view, for instance that of Diesing (1995), within which overt movement can be "interpretation-driven" and can take place even if there are no strong features that need to be checked, does not have to be adopted to deal with the Russian data.

At this point we have not explained how the assumption that all VP-internal positions are subject to existential closure at LF helps us account for the properties of genitive of negation. As we have hinted in the beginning of this section, we are going to treat view the accusative-genitive alternation as an instance of object shift: when a nominal raises to a VP-external position, it surfaces with accusative case-marking. When it remains VP-internal, it surfaces with genitive case-marking. As we will show shortly, only the nominals that do not raise out of the VP at any point in the derivation may bear genitive Case. Thus, only the nominals whose interpretation is compatible with existential binding will be permitted to appear with genitive case-marking. Note that the mechanism of genitive case-assignment, which makes it possible for nominals to remain in their base-generated position, not entering any feature-checking relations, is available only in negated sentences.

Let us begin by showing how the distribution of the genitive of negation construction is explained within this approach. We will provide evidence for it as we proceed. Consider the set of transitive sentences in (108).

108 a. Vanja ne čital 'Vojnu i mir'
Vanya-nom not read-sg-masc 'War and Peace-acc'
'Vanya hasn't read 'War and Peace'
b. *Vanja ne čital 'Vojny i mira'
Vanya-nom not read-sg-masc 'War and Peace-gen'
c. Vanja ne čital nikakix knig
Vanya-nom not read-sg-masc neg-kind book-pl-gen
'Vanya hasn't read any kind of a book'
d. ??Vanja ne čital nikakie knigi
Vanya-nom not read-sg-masc neg-kind book-pl-acc

The direct object in (108a,b) is definite. Thus, within our analysis, it must move out of the domain of existential closure either at Spellout or at LF, if the derivation is to converge.[52] For direct objects, the closest appropriate landing site is the outer Spec of vP, where they must check their categorial, Case, and phi-features. Recall that we have proposed that the case feature specification of accusative Case is [+STR,+OBJ,+AGR], suggesting that the nominals that move through a case-checking position (Spec of vP or Spec of TP) at some point in the derivation must have the [+AGR] feature. Thus, the minimal reflex of a definite nominal moving out of its base-generated position that we can expect to see is accusative case-marking. This much evidence is available: a definite direct object must surface with accusative Case (108a,b), and an indefinite direct object must surface with genitive Case (108c,d).

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[52] The definiteness of the nominal cannot trigger movement in this system. However, if other factors (such as the case features of the nominal) do not force it to move out of its base-generated position, the derivation will crash because of the nominal's definiteness.

Note that if definite direct objects move at LF, no word order evidence of the fact can be available. However, even if they move overtly, this fact may be impossible to detect: the position of negation or adverbs does not clearly identify the edge of VP in Russian (negation cliticizes to the verb and the distribution of adverbs is not very constrained); in addition, if Russian verbs raise to T in overt syntax, both the base-generated and the feature-checking position of the direct object would follow the verb.

Note that within the system we have set up, a derivation containing a definite direct object with a genitive Case feature specification ([+STR, +OBJ,-AGR]), or any other case feature specification that does not have a [+AGR] value, cannot converge: the nominal may move out of its base-generated position to escape existential closure, but it will not be able to check the case features in the outer Spec of vP. If the nominal does not move to the Spec of vP, it will be bound by existential closure.

Let us consider the subjects of unergative verbs base-generated under sentential negation.[53] Given everything we have said, they should behave exactly as direct objects do: if they are definite, they have to move out of the domain of existential closure for the derivation to converge. The closest appropriate landing site for subjects of unergative verbs is the Spec of TP position, where they must check their categorial, Case, and phi-features. Recall that the feature specification of nominative Case is [+STR,-OBJ,+AGR] and that only the nominals with a [+AGR] feature may pass through a Case-checking position. Thus, once again, a definite subject base-generated with genitive ([+STR, +OBJ, -AGR]) Case will cause the derivation to crash: if it raises out of its base-generated position, it will not be able to check

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[53] They are formally identical to the subjects of transitive verbs.

the features in the Spec of TP, and if it does not, it will not be able to escape existential closure.

Definite unergative subjects are illustrated in (109). Note that, just as with the definite direct objects, only nominative case-marking, and not genitive case-marking, is possible here.

109 a. Vanja ne svistel t
Vanya-nom not whistled-sg-masc
'Vanya did not whistle'
b. *Ne svistelo Vani
not whistled-sg-neut Vanya-nom
'Vanya did not whistle'

However, the behavior of definite subjects is not entirely parallel to the behavior of definite objects: there exists a syntactic principle that is relevant for subjects alone, namely the EPP. The strong EPP feature needs to be checked overtly, and as a result, definite subjects of unergative and transitive verbs do not remain in the closest Case-checking position, as definite objects do, but move farther to the Spec of ΠP.

Now consider the indefinite subjects of unergative and transitive verbs, illustrated in (110). As (110a) shows, subjects of unergative verbs may not surface with genitive Case even when they are indefinite.

110 a. *Ne svistelo ni odnogo mal'čika.
not whistled-sg-neut neg single boy-sg-gen
'Not a single boy whistled'
b. Ni odin mal'čik ne svistel
neg single boy-sg-nom not whistled-sg-masc
'Not a single boy whistled'

Within our system, an indefinite nominal remaining in its base-generated position is existentially bound, but that does not create any problems for the derivation. Unless some

independent syntactic factor requires indefinite subjects of unergative verbs to move, they will remain in their VP-internal position, surfacing with genitive case-marking. In fact, they are forced to move to satisfy the EPP. Some element must move to the Specifier of the ΠP projection overtly, and in sentences containing unergative verbs only the subject nominal can do so. As we have shown in section 3.3, the other elements that may be present in the sentence are farther from the EPP position than the subject nominal is; if they were moved to satisfy the EPP, the movement operation would violate the MLC.

As a result of having to raise to the Spec of ΠP to satisfy the EPP, the subject of an unergative verb will be "dragged through" the Spec of TP position, where it will check its features, surfacing with nominative Case. A derivation containing an indefinite subject of an unergative with genitive ([+STR,+OBJ,-AGR]) case features cannot converge: if the nominal raises out of the VP to satisfy the EPP, it will not be able to check the Case-features in the Spec of TP, and if it will remain in the VP-internal position, the EPP will not be satisfied.

Note that we cannot learn whether definite nominals have to escape existential closure in overt syntax or in covert syntax by studying the subjects of unergative and transitive verbs: here, overt movement is forced by the EPP. Evidence for the fact that genitive surfaces on the nominals that do not move out of the VP at any point in the derivation cannot be found here, either: no subject of an unergative verb can remain VP-internal in overt syntax.

Let us turn to sentences containing unaccusative verbs. Consider the sentences in (111), where the subject nominals are definite. The familiar pattern is repeated once again: unless the definite nominals move out of their base-generated position within the VP to escape the domain of existential closure, the derivation does not converge; they move to the

first available landing site, namely the Spec of TP, and check their features there. Then they move to the Spec of ΠP to satisfy the EPP. In the course of the derivation they pass through an agreement position (the Spec of TP), and as a result they surface with nominative Case.[54]

111 a. Vanja ne prišel v školu
Vanya-nom not came-sg-masc to school
'Vanya did not come to school'
b. *Vani ne prišlo v školu
Vanya-gen not came-sg-neut to school
'Vanya didn't come to school'

Now, let us consider the derivation containing an indefinite subject of an unaccusative verb. The interpretation of these nominals is compatible with existential closure, so that they cannot cause the derivation to crash by remaining in their base-generated position. Nonetheless, in the absence of an element that can satisfy the EPP in their place, they will have to undergo movement to the Spec of ΠP position. This will occur if the sentence does not contain a PP argument. In addition, since the choice of the element that undergoes movement to satisfy the EPP is arbitrary from the point of view of syntax (the derivation in which the NP moves and that in which the PP moves are equally economical), an indefinite nominal may raise to satisfy the EPP even if the sentence does contain a PP argument. Of course, if a nominal raises to the EPP position, it will have to move through the Spec of TP and surface with nominative Case.

However, as we have seen in section 3.3, in sentences containing unaccusative verbs, the subject is not the only element that can satisfy the EPP. If a PP argument is present, it

[54] To put it more precisely, only the derivation in which they are base-generated with nominative case features will converge.

may move to the Spec of ΠP position and check the EPP feature. As a result, the indefinite subject can remain within the VP at Spellout, and, if we are correct in claiming that a nominal bearing genitive case-marking under negation does not have to check its Case features, the indefinite subject can remain within the VP at LF as well. The pattern is illustrated in (112).

112 a. Ni odna devočka ne prišla v klass
neg single girl-sg-nom not came-sg-fem to class
'Not a single girl came to class'
b. V klass ne prišlo ni odnoj devočki
to class not came-sg-neut neg single girl-sg-nom
'Not a single girl came to class'

Let us describe how the discourse principles discussed in section 2.4 affect the interpretation of negated sentences containing indefinite subjects of unaccusative verbs, such as those in (112). Recall that in the non-negated counterparts of these sentences (where the nominal also had the option of satisfying the EPP or remaining within the VP at Spellout) the pre-verbal position had a D-linked interpretation and the post-verbal position had a non-D-linked interpretation. The same is true here. The nominative pre-verbal subject has a D-linked partitive interpretation available to it, while the post-verbal genitive subject does not. To the extent that the non-D-linked interpretation is more readily available for indefinite NPs, the post-verbal position of the subject and the accompanying genitive case-marking is more natural for them.

Our analysis is cable of accounting for one of the previously unexplained properties of the genitive of negation construction. As we have mentioned in section 4.1, the indefinite existential interpretation is nearly unavailable for accusative direct objects within the scope of negation, but it is readily available for nominative subjects of unaccusative verbs. This

asymmetry is expected under our approach to genitive of negation: direct objects move out of their base-generated position (and surface with accusative Case) only when forced to do so to escape existential closure, that is, only when they are definite. On the other hand, there are two reasons why a subject of an unaccusative verb may move out of its base-generated position (and surface with nominative Case): by virtue of its definiteness or because of the effects of the EPP. Thus, both definite and indefinite subjects of unaccusative verbs may surface with nominative case.

At this point we are in a position to provide evidence in favor of our treatment of genitive case as the case-marking that surfaces on the nominals that do not move through a feature-checking position at any point in the derivation. Recall that within our analysis of Russian Case, nominative and accusative cases have the feature [+AGR], which we have claimed is the case feature checked in the Spec of vP and the Spec of TP; genitive case lacks this feature. Note that a different treatment of genitive case is also compatible with the general line of analysis we have proposed: genitive case-marking could surface on the nominals that move to a Case-checking position (Spec of vP or Spec of TP) at LF, rather than at Spellout. If this approach were adopted, then we would have to assume that nominative and accusative case-markings surface on the nominals that move to a Case-checking position at Spellout (rather than at any point in the derivation, as we have been assuming).

Genitive subjects of unaccusative verbs provide us with an opportunity to settle these issues. In our discussion of post-verbal subjects in non-negated sentences, we have used tests that determine whether an element occupies the Spec of TP position at LF or not. In

particular, the ability of an element to control gerund phrases, as well as its ability to act as the antecedent of a reflexive, is an indication that it occupies the Spec of TP position at LF. The behavior of genitive subjects of unaccusative verbs with respect to these tests is illustrated in (113).

113 a. *Ni odnogo mal'čika$_i$ ne bylo ubito u sebja$_i$ doma
neg single-gen boy-gen not was-sg-neut killed-sg-neut at self's house
'Not a single boy was killed in his house'
b Ni odin mal'čik ne byl ubit u sebja doma
neg single-nom boy-nom was-sg-masc killed-sg-masc at self's house
c.* PRO$_i$ vozvraščajas' domoj, ni odnogo mal'čika$_i$ ne bylo ubito
returning home, neg single-gen boy-gen not was-sg-neut killed-sg-neut
'Not a single boy was killed while returning home'
d. PRO$_i$ vozvraščajas' domoj, ni odin mal'čik$_i$ ne byl ubit
returning home, neg single-nom boy-sg-nom-masc not was-sg-masc killed-sg-masc
'Not a single boy was killed while returning home'
(Neidle, 1982)

As these sentences show, genitive subjects of unaccusatives fail the tests for LF subjecthood. Thus, we must conclude that they do not occupy the Spec of TP (or the Spec of vP) position at any point in the derivation. This means that genitive case-marking surfaces on nominals that do not participate in case-feature checking relations. Another consideration points to the same conclusion: if genitive corresponded to the case-marking that surfaces on the nominals that remain VP-internal at Spellout (but undergo LF movement to a Case-checking position), then we would expect sentences in (114) to be acceptable in Russian.

(114) a. * Na stole stojala/stojalo lampy
on table stood-sg-fem/stood-sg-neut lamp-fem-sg-gen
'On the table stood a lamp'
b. *V Vaninoj kvartire poavljalas'/pojavljalos' odnoj devočki

in Vanya-poss apartment appeared-sg-fem/appeared-sg-neut one girl-sg-gen
'In Vanya's appartment there appeared a girl'

Note that the nominals in (114) are indefinite, so no interpretation-driven movement out of the VP can be claimed to have occurred and genitive case-marking should be available, if it is the morphological realization of weak Case features. Yet, it may not occur in these constructions.

Settling the analysis of genitive case also helps us justify the second assumption we have made but not yet supported by evidence, namely, that non-genitive nominals move through the Case-checking positions either at Spellout or at LF (rather than at Spellout). If genitive case-marking had turned out to be the realization of weak Case features, checked in covert syntax, we would have good reason to assume that nominative and accusative case-markings are the realization of strong Case features - this is the only distinction that can be drawn between the two types of case, given the fact that the interpretation of nominals with genitive case-marking and the interpretation of nominals with non-genitive case-marking is not always distinct. However, because it has been shown that genitive case-marking is not the realization of weak Case features, much of the motivation for analyzing nominative and accusative case as the realization of strong Case features has disappeared. Moreover, there is a good reason not to do so. The null hypothesis about the properties of the Case-checking positions is that they are identical in negated and non-negated sentences. We have seen that in non-negated sentences containing Locative Inversion constructions, the VP-internal subject surfaces with nominative case even when it undergoes movement to the Spec of TP only at

LF. Thus, we expect nominative and accusative cases to surface on nominals that pass through a Case-checking position at any point in the derivation in negated sentences, as well.

To sum up, all the facts we have presented point to a very simple analysis: the case-assignment mechanisms of negated and non-negated sentences are identical. Whenever a nominal element raises through a feature-checking position overtly or covertly, it has to check a [+AGR] case feature and, as a result, may only surface with nominative or accusative case. Genitive case can only be borne by the nominals that are not forced to raise out of their base-generated position either by the EPP or by the necessity to escape existential binding. The scope of nominals is predictable from their LF positions: the elements occurring in their base-generated positions are within the domain of existential closure, and the elements occurring in the VP-external positions have the option of remaining there or undergoing LF reconstruction.

However, to be able to maintain this view we have to explain how a derivation containing a genitive nominal manages to converge. At this point we should make our analysis of genitive case-assignment explicit. Recall that the case feature specification of genitive is [+STR,+OBJ.-AGR]. We have spoken of it as the default Objective Case; we have also shown that within the morphological component it is less marked than the accusative Case. But what does this mean within syntax? We suggest that this means that the genitive feature specification results entirely from the operation of Redundancy Rules within the morphological component, when they apply to a nominal without any abstract Case features that enters Morphology as a complement of a verb. Thus, in addition to the Redundancy Rules we have already described, the rule given in (115a) also operates in the Russian

morphological component. Note that except for the [+OBJ] feature, all of the feature values of genitive Case are unmarked, so that a nominal node with a [+OBJ] feature will be supplied with a [+STR] and a [-AGR] feature by the remaining Redundancy Rules. The result will be a genitive Case specification.

115 a. [ ] -> [+OBJ] / $[_{VP}\,[_{N}\,\_\,]\,]$

Rule (115a) may only apply to nominals that are complements of Vs (or their traces) when they enter the Morphological component.[55] If a nominal is inserted into the derivation without Case features and it occupies this position, the Morphological Component will interpret it as genitive. However, this will not affect the syntactic derivation: if the VP-internal nominal has to raise covertly and check the features of some functional element, it will not be able to do so, and the derivation will crash.

The analysis above explains why the features of the nominal surfacing with genitive case don't cause the derivation to crash. However, it does not explain why the features of the verbal functional elements do not create the same problem: after all, we have shown that no nominal is capable of checking their features. Note that some of the features of the verbal complex do not need to be considered here: the strong EPP feature has been checked (by a PP), and the weak +Interpretable features do not have to be checked for the derivation to converge. However, the Π-T-Vb complex has Case and phi-features that do need to be

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[55] To be more precise, the rule applies to nominal chains that do not have a member in an A-position.

checked and the genitive nominal is not capable of fulfilling this function. In a non-negated sentence, this situation could only lead to the crash of the derivation.

The explanation we would like to offer is obviously a speculation. However, we find it a plausible and a relatively innocuous one. We suggest that the Π-T-Vb complex checks its features against a "substitute nominal" - the negation morpheme. Negation is a pro-clitic adjoined to the Vb complex that moves together with the verb (see (116)), and serves the same function as direct objects do, that is, it delimits the event described by the verb (in this case, to zero). In non-negated sentences, there is no element other than the nominal that is capable of checking the features of the Vb complex. If the nominal lacks case features (i.e can be interpreted as genitive by the morphological component) the features of the Vb complex are "stranded" and the derivation crashes.

116 a. ne pojavilsja li Vanja doma?
not appeared if Vanya-nom home
'Has Vanya come home?'
b. *ne li pojavilsja Vanja doma?
not if appeared Vany-nom home
'Has Vanya come home'

In fact, there are other aspectual pro-clitics that can serve the same function as negation does, being able to "absorb" the Case-features of the S-T-Vb complex. These are illustrated in (117).

117 a. Travy (po)naraslo!
grass-gen asp-grew-sg-neut
'How much grass there has grown'
b. Gostej (po) naexalo!
guests-gen asp-came-sg-neut
'How many guests there came!'

c. Domov (po) nastroili!
houses-gen asp-built-pl
'How many houses they have built'

Note that these aspectual pro-clitics have a function similar to that of the passive morpheme within Baker, Johnson, and Roberts (1989) analysis of passives, where the passive morpheme was claimed to be assigned Case by the Verb. Case-absorption by the negation morpheme has to be an optional process. It occurs in complimentary distribution with nominals moving through the Spec of TP or the Spec of vP: if Case is absorbed by the negation clitic, the Case features of the nominal cannot be checked. Conversely, if the verb checks its case features against those of a nominal that has moved through the Spec of TP or vP, the negation clitic cannot get any features.

To sum up, the analysis of genitive of negation proposed here views this construction as a syntactic strategy similar to incorporation: genitive nominals occupy the VP-internal position and do not enter into any Case-checking relations. This is possible only if other elements in the sentence can fulfill the syntactic functions typically carried out by a subject: a PP argument must satisfy the EPP (an option that is available only in sentences containing unaccusative verbs) and a "substitute nominal" must check the features of the verb complex (an option that is only available in negated sentences). In addition, genitive case-marking is supplied within the morphological component only to the nominals that lack Case features. Such nominals cannot move out of their base-generated VP-internal positions. If a definite nominal enters the derivation without Case features, the derivation cannot converge, even if no other problems arise: the VP-internal positions are subject to existential closure at LF, and the interpretation of definite nominals is incompatible with existential binding.

4.3 Residual Properties of Genitive of Negation

Let us try to address the issues that have not been dealt with in the description of the genitive of negation phenomenon in the previous section. The first property of the construction we will discuss is its incompatibility with lexical Case (118). Within Pesetsky's analysis this pattern was handled with the stipulation that QPs may not bear Case features. Other authors (e.g. Babby (1985)) have suggested that a Case hierarchy is responsible for this restriction: lexical cases are higher on the higherarchy than genitive, which, in turn, is higher than accusative or nominative. When a case conflict arises, the case highest on the hierarchy "wins" and receives a morphological realization.

118 a. Ja pomogala etomu stariku /*etogo starika
I helped this-dat old-man-dat /*this-acc old-man-acc
'I was helping this old man'
b. Ja ne pomogala *ni odnogo starika/ ni odnomu stariku
I not helped neg single-gen old-man-gen / neg single-dat old-man-dat
'I was not helping any old men'

Our approach will be similar in spirit. Because within our system the genitive case feature specification is produced solely by Redundancy Rules in the morphological component, we expect it to bє "displaced" by any case feature specification that is present in the syntactic derivation.

It is typically assumed that there is a condition that ensures that a complement of a verb which assigns lexical case bears this case. This condition is treated as a restriction on the

structures formed by Merge. Thus in Pesetsky (1982), assignment of a theta-role and assignment of lexical case are seen as one process which takes places at D-Structure. If the complement of a verb that assigns lexical case fails to" match" this case for some reason, the process of theta-assignment cannot occur and as a result the D-Structure violates the Theta-Criterion. Positing some sort of a well-formedness constraint on the structures that contain lexical case assigners appears unavoidable: there is no other way to capture the fact that direct objects bearing "standard" accusative case may not occur as complements of these verbs (see 118a).

Within the framework of Distributed Morphology where late vocabulary insertion is assumed, verbs that assign lexical case "translate into" V nodes that enter into the derivation with a full case feature specification, e.g. [assign [-STR, +OBJ, +AGR]], and verbs that assign accusative case "translate into" V nodes that enter into the derivation with the minimal case feature specification [assign [+OBJ]]. A well-formedness constraint (possibly connected to such obligatory processes as theta-assignment) ensures that the nominal node inserted as a complement of a lexical-case-assigning V node bears the appropriate case features. From this point on, the derivation procedes as usual.

Even if a direct object node with a full case-feature specification is VP-internal at the point where it enters the morphological component, the Redundancy Rule responsible for producing genitive case-marking will fail to apply to its fully specified case-feature matrix - Redundancy Rules may not change feature values, only supply them when they are missing. Note that if a fully specified nominal node fails to raise out of the VP either overtly or

covertly, the derivation will not converge: the unchecked features of the nominal will cause it to crash.

The second issue we need to address concerns the differences in the distribution of singular agreement and genitive of negation. The first of the environments where only conjunction agreement can surface is the environment of "composite unaccusatives" (119a,b), that is, verbs of motion that become unaccusatives when they appear with a goal phrase, but are not unaccusative without it (119c,d)

119 a. K beregu bežal Kolja i Vanja
To shore ran-sg-masc Kolya-sg-nom and Vanya-sg-nom
'To the shore ran Kolya nad Vanya'
b. *K beregu nikogo ne bežalo
To shore nobody-gen not ran-sg-neut
'Nobody ran to the shore'
c. Po dvoru begali/*begal Kolja i Vanja
Around yard ran-pl/*ran-sg Kolya-sg-nom and Vanya-sg-nom
'Kolya and Vanya ran around the yard'
d. *Po dvoru nikogo ne begalo
Around yard nobody-gen not ran-sg-neut
'Nobody ran around the yard'

We do not have anything insightful to say about the fact that genitive of negation appears to be restricted to "lexical", rather than "phrasal" unaccusatives. The only point that we would like to make is that for some speakers the genitive of negation seems to be less restricted than the standard description of the phenomenon suggests: in addition to unaccusative verbs, they allow it to occur with some verbs that appear to be unergative. For these speakers, the unergative verbs whose arguments may surface with genitive case-marking typically are the "composite unaccusatives":

120 a.?V komnatu ne vošlo ni odnogo rebenka
In room not entered-sg-neut neg single child-gen
'Not a single child entered the room'
b. *Na scene ne napevalo ni odnogo rebenka
On stage not sang-sg-neut neg single child-gen
;On the stage, not a single child sang'

The second environment where the distribution of conjunction agreement and genitive of negation differ is that of "consider-type" verbs that take small clause complements (121).

121 a.??Ja ni odnoj devočki ne sčitaju idiotkoj
I neg single-gen girl-gen not consider idiot-sg-fem-instr
'I don't consider a single girl an idiot'
b.Glavnoj zabotoj byla kuxnja i obed
Main-instr concern-instr was-sg-fem kitchen-sg-nom-fem and dinner-sg-nom-masc
'The kitchen and the dinner were the main concern'
c.V gorode ne bylo ni odnogo santexnika
In town not was-sg-neut neg single plumber
'There wasn't a single plumber in town'

Nothing in our analysis of genitive of negation suggests that it should be impossible for subjects of small clauses. Genitive is not an inherent Case in our system, i.e. it is not assigned in conjunction with theta-marking, so the fact that the subject of a small clause is not a complement of the matrix verb should not prevent genitive from surfacing in these environments. Moreover, genitive may surface on the subjects of small clauses in existential or locative sentences (121c), which suggests that the structural configuration of a small clause is in principle compatible with the assignment of genitive of negation.

We would like to explain the impossibility of patterns like (121a) in terms of a clash of semantic requirements that are imposed by the genitive of negation construction and by

"consider-type" verbs. Note that these verbs require the predicate of their small clause complement to be Individual-level, rather than Stage-level (122a,b).

122 a. Ja sčitaju Vanju durakom
I consider Vanya-sg-masc-acc fool-sg-masc-instr
'I consider Vanya a fool'
b. ??Ja sčitaju Vanju zabolevšym
I consider Vanya unhealthy

Individual-level predicates, in turn, are incompatible with indefinite (weak) subjects, as (123a,b) illustrates for English, where the definiteness of the subjects is unambiguously signaled by their Determiner. Milsark (1974) proposes that the inability of Individual predicates to appear with weak subjects is due to a very general semantic principle.

The combination of these two facts leads to the impossibility of weak (indefinite) subjects of small clauses that are complements of "consider-type" predicates (123c). Because in Russian genitive can surface only on indefinite nominals, which do not have to move out of the domain of existential closure, the inability of genitive case to surface in these environments can be seen as a manifestation of the same pattern.

123 a. *There is a student intelligent
b. *A student is intelligent.
c. *I consider a student intelligent.

Given this approach, we expect genitive to be able to surface on the subjects of small clauses when they are acting as complements of perceptual predicates, which require the predicate of their small clause complements to be Stage-level, rather than Individual-level

(124a,b). This prediction is indeed born out, as (124c,d) demonstrates

124 a.*I saw John intelligent
b. I saw John swim
c. Ja za vsju svoju žizn' ne videla ni odnoj devočki takoj p'janoj
In in all my life not seen neg single girl-gen so drunk-instr
'I've never seen any girl so drunk in my life'
d. Za vsju svoju žizn' on ne sdelal ni odnogo rebenka sčastlivym
in all his life he not made neg single child-gen happy-instr
'During his whole life he hasn't made a single child happy'

This constitutes strong evidence that semantic, rather than syntactic, factors rule out the occurrence of genitive of negation on the subject of some small clauses.

Finally, let us emphasize one other property of our analysis of genitive of negation. Note that for us, the interpretation of a nominal is related to its position (within the domain of existential closure vs. outside of this domain), and only indirectly to its case. Genitive case correlates with indefiniteness to the extent that it surfaces on the nominals that may remain within the VP, and only indefinites are permitted to do so. We can see that this approach is correct by examining the sentences containing verbs of existence, within which genitive may surface on both definite and indefinite nominals. Here, the definiteness of the 'subject' is strictly correlated to its position, with the case-marking being irrelevant (125): definite nominals may not appear in the post-verbal (VP-internal) position, and indefinite nominals must do so. An analysis of the behavior of these verbs is the topic of the next chapter.

125 a.U menja ne bylo sester/??Vani
at I-gen not was-sg-neut sister-pl-gen/ Vanya-sg-gen
'I didn't have (any) sisters/ I didn't have Vanya'
b. Vanja byl/ sestra byla u menja
'Vanya/ the sister was at my place'

5 The Verbs of Existence

"Aleksandr Ivanovič, Aleksandr Ivanovič!" - zarevelo neskol'ko
"Alexander Ivanovich, Alexander Ivanovich!" roared several
golosov. No nikakogo Aleksandra Ivanoviča ne bylo.
voices. But neg-kind Alexander Ivanovich-sg-gen not was-sg-neut.
(Nabokov, Zaščita Lužina)

In the preceding chapters, we have often had to make a disclaimer about the behavior of the verbs of existence, most notably the verb *est'* - 'be'. Describing the pattern in very general terms, we can say that these verbs allow the occurrence of all the syntactic processes that are possible only with unaccusative verbs. However, while for the majority of unaccusative verbs these processes are optional, for the verbs of existence they are obligatory. Let us review the relevant properties of these verbs.

First of all, in sentences containing the verbs of existence the position of an argument is strongly correlated with its interpretation. An indefinite subject must occur VP-internally (at the right edge of the sentence) and a definite subject must occur VP-externally (at the left edge of the sentence), as (126) demonstrates. This is the same pattern we have observed with other unaccusative verbs that can appear in the Locative Inversion constructions: if the discourse function of the arguments is not manipulated, definite nominals appear pre-verbally and indefinite nominals appear post-verbally. However, the effect is much sharper and easier to detect in sentences with verbs of existence.

126 a. Glavnyj vrač - na dače
Head-sg-nom doctor-sg-nom - on summer house
'The head doctor is in his summer house'
b. V gorode est' vrač
In town be doctor-sg-nom
'There is a doctor in the town'
c. Glavnogo vrača net v gorode
Head-sg-gen doctor-sg-gen not-be in town
'The head doctor is not in town'
d. V gorode net vrača
In town not-be doctor-sg-gen
'There is no doctor in town'

Note that the pattern is independent of whether the sentence is negated (126c,d), so that the subject appears in the genitive case, or non-negated, so that the subject appears in the nominative case (126a,b). The same pattern is observed in possessive, locative, and existential sentences (127).

127 a. U menja est' / byla sestra
At I-gen be / was-sg-fem sister-fem-sg-nom
'I had a sister'
b. Sestra byla u menja
Sister-fem-sg-nom was-sg-fem at I-gen
'The sister (relation or profession) was at my place'
c. U menja ne bylo sester
At I-gen not was-sg-neut sister-pl-gen
'I had no sister'
d. Sester ne bylo u menja
Sister-gen-pl not was-sg-neut at I-gen
'The sisters were not at my place'

In (127a,c), where the nominal occurs in the post-verbal position, the sentence describes possession, and cannot mean anything other than 'I had a sister'. In (127b,d), where the nominal occurs in the preverbal position, the sentence has a locative meaning, in which a specific sister is located 'at my place'.[56] The non-negated verb 'be' - *est'* - changes its form,

[56] Note that everything we are saying holds only of sentences with "discourse neutral"

depending on whether the nominal argument is definite (and occurs pre-verbally) or indefinite (and occurs post-verbally). The phonologically realized form *est'* surfaces in the sentences containing indefinite nominals (see (126b) and (127a)), and the phonologically null form of the verb surfaces in the sentences containing a definite nominal (see (126a) and (127b)).

Importantly, in sentences containing verbs of existence (just as in the sentences containing other unaccusative verbs) it is the discourse function of arguments, rather than the grammatically specified definiteness, that determines their position. If a grammatically indefinite nominal is D-linked (an picks out a member of a set previously established in the discourse), it will occur pre-verbally. If a grammatically definite nominal is non D-linked (and represents new information in the context of the utterance) it will appear post-verbally (see (128)).

128 a. Who was home?
Doma byl Vanja
Home was-sg-masc Vanya-masc-sg-nom
'It was Vanya that was home'
b. Who wasn't home?
Doma ne bylo Vani
Home not was-sg-masc Vanya-masc-sg-nom
'It was Vanya that wasn't home'
c. Odna kniga byla u menja
one book-fem-sg-nom was at I-gen
'I had one of the books'
d. Ni odnoj knigi ne bylo u menja
neg one book-fem-sg-gen at I-gen not was-sg-neut
'I didn't have any of the books'

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intonation: thus, in (127b) the nominal can be interpreted as indefinite (and the sentence - as describing a relationship) if it is given contrastive stress, "I had a SISTER (but not a brother)".

Thus, the inherent definiteness specification of a nominal can be "over-ridden" by its discourse interpretation. This property distinguishes the interpretive effects of the position of arguments of verbs of existence from the Definiteness Effect exhibited in the genitive of negation environments, where the inherent definiteness specification of a nominal cannot be "over-ridden" by its discourse interpretation, and a definite NP cannot remain within the domain of existential closure, regardless of what its discourse function is. Thus, in sentences containing verbs of existence the position of elements has a sharp interpretive effect.

The second relevant property of verbs of existence is their propensity for conjunction agreement. If we characterize the pattern more accurately, perhaps only one verb of existence shows it to a full extent - it is the verb *est'* denoting possession. For other unaccusative verbs, both plural and singular agreement is possible when the subject occurs VP-internally at Spellout (129a), but for this verb of existence the "normal" plural agreement is at best marginal (129b,c).

129. a. Na stole stojala / sojali lampa i pustoj stakan
On table stood-sg-fem / stood-pl lamp-sg-fem-nom and empty glass-sg-masc-nom
'On the table stood a lamp and an empty glass'
b. U tebja byla kosa i beloe plat'e v rozovuju kletočku
At you-gen was-sg-neut braid-sg-fem-nom and dress-sg-fem-nom with rose checks
'You had a braid and a white dress with a pink check pattern'
c. *U tebja byli kosa i beloe plat'e v rozovuju kletočku
At you was-pl braid-sg-fem-nom and white dress-sg-fem-nom with rose checks

This pattern is very reminiscent of the agreement that occurs in the English expletive constructions. Thus, a study reported in Sobin (1996) has shown that speakers of English judge sentences like those in (130a,b) as significantly more natural than those in (130b.c).

130 a. There's a pen and a stamp on the desk
b. There's a pen and some stamps on the desk
c. There are a pen and a stamp on the desk
d. There are a pen and some stamps on the desk.
e. The *'there are...'* Rule:
If: *there* [$_{AGRS}$ +plural] ... *be* [$_{NP}$ +plural]
1 2 3 4
then: check the plural feature on 2
(Sobin, 1996)

Sobin explains the pattern by saying that the singular agreement is a reflex of "normal" feature-checking relationship between the subject (namely, the expletive) and a functional head (which for him is AgrS), but plural agreement can arise only as a result of the operation of a "grammatical virus", characteristic of Prestige English, given in (130e). Note that the Russian facts do not lend themselves to such an analysis (and cast serious doubt on whether it is appropriate for English, as well): both plural agreement and conjunction agreement are very general phenomena in Russian, and neither is restricted to occurrence with a specific lexical item, such as 'there', or 'be'.

This is a good point to discuss the agreement patterns shown by the verbs of existence in general. One member of this class, the verb *est'* - 'to be', shows an exceptional agreement pattern: in the present tense, it has an invariant, non-agreeing form in both the negated and the non-negated sentences (131a,b,c).

131 a. U slona est' žena, Matrena Ivanovna
At elephant-gen be wife-fem-sg-nom, Matrena-sg-nom Ivanovna-sg-nom
'The elephant has a wife, Matryona Ivanovna'
b. Petja vo dvore
Petya-masc-sg-nom in yard
'Petya is in the yard'

c. U slona net ženy
At elephant-gen not-be wife-fem-sg-gen
'The elephant does not have a wife'

This fact has prompted some researchers to analyze the verbs of existence as deficient in not having the functional projections or not undergoing the movement operations associated with agreement processes. Thus, Pesetsky (1982) relates the behavior of these verbs under negation to the non-occurrence of the agreement and nominative case assignment projections with them. The problematic aspect of such analyses is that the verb 'be' displays normal verbal agreement in the past and future tenses, surfacing with the subject's gender and number features in the past tense and with its person and number features in the future tense (132a,b). In addition, other verbs of existence show standard agreement in the present tense, as well as in the future and past tenses (132c,d).

132. a. U slona byla žena
At elephant-gen was-sg-fem wife-fem-sg-nom
'The elephant had a wife'
b.U slona ne bylo ženy / *ne byla žena
At elephant not was-sg-fem wife-fem-sg-gen /* not was-sg-fem wife-fem-sg-nom
'The elephant did not have a wife'
c. V skazkax sušestvujut / byvajut edinorogi
In fairy tales exist-3rd-pl unicorn-pl-nom
'In fairy tales there are unicorns'
d. Najavu ne sušestvujet / byvaet edinorogov
In real life not exist-3rd-sg unicorn-pl-gen
'In real life unicorns don't exist'

Finally, verbs of existence differ from other unaccusative verbs in their behavior under sentential negation. Here, genitive case-marking surfaces obligatorily on the nominal

argument of the verb (133a,b). Thus, neither definite nor indefinite nominals may appear with the nominative case-marking (133c,d).

133 a. Vovy netu doma
Vova-sg-masc-gen not-be home
'Vova is not at home'
b. U menja net nikakix problem
At I-gen not-be neg-kind problem-pl-gen
'I don't have any problems'
c. *Vova netu doma
Vova-sg-masc-nom not-be home
'Vova isn't home'
d. *U menja net nikakie problemy
at I-gen not-be neg-kind problem-pl-nom
'I don't have any problems'

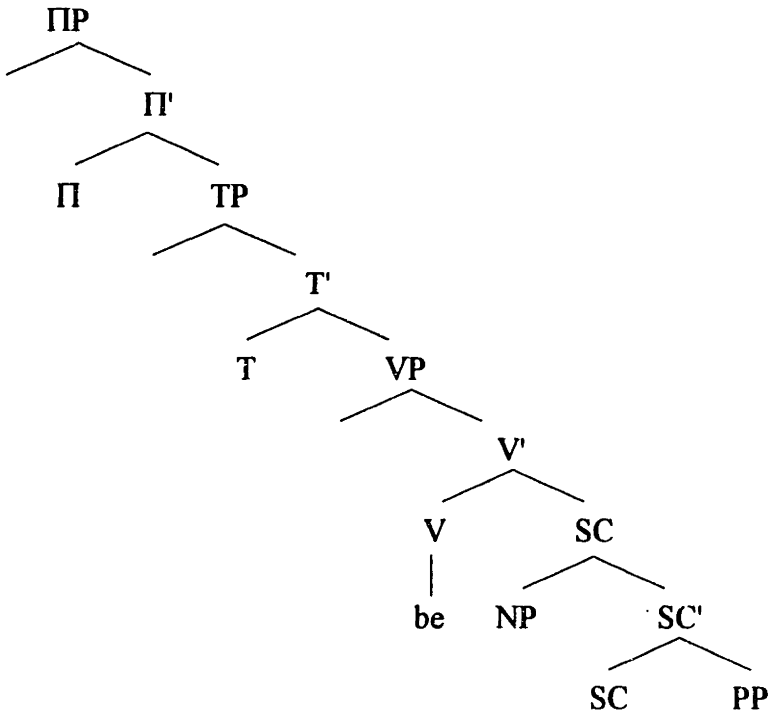
As we have mentioned before, the preferred position of definite genitive nominals is pre-verbal (133a,c), and the preferred position of indefinite genitive nominals is post-verbal (133b,d), just as in the non-negated sentences.

5.2 The Syntactic Analysis of Verbs of Existence

While all of the properties of the verbs of existence described in the previous section are intriguing and somewhat mysterious, only two of them characterize these verbs as radically different from the "normal" unaccusatives: the absolute inability of nominative case to surface in negated contexts and the "suspension" of the Definiteness Effect associated with the genitive of negation (133). In the analysis that we offer, these two properties are connected, but do not reduce to a single syntactic factor.

We adopt a syntactic analysis of verbs of existence, within which a Small Clause is a complement of the matrix verb, and contains both the Theme and the Location arguments (c.f. Stowell (1981)). The structure of the Small Clause appearing in (134) represents it as being headed by a functional category (SC), but the analysis we present is also compatible with the structure of a Small Clause where it is simply the Locative PP with the Theme argument occurring in its Specifier position.

134.



We take verbs of existence to be truly exceptional with respect to a single property: the T node that occurs with them under negation is incapable of checking features. This statement is an incarnation of Pesetsky's analysis, within which the verbs of existence were said not to co-occur with Agreement. This approach appears sensible and even unavoidable when we consider the most central and typical member of this verb class, the verb *est'* - 'to be' - but it

becomes less attractive when it is extended to other verbs of this class. As we mentioned in the previous section, *est'* does not show subject-verb agreement in non-negated sentences in the present tense, but all other verbs of existence do. However, if verbal agreement is a morphological reflex of case- and phi-feature checking, as is assumed in the Minimalist syntactic framework, then the absence of subject-verb agreement in negated sentences containing verbs of existence has to be taken as an indication that no feature-checking has taken place between T and the Theme argument of these verbs (see (135)).

135 a. Svety ne bylo v klasse
Sveta-gen not-was-sg-net in class
'Sveta was not in class'
b. Na perekrestke ne proisxodilo avarij celyj mesjac
on intersection not happened-sg-neut accident-pl-gen whole month
'No accidents happened on the intersection for a whole month'

Once the assumption that the TP projection dominating the negated verbs of existence is incapable of checking Case and phi-features is made, most of the properties of these verbs fall into place.

Of course, the verbal complex occurring in sentences like (135) is unable to check the Case features of any nominal. However, the EPP projection in the clause has its normal properties. Specifically, some element must move into the position of the Spec of ΠP to check the EPP feature in overt syntax. With verbs of existence, just as with all other unaccusative verbs, the PP argument and the NP argument are equally close to the Spec of ΠP position: in the structure of (134), both elements are in the minimal domain of the head of

the Small Clause.[57] Thus, the derivation can converge if either the PP or the NP moves to satisfy the EPP. In other words, this is one of the situations where syntax "has a choice" of which element moves to the EPP position, and, as a result, the movement operation has interpretive consequences: the element that satisfies the EPP and occurs in the sentence-initial position is interpreted as D-linked and the element that remains VP-internal is interpreted as non-D-linked by the discourse principles (see section 2.4). The positional interpretive effects in the negated sentences with existential verbs are identical to the positional interpretive effects in the non-negated sentences with these verbs or to the positional interpretive effects in sentences with other unaccusative verbs (136).

136 a. Direktora ne bylo v škole
principal-gen not-was-sg-neut in school
'The principal was not in the school' *'There was no principal in the school'
b. Director byl v škole
principal-nom was-sg-masc in school
'The principal was in the school' *'There was a principal in the school'
c. Director pojavljalsja na rabote
principal-nom appeared-sg-masc at work
'The principal appeared at work'

Note that the Theme argument appears with the genitive case-marking in the negated sentences containing verbs of existence because it meets the environment of the application of the Redundancy Rule in (115), which supplies the nominals that lack Case features within syntax with the default Objective case specification when they enter the morphological component of the grammar. If the T projection dominating a verb of existence cannot check

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[57] If Small Clauses are taken to be PPs, tehn some non-standard assumptions have to be made to allow X' movement, but the two elements that can undergo movement (namely, the NP and teh P') are still in the same minimal domain, and, therefore, equidistant from the target of movemement.

Case features, then only the derivations that contain Caseless nominals as arguments of negated verbs of existence can converge. If a nominal with Case features is base-generated as the Theme argument of a negated verb of existence, then it will not be able to check its Case features against any element, and the derivation will crash.

The pattern we have described above is a strong argument in favor of a complete separation of the EPP and Case, as well as discourse interpretation and Case: it is clear that nominals lacking Case features undergo movement to satisfy the EPP position, just as Cased nominals do; the discourse principles interpret the Caseless nominals satisfying the EPP in the same fashion as the Cased nominals fulfilling the same function. We have presented a similar argument using PPs that satisfy the EPP, but, perhaps, this is a cleaner case.

Nothing we have said so far explains why definite nominals (regardless of their Case feature specification) are able to occur with the genitive Case-marking. Recall that genitive case features are assigned within morphology to Caseless nominals (or nominal chains) that occupy a VP-internal position. Such nominals, or such nominal chains, should be subject to existential closure that affects all VP-internal positions indiscriminately. Note that it is irrelevant if the head of the nominal chain is outside of the VP at Spellout, if it is not occupying an A-position: it will undergo reconstruction at LF, and be interpreted as VP-internal. as we have shown previously, the EPP position, which the D-linked genitive nominal in (136a) occupies, is A-bar (see section 2.3), and the elements occupying it undergo obligatory reconstruction at LF. On the other hand, we have had to assume that the A-position that nominals satisfying the EPP typically pass through - namely, the Spec of TP - is unavailable in sentences like (136a). Thus, we might expect the genitive definite nominals

to reconstruct to their base-generated positions, which for unaccusative verbs is subject to existential closure, so that the structure is expected to be ungrammatical, contrary to fact.

We suggest that the verbs of existence are not displaying another exceptional characteristic. Rather, the absence of the Definiteness Effect for their genitive arguments is a normal and expected consequence of their syntactic structure (see (134)). While the Mapping Hypothesis of Diesing (1982), which we have taken as the basis of the Definiteness Effect, refers simply to VP-internal and VP-external positions, within other theories more fine-grained distinctions are made. We have already mentioned the theory of Adger (1994), which connects the definite, presuppositional, or familiar interpretation of nominals to their occurrence in Agr Phrases. Tsai (1994) argues for a cyclic version of a Mapping Hypothesis, where the arguments occurring in their base-generated, theta-related positions map onto the nuclear clause and are interpreted existentially, while the arguments occurring within functional projections dominating projections such as VPs are mapped onto the restrictive clause and are interpreted presuppositionally. Similarly, Percus (1995) suggests that only the arguments of the VP proper, but not necessarily the arguments more deeply embedded inside the VP are subject to existential closure.

We would like to suggest that a finer-grained Mapping Hypothesis, along the lines suggested in Tsai (1994) or Percus (1995), should be adopted to deal with the Russian verbs of existence. Given the syntactic structure in (134), where the Small Clause is headed by a functional category, both of these proposals will give us the desired result: the arguments of the VP, but not the arguments of its complement Small Clause will be subject to existential closure. If the analysis of Small Clauses represented in (134) should turn out to be incorrect,

so that a Small Clause should be analyzed as a PP with an NP occurring in its Specifier position, then some approach closer to that of Percus (1995) will have to be adopted. The theory required to deal with the data presented here would put only the direct object and the subject arguments of a VP within the domain of the existential closure induced by it. [58]

The claim that the subject of a Small Clause argument of a verb of existence is outside of the domain of existential closure will, of course, give the result that definite nominals acting as the Theme arguments of verbs such as 'be' will be able to surface with genitive case: whether they remain VP-internal at Spellout (this happens when they correspond to new information in the context of the utterance) or raise to the EPP position (this happens when they correspond to old information), they will not have a chance to occupy an A-position and will meet the environment of the operation of the Redundancy Rule that supplies the genitive case specification to Caseless nominals. However, we can find independent empirical evidence in support of the fact that the formulation of the Mapping Hypothesis required for the handling of verbs of existence is correct more generally.

In chapter 4 we have suggested that verbs of perception take Small Clauses as complements, and require that the predicate of the Small Clause be Stage-level. Thus, perception matrix predicates allow genitive of negation to surface on the subject of their Small Clause complement (137a). Now, notice that the finer-grained definition of the Mapping Hypothesis that we have proposed above, within which the arguments of Small

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[58] Note that our analysis crucially differs from that of Hoekstra & Mulder (1990), who treat all unaccusatives as copular verbs with a Small Clause complement. For us, there is a difference in the interpretation of the nominal arguments of 'standard' unaccusative verbs and those of verbs of existence, and that difference is explained by the fact that 'standard' unaccusative verbs take an NP complement, while the verbs of existence take a Small Clause complement.

Clauses are outside of the domain of the existential closure imposed by the matrix predicate, predicts that the direct objects of perception verbs should be exempt from the Definiteness Effect typically imposed on the genitive arguments: they do occur within a VP, and, thus, can occur with the genitive case-marking, but their base-generated position is too low for them to be in the domain of the existential closure. This prediction is indeed borne out (see (137b)).

137 a. Ja ne videla ni odnoj sobaki takoj golodnoj
I-nom not see neg single dog-gen so hungry-instr
'I've never seen a single dog so hungry'
b. Ja ne vižu v klasse Peti
I-nom not see in class Petya-acc
'I don't see Petya in class'

Thus, we take this "exceptional" property of the verbs of existence to be fully explained by the fact that their complements are Small Clauses, rather than simple NPs.

In this chapter we have presented a description of the "exceptional" properties of the Russian verbs of existence. We have shown that they reduce to two syntactic factors: the inability of the T occurring with negated verbs of existence to check Case (and phi-) features and, consequently, act as an A-position, and the fact that the verbs of existence take Small Clauses, rather than simple NPs, as complements. As a result, the "objects" of the verbs of existence are not subject to existential closure and may not occur with nominative case-marking. The negated clauses containing verbs of existence have all the other standard clause properties. In particular, the EPP and the discourse principles interpreting the results of its operation function just as they normally do.

6 Conclusion

In this work, we have presented an analysis of two syntactic phenomena in Russian - the conjunction agreement and the genitive of negation - expressed in terms of the interaction of a specific formulation of the Extended Projection Principle we have argued for and several other general processes operating in the Russian language. The version of the Extended Projection Principle that we have arrived at is not restricted in terms of the categories of the elements that can satisfy it - any element may do, provided that the movement operation that raises it to the EPP position does not violate constraints on legitimacy of movement operations, most importantly, the Minimal Link Constraint.

This way of looking at the EPP allows us to characterize the distribution of the Locative Inversion Constructions, as well as a number of other syntactic phenomena, whose occurrence depends on the subject's ability to remain in its base-generated position in overt syntax and at LF. What emerges is a coherent picture of a number of unaccusativity-related phenomena in Russian syntax.

1 Introduction[1]

In this work we discuss a range of empirical and intuitive data on the processing complexity of unambiguous Japanese sentences. Our purpose in doing so is twofold: first, some of the structures made available by a head-final language like Japanese allow us to test the predictions of theories of processing complexity in a more direct fashion than the structures of a head-initial language like English. Second, examining the Japanese data allows us to pursue a more general goal: in the processing literature it is commonly assumed that the mechanisms involved in language processing are universal. This is clearly the null hypothesis: the ability to process any language is as much a part of human cognitive abilities as the ability to learn the grammar of any language; this ability can be seen as the manifestation of a universal innate system that determines the manner in which all languages are processed and differs from language to language only as much as the grammars of these languages differ (but see Mazuka & Lust (1990) for a different view). Yet this approach can be maintained only if it is possible to formulate explicit and descriptively adequate processing theories that can apply to diverse languages. In this work, we apply a theory of processing complexity presented in Gibson & Thomas (1996a) (henceforth, G & T) that has been developed to account for data from a head-initial language to data from a head-final language, showing that the theory is capable of dealing with both. In addition, we describe the properties any theory of processing complexity must have to handle the task

[1] The work presented here has been done in collaboration with Ted Gibson. The appropriate reference is Babyonyshev & Gibson, forthcoming.

The sort of processing complexity contrasts we will be concerned with are illustrated in (1):

1 a. The man slammed the door.
b. The man the woman slapped slammed the door.
c. #The man the woman the child kicked slapped slammed the door.

While all of these three sentences are grammatical, their processing complexity differs: (1b) is slightly more difficult to process than (1a), and (1c) is still more difficult - in fact it causes processing breakdown for the majority of English speakers, who are unable to construct its complete syntactic representation and compute its meaning. This difficulty arises because of the limited resources of working memory available for language processing: in sentences like (1c), there are points where too many incomplete relationships among words have to be retained in working memory for the parser to deal with the structure successfully.

Various studies have demonstrated that language processing utilizes the same pool of working memory resources as other tasks, for instance, retaining a list of items in memory for retrieval after a brief period of time. It has been shown that when people have to remember a list of unrelated words while processing a set of sentences, they do so at a slower rate and with poorer comprehension, than when they do not have to remember anything (King & Just, 1991). And conversely, when people are remembering a list of items while processing a set of syntactically simple sentences, their ability to recall the items is better than when they are processing a set of sentences that are more complex (Carpenter & Just, 1989). Thus, the greater the complexity of a sentence being processed, the more memory resources are required. The main task of a processing complexity theory is to specify which syntactic

properties of structures need to be represented by the human parser, requiring a portion of the working memory resources and increasing the perceived complexity of the structures. An additional task is to specify in which situations the demands of a structure exceed the resources of the working memory.

While most theories are careful to make their complexity metric syntactically plausible, basing it on the aspects of structures that must be present in the syntactic representations of sentences (e.g. theta-relations, case-assigning relations, syntactic positions of elements, the number and type of nodes present, etc.), relatively few make an effort to make assumptions plausible from the point of view of the known properties of working memory. Lewis (1996) takes a step in this direction, arguing that the difficulty of processing certain structures is due to the interference between similar elements contained in them, just as the difficulty of recalling an early item on a list is due to the interference of the later items (Waugh & Norman, 1965). The theory of G & T takes the parallel between the mechanisms of language processing and other operations of working memory even further, incorporating the notion of locality into their framework, so that a syntactic relationship that has to be retained in memory over a long period of time (i.e., while a large number of words is processed) requires greater memory resources and causes greater difficulty than a syntactic relationship that has to be retained in memory for a short period of time (i.e. while a smaller number of of words is processed), just as an item on a list is more difficult to recall than a later one.

From a very general perspective, the main point of the processing theory of G & T is this: working memory operates in a specific, universal fashion that does not change

depending on the units it is operating on. When language is processed, these units are syntactic dependencies among words in a sentence. While different languages give rise to different combinations and orders of syntactic dependencies, the mechanisms involved in processing them are the same, because both UG and working memory are universal properties of human cognition.

2. The Processing Framework: Locality of Syntactic Dependencies

2.1 The Theory

2.1.1. Building the Appropriate Syntactic Structure: the Parsing Algorithm

Within the theory of processing complexity developed in G & T, memory cost is associated with obligatory predicted categories that a partial structure contains. In other words, as a parser encounters a string of words and constructs a syntactic representation for it, it has to keep track of the categories that have been predicted but have not been encountered yet (and will have to be encountered for the string of words to become a complete sentence). This process requires considerable memory resources and affects the perceived processing complexity of a sentence.

Of course, for this complexity metric to operate, an appropriate partial structure with all the relevant predicted categories has to be constructed. In the remainder of this subsection we provide a description of a parsing algorithm that is capable of constructing the appropriate structure for all of the sentences we will be concerned with. We want to emphasize that while the existence of some parsing algorithm capable of carrying out this task is absolutely crucial, the specific mechanisms employed are less important for our purposes here: there has to exist an appropriate structure on which the complexity metric may operate, but the manner in which this structure has been built does not directly affect its operation.

One model of the human parser that fits our needs naturally utilizes the version of the head-corner parsing algorithm adopted in Gibson (1991). This algorithm has both bottom-up

and top-down components and is based on X-bar theory. For example, suppose the parser is operating in a language that contains the set of PS-rules given in (2).

2 a. DP -> Det NP
b. IP -> DP I'
c. I' -> I VP

If it encounters a lexical item of the category Determiner (e.g. 'the'), which occurs as a left-most daughter in a PS-rule of the grammar (namely (2a)), the parser accesses this PS-rule and proceeds to build structure in accordance with it. First it operates in a bottom-up fashion, constructing a Det node for the lexical item 'the', as well as a node of the category DP, which appears as the root category in the PS-rule. Now the parser operates in a top-down fashion, predicting a node of the category NP, which appears as a daughter in the PS-rule and acts as a complement of the Comp. This process is illustrated in (3a).

3 a. input: 'the'; structure: $[_{DP}\ [_{D'}\ [_{Det}$ the] $[_{NP}\ [_{N'}\ [_{N}\ ]]]\ ]]$
b. input: 'the'; structure: $[_{IP}\ [_{DP}\ [_{D'}\ [_{Det}$ the] $[_{NP}\ ]]]\ [_{I'}\ [_{I}\ ]]]$
c. input: 'the'; structure: $[_{IP}\ [_{DP}\ [_{D'}\ [_{Det}$ the] $[_{NP}\ [_{N'}\ [_{N}\ ]]]\ [_{I'}\ [_{I}\ ]\ [_{VP}\ [_{V'}\ [_{V}\ ]]]\ ]]$

Note that each node (whether dominating an item already processed or created as a result of a prediction) is constructed with the appropriate X-bar-structure. As this simple example shows, when a head-corner parsing algorithm is operating, processing a lexical item of a category that occurs as the left-most daughter in a PS-rule causes the prediction of all the other categories that appear in the PS rule.

Now it is possible to illustrate the next important property of the parsing algorithm we are describing: it is head-driven in the sense that processing the head of a given category

is equivalent to processing the complete category for the purposes of hypothesizing further sentence structure. For instance, in our example processing the Determiner 'the' is sufficient for the parser to access the PS-rule (2b), in which a DP appears as a left-most daughter node, and to construct an IP and an I' node in accordance with it, as shown in (3b). The parser does not have to wait until the NP complement of the Determiner is processed and the DP is complete to proceed with building this structure.

So far, we have described one situation in which the parser may access a PS-rule and build predicted categories in accordance with it: when a parser encounters a lexical item of a category that appears as a left-corner member of the PS-rule. The same process may occur in another situation: when the category that appears as the left-corner member of a PS-rule may be realized as a phonologically null lexical item. The process of parsing language is word-based, and this mechanism gives the parser the ability to predict the next word "through" a phonologically null lexical item. Let us suppose that in the language whose grammar we are considering some of the lexical items of the category Infl are phonologically null. If this is so, the parser may access the PS-rule in (2c) and use it to build the structure in (3c). Given the set of PS-rules that we have provided, (3c) shows the most structure that our parsing algorithm can build on processing the lexical item 'the'.

If the next item in the input string is a Noun, such as 'boy', the parser will access the PS-rules which have a Noun as the left-corner member (see (4a,b)) and create structure in accordance with them, as illustrated in (4c). Note that the PS-rule in (4a) contains an optional node - that of an AP modifier - that does not correspond to any lexical items in the input string. The parser has assumed that it is not instantiated in this particular sentence and built

the structure of the NP accordingly. Because the optional node in the PS-rule (4b) - that of a PP complement of the Noun - follows the Noun, it is still possible that the PP may be encountered in this sentence, and this node is represented in the structure of the NP.

4 a. NP -> (AP) N'
b. N' -> N (PP)
c. input: 'boy'; structure: $[_{NP}[_{N'}[_{N}$ boy] ($[_{PP}[_{P}[_{P}$]]])]]
d. $[_{IP}[_{DP}[_{D'}[_{Det}$ the] $[_{NP}[_{N'}[_{N}$ boy] ($[_{PP}[_{P}[_{P}$]]])]] $[_{I'}[_{I}$] $[_{VP}[_{V'}[_{V}$]]]]]

Consider the two structures the parser has created after processing the string 'the boy', given in (3c) and (4c). (3c) contains a predicted NP structure and (4c) contains a confirmed NP structure dominating some lexical material. The lexical features, bar-levels of structure, and the tree structure above the two NP nodes are compatible. As a result, the parser will match the two NP nodes and unify them, creating the single structure given in (4d). Note that while the NP structure in (4c) contains a PP node not present in the IP structure in (3c), this node is optional and so may be ignored by the parser in determining whether the two structures are compatible or not. This illustrates the process of node attachment as it occurs in this framework.

Let us take a further step towards making our example more realistic, illustrating the last relevant property of the parsing system we are describing. Of course, the sentence structure of English (and any other natural language) is much more varied than the set of PS-rules in (2) and (4) suggests. Frequently the lexical input matches more than one possible structure and can be continued in a number of ways. Suppose the next element encountered in our input string is the Verb 'sees', so that the complete string becomes 'the boy sees...' The verb is ambiguous (has two lexical entries): it may occur with a DP direct object, as in (5a),

or with a CP direct object, as in (5b). In addition, it may optionally occur with a PP, as in (5c). The set of PS-rules that represents these possibilities is given in (5d-g). Note that a direct object corresponding either to (5e) or (5f) is obligatory - if our input string does not continue, it will not constitute a grammatical sentence - but a PP adjunct is not , as witnessed by the acceptability of (5a) and (5b).

5 a. The boy sees the ant.
b. The boy sees that the ant was crawling away.
c. The boy sees the ant through a magnifying glass.
d. VP -> V' (PP)
e. V' -> V DP
f. V' -> V CP
g. CP -> C IP

How does the parser deal with the fact that more than one syntactic structure may be built based on the input string? There exist two classes of theories about the way the human parser behaves when faced with structural ambiguity: the serial models, within which one structure is chosen and built, and the parallel models, within which a number of the possible structures are built and retained. Within the model of Gibson (1991) which we are describing, a middle course is chosen: the human parser operates in a ranked parallel fashion. Let us illustrate the "parallel" aspect of its operation first. The parser creates all the syntactic representations compatible with the input string, so that in our example, both the structure in (6a) and the structure in (6b) are built.

6 a.. $[_{IP}\ [_{DP}\ [_{D'}\ [_{Det}$ the] $[_{NP}[_{N'}[_{N}$ boy]]]] $[_{I'}[_{I}\ ]\ [_{VP}[_{V'}\ [_{V}$ sees] $[_{DP}[_{D'}[_{Det}\ ]]\ (\ [_{PP}[_{P'}\ [_{P}\ ]]]\ )\ ]]$
b. $[_{IP}\ [_{DP}\ [_{D'}\ [_{Det}$ the] $[_{NP}[_{N'}[_{N}$ boy]]]] $[_{I'}[_{I}\ ]\ [_{VP}[_{V'}\ [_{V}$ sees] $[_{CP}[_{C'}[_{Comp}\ ]]\ (\ [_{PP}[_{P'}\ [_{P}\ ]]]\ )\ ]]$

Actually, both structures are expanded a bit farther, since in English both Determiners and Complementizers may be phonologically null, but we ignore this process because it is not crucial for our purposes here. Now let us describe the two situations in which a structure that has been built for the input may be discarded. First, it may be discarded if it becomes incompatible with the continuation of the input. For instance, suppose our input string 'the boy sees...' continues as in (5b), so that the structure in (6b) is the correct representation of the sentence. At the next word of the input string - 'that' - both representations in (6) remain compatible with the input, because 'that' may be either a Determiner, which can be attached into the structure in (6a), or a Complementizer, which can be attached into the structure in (6b). However, at the next word of the input string - 'the' - the structure in (6a) stops being compatible with the input string. Only the structure in (6b) contains a predicted category into which the Determiner node dominating 'the' can be attached. As a result, the structure in (6a) is discarded at this point.

Let us consider the other possible continuation of our input string. Suppose it continues as in (5a), so that (6a) is the correct representation for it. The remainder of the input string - 'the ant' - can be attached into the structure (6a) as the matrix direct object DP or into the structure (6b) as the embedded subject DP (if a phonologically null Complementizer is posited as the head of the embedded CP), so both (6a) and (6b) remain compatible with the input string. However, the input string stops at this point, and the structure (6b) contains a number of obligatory predicted categories (such as the embedded IP and VP) that have not been filled with lexical material. Thus, it is taken to not be the correct representation for the input and it is discarded. At the end of the input string the structure

(6a) also contains a predicted category that has not been filled (namely, the PP), but because this category is optional, it is simply pruned from the structure, which is then taken to be the correct representation for the sentence being processed.

Let us describe the second situation in which a structure that has been constructed may be discarded. This illustrates the "ranked" aspect of the parser's operation. As the parser encounters each new word in the input string, it computes the memory cost associated with all of the syntactic representations it has built, using the complexity metric that we will make explicit shortly. If at any point one of the representations becomes significantly more expensive than the other ones, it is discarded. A conscious garden-path effect is experienced if a representation that has been discarded later turns out to be the appropriate one. The "costliness" of a representation is calculated in all situations, regardless of whether the structure being built is one of many (that is, the input string is locally or globally ambiguous) or the only one (that is, the input string is unambiguous). Processing breakdown may occur in the absence of ambiguity: this happens if the only structure constructed for the input string becomes excessively expensive and requires more memory resources than are available. Note that what is important in this situation is the notion of absolute memory cost of a structure, rather than its cost relative to the cost of other structures.

Before we turn to a description of the complexity metric the parser uses to evaluate the difficulty of sentences, let us clarify one aspect of this model of processing that may be confusing and say a few words about the status of PS-rules within it. It is not claimed that they are real syntactic objects or a part of the grammar (or UG). With much of the current syntactic literature, we assume that PS-rules are an epiphenomenon, describing (rather than

determining) the surface order of lexical items in a given language, which is really determined by a combination of syntactic processes (e.g., Merger, the strength of the features born by different categories, etc. within the syntactic framework of Chomsky (1995)). The only point crucial for our purposes here is that PS-rules are a convenient descriptive device for expressing the word orders created by these syntactic processes. It is possible that the human parser uses PS-rules as part of its operation (and, thus, differs from the human grammar), but it is also possible that it uses some other, more syntactically meaningful, device to encode the same information and relationships among categories.

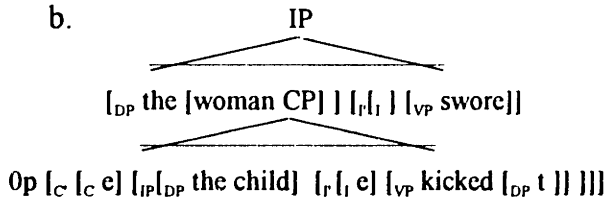
2.1.2 Evaluating the Memory Cost Associated with a Structure: the Complexity Metric

Now we are in a position to describe the complexity metric adopted within the framework of G & T. The complexity metric is used by the human parser to determine which syntactic structures are "costly" or difficult to process. In this work, we will mostly be concerned with syntactic factors that contribute towards processing complexity, although a great many other factors may affect the processing complexity of a sentence as well: plausibility, frequency of the lexical items involved, discourse factors, pragmatic confusability of lexical items, etc. Some of these factors will be mentioned briefly as they become relevant to our discussion, in all other places we will attempt to keep all potentially relevant non-syntactic factors constant, so that the effect of the syntactic properties of utterances on processing complexity may be isolated for study.

Within the theory of processing complexity of G & T, the structures created by the parser are evaluated in terms of the working memory cost associated with them at each point where a new lexical item is processed. In most general terms, given a partial structure that has been constructed by the parser, a category that has not been processed but is necessary for the partial structure to become a complete grammatical sentence may potentially be associated with memory cost. The total cost associated with a given partial structure is the sum of the costs associated with each required predicted category within it.

As a first step towards making this mechanism explicit, we need to specify exactly what counts as a required predicted category within a structure. These categories, which must be filled with lexical items (or traces) for a partial structure to become a complete sentence, are a subset of "obligatory predictions" we have already encountered in the previous example. Let us go through an example to make this notion clearer. Suppose the parser has encountered the input string given in (7a). (7b) provides the appropriate structure for this sentence in a slightly abbreviated form.

7 a. The woman the child kicked swore.

b. 

c. [IP [DP the [woman ([CP])]] [I' [I] [VP [V' [V]]]]]

Consider the structure that has been built at the point where the first nominal - 'the woman' - has been processed, given in (7c). At this point, the IP and the VP of the matrix clause and a relative clause CP are predicted. The predicted relative clause CP is optional, in the sense that

it does not have to be filled with lexical material for the sentence to be complete, but the predictions of the matrix IP and VP are obligatory - the elements filling these categories have to be encountered for the input string to become a sentence.

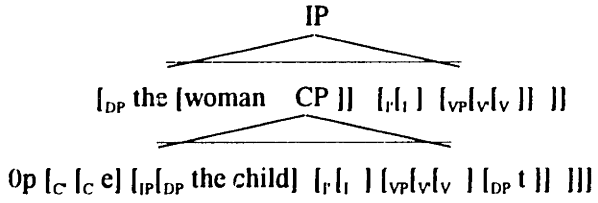
Do both of these predictions count as distinct, so that memory cost may be associated with each of them? Or, to put the question more generally, which functional projections are considered to be "separate" by the parser? If our syntactic representation of (7a) were more accurate, it would perhaps contain AgrS, TP, AgrO, and several V heads (at the very least) - does the parser treat all of these elements as separate predictions? This is one point within the theory where a number of slightly different approaches are possible and the known data do not completely determine the answer. Note that the answer has empirical consequences, because examples can be constructed in which some of the relevant projections would be absent (e.g. a sentence containing an unaccusative verb vs. a sentence containing an unergative verb), so that - if all projections contribute to processing difficulty - these examples would be expected to be easier to process. Such contrasts are not observed, and, in general, fewer categories need to be considered to account for all of the processing complexity contrasts that we will be concerned with here.

A hypothesis proposed in G & T is that only morphologically independent categories, that is, categories that are not part of a chain formed by head-movement, constitute separate predictions that the human parser needs to keep track of. Thus, because in English V raises to Infl by head-movement (at some level of the derivation), the parser does not treat an IP as a morphologically independent category and as a result the prediction of the IP/VP complex is considered a single prediction, rather than two separate predictions. Note that this approach

makes strong (and easily testable) cross-linguistic predictions: for instance, if in a certain language some element that is realized as a verbal inflectional morpheme in English is consistently realized as a separate word, then it should be possible to create situations in which the sentences of this language will be more difficult to process then the corresponding English structures. Let us adopt this hypothesis. Its consequences for English are that the prediction of a VP (along with all the relevant functional projections), the prediction of a CP (along with all of the relevant functional projections), and the prediction of an NP (along with all the relevant functional projections) all need to be kept track of by the parser and may be associated with memory cost[2]. With respect to our example (7c), this means that the predicted IP/VP complex is a single obligatory prediction that may increase the complexity of the partial structure.

Consider the partial structure the parser builds as it encounters the next nominal in the input string - 'the child'. It is given in (8). This nominal has been attached into the position of the subject of the relative clause. Note that to attach the nominal into this position, the parser has had to posit a phonologically null Operator that occupies the Spec of CP (as well as a phonologically null Complementizer that heads this CP).

8.



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[2] Of course, there may exist other obligatory predictions, such as those associated with an argument-taking Adjective or Preposition, but since they are not relevant in any of the examples we will consider, we leave them out of the discussion.

As (8) shows, the IP/VP complex of the embedded clause is one obligatory prediction that the structure contains. In addition, there is another obligatory prediction that has been made at this point: processing the head of a chain (the Operator) causes the prediction of the tail of the chain. This prediction is obligatory, because the trace needs to be encountered and attached into the structure for the structure to become a complete grammatical sentence. Thus, the parser needs to keep track of this prediction, and it may increase the processing complexity of the sentence. Note that for the parser we are assuming here it does not matter whether a lexical item it has attached into a partial structure as a head of a (possibly trivial) chain is phonologically realized or not: for instance, the relative pronoun in (8) is phonologically null, but the structure is in all respects identical to that in which the relative pronoun is a phonologically realized lexical item. The parser is concerned with obligatory predictions caused by all lexical items that have been attached into the partial structure, whatever their phonological realization.

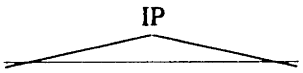
Having described what constitutes an obligatory predicted category in this system, let us explain in which situations an obligatory predicted category is associated with working memory cost. Within the processing framework of G & T, memory cost is caused by the interference of two predictions. Thus, if a partial structure contains a single obligatory predicted category, there is no interference of predictions, and no memory cost is associated with the prediction, but if a structure contains more than one obligatory predicted category, there is interference among the predictions, and memory cost is associated with them. This approach follows a line of research on working memory that has shown that the difficulty of

recalling one item out of several that are being remembered is due to the interference among the items (c.f. Lewis (1996)). Relating this fact to language processing, we have the following situation: the first obligatory prediction made in a structure is not associated with memory cost (because of the absence of interference), but each subsequent obligatory prediction is associated with memory cost (because of the presence of interference).

Let us see what this means for the example we have just worked through. The relevant partial structures are repeated in (9). Consider the partial structure constructed at the point where the matrix subject has been processed, given in (9b). A single prediction - that of the matrix predicate - has been made at this point, and since the structure contains no other competing predictions, no cost is associated with the predicted VP/IP complex. Now consider the partial structure constructed at the point where the embedded subject has been processed, given in (9c). Two new predictions have been made at this point - that of the embedded predicate and that of the trace. Because one unfulfilled prediction is being kept in working memory when these new predictions are made, interference arises, and the two new predictions are associated with memory cost.

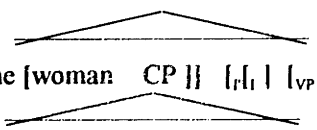
9 a. The woman the child kicked swore

b.



$[_{DP}$ the [woman $([_{CP}\ ])]]\ [_{I'}[_{I}\ ]\ [_{VP}[_{V'}[_{V}\ ]]\ ]]$

c.



$[_{DP}$ the [woman CP]] $[_{I'}[_{I}\ ]\ [_{VP}[_{V'}[_{V}\ ]]\ ]]$

Op $[_{C'}[_{C}$ e] $[_{IP}[_{DP}$ the child] $[_{I'}[_{I}\ ]\ [_{VP}[_{V'}[_{V}\ ]\ [_{DP}$ t]]]]

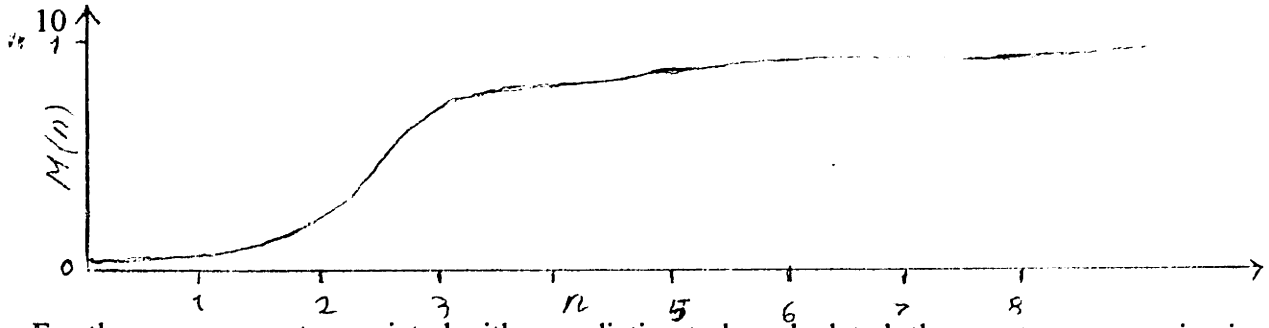
Note that it is possible that the first predicted category is associated with some memory cost (lower than the memory cost associated with the second predicted category) - whether it is or not is an empirical question. The assumption that it is not is the simplest one compatible with the data available to us, and, therefore, we will adopt it.

Having said which categories play a role in the complexity metric and described the situations in which they are associated with a memory cost, let us turn to specifying how this memory cost is determined. Informally speaking, the longer a predicted category has to be retained in short-term memory, the greater the memory cost. This assumption again draws a parallel between the operation of the human parser and the known properties of working memory: a number of studies have shown that the ease of recalling an item depends on the length of time it has been remembered and the number of times that have occurred after it (Waugh & Norman (1965), Baddeley (1990)). For the purposes of the human parser, length is defined in terms of the number of categories that are processed from the point at which an obligatory category is predicted to the point at which this prediction is satisfied, i.e. the head of the predicted category is processed. This is another point in the theory where a parameter could be defined in a number of different ways, with potential empirical consequences: each category encountered could count as an increment of the "distance", only morphologically independent elements that are not members of a chain could count (as with obligatory predictions), or a subset of morphologically independent elements could count as an increment of distance. Ultimately, the question is an empirical one. G & T adopt a definition, in which the most restricted set of categories possible is taken to count as increasing the distance, namely, the nominal and verbal projections (NPs and VPs), referred to as "thematic

elements". Under this definition, the memory cost associated with a given predicted category is taken to be a function of the number of NPs and VPs processed before the prediction is fulfilled.

As a last step towards giving an explicit description of the way the processing complexity of sentences is evaluated, we need to specify what the function is that maps the number of intervening elements onto a specific value of memory cost. The function that gives the value of the memory cost within the theory of G & T is a sigmoid function, illustrated in (10), where the memory cost associated with a prediction is given on the y-axis and the number of thematic elements encountered since the prediction has been made is given on the x-axis. A sigmoid function is like a flattened linear function, with the plateaus representing a ceiling and a floor effect. In research on working memory recall, interference effects have been modeled with functions of this general form

($P(n) = \frac{1}{1+e^{-An+B}} + C$ where P is the performance on the recall of an element, and n is the number of interfering items).



For the memory cost associated with a prediction to be calculated, the constants appearing in the function above have to be set to specific values. The constant A, which determines the slope of the function, has to have positive value for the function to be increasing (the memory cost of a prediction grows as it is held in memory over more intervening items). Here, A = 1. The value of the constant B, which determines the point (i.e. the value of n) at

which the cost increment is greatest is set to 2.5. Finally, the value of C, which is the intercept constant, is set to 0[3]. Thus, the memory cost function assumed here has the form of $M(n) = \frac{1}{1+e^{-n+2.5}}$, where n is the number of intervening thematic categories and M is the memory cost associated with a prediction, measured in arbitrarily defined Memory Units (MUs). The values of the function for n ranging from 0 to 6 appear in (11).

11

	n	0	1	2	3	4	5	6
M(n)	in MUs	.08	.18	.38	.62	.82	.92	.97

Let us take a step back from these technical details and sum up the properties of the function that play an important role in this theory: the memory cost of a prediction is very small at the point where the prediction is made; the memory cost increases as the number of interfering categories increases; the cost increment is greatest between 2 and 3 interfering categories and gradually decreases after that; as the number of the interfering categories increases, the memory cost approaches 1 MU.[4]

Now we are in a position to pull all the properties of the complexity metric together and give its explicit formulation. This is done in (12), where the cost metric is called the Locality of Syntactic Dependencies Principle.

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[3] In a sense, the exact values of the constants are not crucial: the complexity contrasts we will be concerned with here will be preserved under different values of the constants.

[4] Note that the assumption that the memory cost of a given prediction increases linearly with the number of interfering categories is inappropriate here because the floor and the ceiling effect cannot be represented using a linear function, and both of these are important properties of the system.

12 The Locality of Syntactic Dependencies Principle:

For each obligatory predicted category C which, at the point of its prediction, interferes with another obligatory predicted category, associate a memory cost of $M(n) = \frac{1}{1+e^{-n+2.5}}$ Memory Units (MUs), where n is the number of thematic categories that have been processed since C was predicted. (Adapted from Gibson and Thomas (1996))

To calculate the total memory cost associated with a partial structure we must first calculate the memory cost associated with each predicted category contained in the structure using the formula given in (12), and then add all of the costs thus derived. The higher the total memory cost associated with a sentence at any point in its processing, the more difficult it is to process. The English data suggest that memory cost of 1.64MUs or greater results in processing breakdown, but since cost in language processing is based on working memory resources, the point of processing breakdown may be slightly higher or lower for some speakers, depending on how good (or poor) their short-term memory is.[5]

To sum up, we have presented an explicit theory of the operation of the human parser developed in G & T. Within this theory, the complexity metric that determines how great the memory resources required by a particular structure are mirrors the known properties of working memory. Predicted categories require greater memory resources if additional predictions are being remembered or if they have to be retained in memory over a large number of interfering elements. In the next section we present some examples of how this theory operates on more complicated and interesting English structures.

[5] Of course, the processability threshold might be lower than 1.64 MUs, for instance, it could occur at 1.30, 1.40, or 1.50 MUs. Not enough is known to say for certain. English data tell us only that it lies between 1.0 MU and 1.64 MUs. The Japanese data that will be discussed herre suggest that it lies above 1.20 MUs.

2.2 Some English Examples

In this section we show how the theory of processing complexity of G & T deals with both relatively simple and more complicated English examples. The examples we discuss were chosen as illustrations of the types of predictions the theory makes and the types of contrasts it accounts for and do not constitute a complete set of facts that can be handled by it.

Let us walk through two types of structures that will come up frequently in this work: a sentence containing a CP complement of a verb or a noun (13a) and a sentence containing a relative clause (13b).

13 a. $[_{IP}[_{DP}$The rumor $[_{CP}$that $[_{IP}$ $[_{DP}$the suspect] $[_{VP}$left]]] $[_{VP}$bothered $[_{DP}$the detective]]]
b. $[_{IP}[_{DP}$The suspect $[_{CP}$who $[_{IP}$ $[_{DP}$ t] $[_{VP}$ insulted $[_{DP}$the detective]]]] $[_{VP}$ left]]

Consider the case of a CP complement, such as the one in (13a), first. The table in (14) summarizes the memory cost associated with the structure at each parse state where it is evaluated[6].

14.

Processed category; Predicted category	Lexical input; number of intervening elements (n); memory cost (in MUs)		
	$[_{DP1}$The rumor]	$[_{Comp1}$ that]	$[_{DP2}$the suspect]
DP_1: VP_1	--	--	--
$Comp_1$: VP_2		0 ; 0.08	1; 0.18
Total cost	0.00	0.08	0.18

[6] In this and all subsequent tables, the first column specifies the element which causes a prediction and the category that is predicted; the memory cost associated with this prediction appears on the same line, with the first number giving the number of interfering elements (n) and the second number giving the corresponding memory cost (M(n)); a -- indicates a prediction not associated with any memory cost and a * indicates a satisfied prediction. The number appearing in the 'Total cost' row is the sum of the memory costs of all unsatisfied predictions contained in the partial structure. For the sake of brevity, DPs are treated as a single unit.

	$[_{V2}$ left]	$[_{V1}$ bothered]	$[_{DP3}$ the detective]
DP_1: VP_1	--	*	
$Comp_1$: VP_2	*		
V_1: DP_3		--	*
Total cost	0.00	0.00	0.00

Let us go through this table step by step. As the first nominal in the string, 'the rumor' (DP1), is processed and the structure in which it is the matrix subject is created, the matrix predicate (VP1) is predicted. VP1 is an obligatory predicted category, which must be processed for the structure to become a complete sentence. However, because it is the first prediction that has been made here, it does not interfere with any other prediction and is not associated with any memory cost.

Note that although DP1 takes a CP complement in this sentence, the prediction of this CP is not considered obligatory in our system: even if this category is not encountered, the structure may become a complete grammatical sentence, as witnessed by the acceptability of 'the rumor bothered the detective'. As a result, no cost is associated with this prediction until the complement CP is confirmed. This happens as the next word in the input string, 'that' (Comp1), is processed. Now the parser "knows" that an embedded clause must follow, i.e. processing the Complementizer causes the prediction of the embedded IP/VP complex. Since the partial structure now contains two unfulfilled predictions (VP1 and VP2), interference is created and memory cost is associated with the last prediction (VP2). The prediction has just been made, that is, it has been retained in memory over 0 intervening thematic elements, and so its memory cost is very low.

At the next element in the string - 'the suspect' (DP2) - no new predictions are made: processing a subject causes the prediction of the corresponding predicate, but in this structure the predicate (VP2) has already been predicted at the Complementizer. However, DP2 is a thematic element and the prediction of VP2 has to be retained in memory as it is processed. As a result, the number of intervening elements increases (becoming 1) and the memory cost associated with the prediction of VP2 increases correspondingly.

The next element processed is the embedded predicate, 'left' (V2). As it is attached into the partial structure, the memory cost associated with its prediction goes away. At this point, the structure contains only one prediction - that of VP1 - and is not associated with any memory cost. This prediction is fulfilled as the next element in the string - the matrix predicate, 'bothered' (V1) - is encountered and attached into the structure. Note that this does not affect the cost of the partial structure, since the prediction of VP1 was the first one made and therefore it was "costless". Because 'bother' is a transitive verb, processing it causes the prediction of a direct object (DP3). However, this prediction is the only one the partial structure contains at this point, so that no interference of predictions is created and no memory cost is associated with the prediction, which is satisfied at the next lexical item encountered.

Let us turn to the example which contains a relative clause (13b). The memory cost table for the relevant partial structures is given in (15).

15.

Processed category; Predicted category	Lexical input; number of intervening elements (n); memory cost (in MUs)		
	[$_{DP1}$ The suspect]	[$_{DP2}$ who] t	[$_{V2}$ insulted]
DP_1: VP_1	--	--	--
DP_2: VP_2		0; 0.08	*
DP_2: t		*	
V_2: DP_3			0.08
Total cost	0.00	0.08	0.08
	[$_{DP3}$ the detective]	[$_{V1}$ left]	
DP_1: VP_1	--	*	
V_2: DP_3	*		
Total cost	0.00	0.00	

As in the previous example, when the first nominal in the input string, 'the suspect' (DP1), is processed and attached into the structure as the matrix subject, the matrix predicate (VP1) is predicted. The prediction is not associated with any memory cost, since the partial structure contains no other predicted categories yet. The relative clause, which modifies this DP, is an optional, rather than an obligatory, prediction, and so does not affect the memory cost associated with the structure.

The next word in the input string is 'who' (DP2). Recall that our parser creates as much structure as it can at each point, so that in this particular instance it creates the structure in which a wh-trace occupies the embedded subject position. Once this structure - the most expanded one compatible with the input - is built, the memory cost associated with it is evaluated. The presence of the relative clause operator, 'who', causes the prediction of the embedded predicate (VP2). Since this is the second predicted category within this partial structure, it is associated with memory cost. This prediction has just been made, that is, it has been held in memory over 0 intervening elements at this point.

Note that as the relative clause operator is processed, its trace is predicted as well. While this is a prediction that can potentially be associated with memory cost, in this particular structure the trace has already been posited and attached at the point we are considering. As a result, this prediction is fulfilled immediately and does not affect the complexity of the structure. In our framework, the members of a nontrivial chain are treated as one element, that is, if a prediction is made at some point in the structure and retained over both the head and the tail of a chain, the memory cost of this prediction increases by as much as it would if it were retained over one thematic element. Thus, in (15) the embedded predicate (VP2) has been predicted at the relative pronoun and at the parse state we are discussing, this prediction has been retained in memory over both the relative pronoun (the head of the chain) and its trace (the tail of the chain). If both of these are considered as separate thematic elements, then the cost of the prediction should be M(1); here they are considered as one thematic element, and the cost of the prediction is M(0).

The next element in the input string is the embedded verb, 'insulted' (V2). As it is processed and attached into the structure, the prediction of the embedded IP/VP complex, which was made at the relative clause operator (DP2), is fulfilled. Because 'insulted' is a transitive verb, processing it causes the prediction of the direct object (DP3). This prediction is the second one present in the structure, and so is associated with memory cost (M(0)). It is fulfilled at the next parse state, where the nominal 'the detective' (DP3) is encountered. The last element in the input string is the matrix predicate, 'left' (V1), which fulfills the "costless" prediction that was made at the matrix subject (DP1).

Within the framework of G & T, several factors can contribute towards the processing difficulty of a sentence. One of them is the number of thematic elements processed between the point at which a category is predicted and the point at which it is confirmed. If two structures are identical in all respects, except for the length of time one of the predictions has to be held in working memory, the structure in which the prediction remains unfulfilled longer is expected to be more difficult. One type of structure in which this situation arises and the predicted contrast in processing difficulty is well-documented is in subject-gap relative clauses and object-gap relative clauses, illustrated in (16).

16 a. $[_{IP}[_{DP}$The reporter $[_{CP}$ who $[_{C}$ $[_{IP}$ $[_{DP}$ t] $[_{VP}$ attacked $[_{DP}$the senator]]]]
$[_{VP}$admitted $[_{DP}$the error]]]

b. $[_{IP}[_{DP}$The reporter $[_{CP}$ who $[_{C}$ $[_{IP}$ $[_{DP}$ the senator] $[_{VP}$ attacked $[_{DP}$ t]]]]
$[_{VP}$admitted $[_{DP}$the error]]]

It has been shown that unambiguous subject-gap relative clauses (16a) are read faster and interpreted more accurately than object-gap relative clauses (16b) in English and French (Holmes & O'Reagan (1981), King & Just (1991)). Within the framework of G & T, the difference is due to the fact that in subject-gap relative clauses the wh-trace, predicted at the Operator, is encountered almost immediately, while in the object-gap relative clauses it comes at a later point in the structure. The memory cost table for (16a) is given in (17a), and the memory cost table for (16b) is given in (17b).

17 a.

Processed category; Predicted category	Lexical item; number of intervening thematic elements; memory cost (MUs)		
	[$_{DP1}$ The reporter]	[$_{DP2}$ who] t	[$_{V2}$ attacked]
DP_1: VP_1	--	--	--
DP_2: VP_2		0; 0.08	*
DP_2: t		*	0; 0.08
V_2: DP_2			
Total cost	0.00	0.08	0.08
	[$_{DP3}$ the senator]	[$_{V1}$ admitted]	[$_{DP4}$ the error]
DP_1: VP_1	--	*	
V_2: DP_3	*		
V_1: DP_4		--	*
Total cost	0.00	0.00	0.00

b.

	[$_{DP1}$ The reporter]	[$_{DP2}$ who]	[$_{DP3}$ the senator]
DP_1: VP_1	--	--	--
DP_2: VP_2		0; 0.08	1; 0.18
DP_2: t		0; 0.08	1; 0.18
Total cost	0.08	0.16	0.36
	[$_{V2}$ attacked] t	[$_{V1}$ admitted]	[$_{DP4}$ the error]
DP_1: VP_1	--	*	
DP_2: VP_2	*		
DP_2: t	*		
V_2: t	*		
V_1: DP_4		--	*
Total cost	0.00	0.00	0.00

In the sentence containing a subject-gap relative clause, the maximal complexity of M(0) = 0.08 MUs occurs at the parse state where therelative clause Operator and the subject of the embedded clause (the trace) are attached into the partial structure (see (17a)). The memory cost is associated with the prediction of the embedded verb that has been made at the Operator (DP2). The prediction of the trace has been satisfied at this point and thus has no

cost associated with it. In contrast, in the sentence containing an object-gap relative clause, the maximal complexity of M(1) + M(1) = 0.36 MUs occurs at the parse state where the subject of the embedded clause is processed (see (17b)) and is associated with the predictions of the trace and the embedded verb that have been retained in memory over one thematic element (the embedded subject DP3). While the maximal memory cost is quite low in both structures, it is greater for the object-gap structure, accounting for the relative difficulty of the construction. Note that within this theory of processing complexity, the length of the embedded clause in singly-embedded sentences is expected to determine the difficulty of the structure: for instance, if another three thematic elements are added to the relative clause in (16b), the memory cost associated with the structure is predicted to grow very high, past the processability threshold. Thus, processing breakdown is expected to occur not only in doubly-embedded structures, but in certain singly-embedded structures as well.

A processability contrast due to the same factor (the number of thematic elements processed before a prediction is fulfilled) shows up in other situations, as well. One of them is illustrated in (18). If one of the arguments of a ditransitive verb is much longer or "heavier" than the other, it typically undergoes "heavy NP shift", moving to the right edge of the sentence (see (18a,b)). If heavy NP shift fails to occur, the sentence is felt to be marginal and difficult to process (see (18c,d)). Contrasts such as this have prompted researchers to say that the human parser prefers to encounter the harder items later, rather than earlier, in the structure (Bever, (1970), Hawkins (1994)).

18 a. I gave to my mother the beautiful green pendant that's been in the jewelry store for weeks.
b. DP give t PP DP

c ?I gave the beautiful green pendant that's been in the jewelry store window for weeks to my mother.
d. DP give DP PP

Consider the abbreviated memory cost table for sentence (18a), within which heavy NP shift has occurred:[7]

19 $[_{DP1}$ I] $[_{V1}$ gave] $[_{DP2}$ t_i] $[_{PP1}$ to my mother] $[_{DP3}$ $[_{DP4}$ the beautiful green pendant]
-- M(0) M(1) *
$[_{CP}$ $[_{DP5}$ $0p_j$ that] $[_{DP6}$ t_j] $[_{V2}$'s been] $[_{PP2}$ in the jewelry store window] $[_{PP3}$ for weeks]]]$_i$.
-- M(0) M(1) *

At the point where the ditransitive verb has been processed the partial structure contains no unsatisfied predictions. Attaching the verb into the structure causes the prediction of the Theme DP (DP2) and the Goal PP (PP1). As always, our parser builds as much structure as it can in a single step, so that the trace of the shifted direct object is posited and attached at this point. Thus, the prediction of the Theme DP is satisfied immediately, and the prediction of the Goal PP is not associated with memory cost. However, there is an additional prediction made at this point: once the trace of the shifted NP is processed, the prediction of the shifted NP is made. This prediction does cause interference, and is associated with memory cost, as shown in (19). The goal PP is encountered next, so that all of the predictions that were made at the verb are satisfied and the cost of the predicted shifted NP increases. The head of the shifted NP is processed next, and the partial structure once again does not contain any unsatisfied predictions. The relative clause modifying the shifted NP is processed in the

[7] For the purposes of this discussion, we treat a PP as a single thematic element, exactly as we treat a DP. Alternatively, we could treat a PP as two thematic elements - a theta assigner (P) and a theta-receiver (DP), as we treat a VP. The contrast between sentences (19a) and (19c) would only become sharper under this approach.

familiar fashion: the verb and the trace are predicted at the Operator, and the two PPs are predicted at the verb (we treat both PPs as arguments, i.e. "obligatory predictions", here to stack the cards against ourselves). The prediction of the trace is satisfied immediately, and does not affect the complexity of the structure. The predictions of the verb (V2) and one of the PP arguments of the verb (PP2) are "costless", and the total complexity of the structure remains quite low. Thus, the highest memory cost associated with this sentence is M(1) = 0.18 MUs; it is reached once at the point where the direct object of the matrix verb is processed and a second time at the first PP within the relative clause. Put simply, this structure is easy to process because the prediction of the shifted Theme argument does not have to be held in memory for a very long time - only over the relatively short Goal argument.

Let us compare this with what happens when the more difficult (18c) is processed. The abbreviated memory cost table is provided in (20).

20 $[_{DP1}$ I] $[_{V1}$ gave] $[_{DP2}$ $[_{DP3}$ the beautiful green pendant] $[_{Cp}$ $[_{DP4}$ $0p_j$ that] $[_{DP5}$ t_j]
-- M(0) M(1) M(2)+M(0)
$[_{V2}$'s been]] $[_{PP1}$ in the jewelry store window] $[_{PP2}$ for weeks]]] $[_{PP3}$ to my mother]
M(3)+M(0)+M(0) M(4)+M(1) M(5) *

At the point where the ditransitive verb (V1) is processed, the Theme DP (DP2) and the Goal PP (PP3) are predicted. The crucial assumption that we need to make to handle this example is that the prediction of the theme DP is the first one (and therefore "costless"), but the prediction of the Goal PP is associated with memory cost. As the next element in the string - the head of the "heavy NP" - is processed, the prediction of the direct object DP is

satisfied and the cost of the prediction of the Goal PP increases. Next, the relative clause modifying the direct object DP is encountered. As the relative clause is processed, the memory cost associated with the predicted Goal PP increases. In addition, the predictions caused by the elements within the relative clause are not "costless" in this structure, as they were in (19), and contribute to the structure's overall complexity. By the time the Goal PP is encountered, its prediction has been retained in memory over 5 thematic elements. The maximal complexity of M(4) + M(1) = 1.00 MUs occurs at PP1. It is much greater than the maximal complexity of (18a), which was M(1) = 0.18 MUs. This structure is relatively difficult to process because the prediction of the Goal PP has to be retained in memory over all the material of the "heavy" Theme NP. In this fashion we derive the generalization that structures in which the heaviest element undergoes movement to the right edge of the sentence are easier to process than structures in which it does not.[8]

Another factor that can contribute towards the difficulty of processing a sentence is the number predicted categories contained in its partial structure at any point. The more predictions the structure contains, the higher the memory cost may go. Of course in practice a structure containing a large number of predictions also contains a large number of lexical items, so that the predictions made early on have to be retained in the working memory for a long period of time. For instance, if we take a sentence containing one center-embedded relative clause, like that in (21a), and add an extra level of center-embedding, as in (21b), we increase both the number of predictions and the length of time they have to be retained in

[8] Note that under this approach it is the relative length of the Theme argument and the Goal argument that is important: if the Goal PP were longer and contained more thematic elements, the sentence in which heavy NP shift has occurred (19a,b) would be expected be less acceptable and the sentence in which heavy NP shift has not occurred (19c,d) would be expected to be more acceptable. This is exactly the pattern that is attested.

memory. The doubly-embedded structure in (21b) is much more difficult to process. In fact, sentences like (21b) cause processing breakdown for the majority of speakers of English. Let us see how the framework of G & T accounts for this fact.

21 a.The administrator [$_{CP}$ who [$_{IP}$ the intern had bothered t]] lost the medical reports.
b.#The administrator [$_{CP}$ who [$_{IP}$ the intern [$_{CP}$ who [$_{IP}$ the nurse supervised t]] had bothered t]] lost the medical reports.

The sentence in (21a) contains an object-gap relative clause, just as the example (16b) which we have already worked through (see (17b)). Recall that the maximal complexity of that structure was 0 .36 MUs. The memory cost table for the doubly-embedded object-gap relative clause is given in (22).

22.

Processed category; Predicted category	Lexical item; number of intervening thematic elements; memory cost (MUs)		
	[$_{DP1}$ The administrator]	[$_{DP2}$ who]	[$_{DP3}$ the intern]
DP_1: VP_1	--	--	--
DP_2: VP_2		0; 0.08	1; 0.18
DP_2: t		0; 0.08	1; 0.18
Total cost	0.00	0.16	0.36
	[$_{DP4}$ who]	[$_{DP5}$ the nurse]	[$_{V3}$ supervised] t
DP_1: VP_1	--	--	--
DP_2: VP_2	2; 0.38	3; 0.62	4; 0.82
DP_2: t	2; 0.38	3; 0.62	4; 0.82
DP_4 VP_3	0; 0.08	1; 0.18	*
DP_4 t	0; 0.08	1; 0.18	*
V_3: t			*
Total cost	0.92	1.60	1.64
	[$_{V2}$ bothered] t	[$_{V1}$ lost]	[$_{DP6}$ the papers]
DP_1: VP_1	--	*	
DP_2: VP_2	*		
DP_2: t	*		
V_1: DP_6		--	*
Total cost	0.00	0.00	0.00

In this structure, the maximal complexity of M(4) + M(4) = 1.64 MUs occurs at the point where the most deeply embedded verb (V3) and its direct object (the trace) are processed. The memory cost is associated with the two predictions that were made at the Operator of the intermediate clause (DP2) - the prediction of the corresponding VP and the prediction of the trace - and have been retained in memory over four thematic elements ('the intern', 'who', 'the nurse', and 'supervised'). As we have mentioned before, for the majority of speakers processing breakdown happens at around 1.64 MUs, so the structure we are considering is correctly predicted to be unprocessable. Of course, it is also expected to be much more difficult to process than the sentence with a single center-embedding, whose maximal complexity is only 0.36 MUs.

Because (21a) contains an extra clause, two extra predictions are made within it at the point where the first element of that clause is processed. In addition, the predictions made in the intermediate clause have to be retained in memory over all the elements in the most deeply embedded clause. Both factors contribute towards the difficulty of the sentence. Note that a sentence within which a large number of categories are predicted at various points is not necessarily difficult to process: each prediction becomes expensive only if it is retained in memory for a long time, and the structure as a whole becomes expensive only if a large number of predictions are unsatisfied at the same time. For instance, the paraphrase of the unprocessable (23b) given in (23a) is quite easy to process, even though it contains the same lexical items in the same theta-relations.

23 a The nurse supervised the intern [$_{CP}$ who [$_{IP}$ t had bothered the administrator [$_{CP}$ who [$_{IP}$ t lost the medical reports]]]]

b. #The administrator [$_{CP}$ who [$_{IP}$ the intern [$_{CP}$ who [$_{IP}$ the nurse supervised t]] had bothered t]] lost the medical reports.

The contrast between these two sentences illustrates the well-known fact that structures containing center-embedding are much more difficult to process than right-branching (or left-branching) structures (e.g. Chomsky & Miller (1963)). Let us see how this contrast is accounted for within G & T's theory. The table in (24) contains the memory costs associated with (23a) at the relevant points.

24

Processed category; Predicted category	Lexical item; number of intervening thematic elements; memory cost (MUs)		
	[$_{DP1}$ The nurse]	[$_{V1}$ supervised]	[$_{DP2}$ the intern]
DP_1: VP_1	--	*	
V_1: DP_2		--	*
Total cost	0.00	0.00	0.00
	[$_{DP3}$ who] t	[$_{V2}$ had bothered]	[$_{DP4}$ the administrator]
DP_3: VP_2	--	*	
DP_3: t	*		
V_2: DP_4		--	*
Total cost	0.00	0.00	0.00
	[$_{DP5}$ who] t	[$_{V3}$ lost]	[$_{DP6}$ the reports]
DP_5: VP_3	--	*	
DP_5: t	*		
V_3: DP_6		--	*
Total cost	0.00	0.00	0.00

This sentence is not associated with any memory cost, because no more than one unsatisfied prediction exists at any point in processing it and no interference between predicted categories can occur. Thus, the prediction of the matrix verb, made at the matrix subject, is costless, being the first prediction; it is satisfied at the next word of the input string, so that

the partial structure contains no unsatisfied predictions again. The next prediction - that of the matrix direct object - causes no interference and is not associated with any memory cost. It is satisfied at the next word, and the structure contains no unsatisfied predictions once more. At the next element - the relative pronoun - the embedded verb is predicted, but the prediction is again costless. There is another prediction made at this point - that of the trace - and this prediction could potentially cause interference and increase the complexity of the structure. However, the trace is posited in the subject position as soon as the relative pronoun is processed, so that the prediction is satisfied immediately. The predictions continue to be made and immediately satisfied in the same fashion for the remainder of this structure.

So far we have seen how the processing framework of G & T accounts for very basic and well-known contrasts (doubly center-embedded sentences vs. singly center-embedded sentences and center-embedded structures vs. right-branching structures) that few processing theories fail to explain. Let us now turn to less well-studied contrasts that prove quite problematic for many theories. Consider the sentences in (25). (25a), which contains a CP complement of a noun embedded inside a relative clause, is considerably more difficult to process than (25b), which contains a relative clause embedded inside a CP complement of a noun.

25 a. #The old woman who the information that the child survived the crash had comforted looked for the rescue worker.
b. The information that the child who the rescue worker looked for survived the crash comforted the old woman

This processability contrast is strong enough to be easily confirmed by an intuitive judgement. In fact, for the majority of English speakers sentences like (25a) cause processing overload. The processability contrast has also been shown to exist in the questionnaire study in Gibson & Thomas (1996b), where sentences like that in (25a) were rated significantly less processable and understandable than sentences like that in (25b).

Let us look at the analyses these sentences receive in the framework adopted here. Consider the memory cost table for the unprocessable (25a), given in (26).

26

Processed category; Predicted category	Lexical item; number of intervening thematic elements; memory cost (MUs)		
	$[_{DP1}$ The woman]	$[_{DP2}$ who]	$[_{DP3}$ the information]
DP_1: VP_1	--	--	--
DP_2: VP_2		0; 0.08	1; 0.18
DP_2: t		0; 0.08	1; 0.18
Total cost	0.00	0.16	0.36
	$[_{Comp1}$ that]	$[_{DP4}$ the child]	$[_{V3}$ survived]
DP_1: VP_1	--	--	--
DP_2: VP_2	1; 0.18	2; 0.38	3; 0.62
DP_2: t	1; 0.18	2; 0.38	3; 0.62
C_1: VP_3	0; 0.08	1; 0.18	*
V_3: DP_5			0; 0.08
Total cost	0.44	0.94	1.32
	$[_{DP5}$ the crash]	$[_{V2}$ comforted] t	$[_{V1}$ looked for the worker]
DP_1: VP_1	--	--	*
DP_2: VP_2	4; 0.82	*	
DP_2: t	4; 0.82	*	
V_3: DP_5	*		
Total cost	1.64	0.00	0.00

In this sentence the maximal complexity of M(4) + M(4) = 1.64 MUs comes at the point when the direct object of the most deeply embedded clause (DP5) is processed. The memory

cost is higher than the processability threshold for the majority of speakers, so that the sentence is correctly predicted to be unprocessable. The high cost is due to the two predictions that were made at the relative pronoun (DP2) - the prediction of the trace and the prediction of the corresponding verb - and carried in memory over four intervening thematic elements.

Let us consider the situation in the reverse order of embedding, with a relative clause occurring inside a complement CP. (27) provides the memory cost table for this structure.

27

Processed category; Predicted category	Lexical input; number of intervening elements (n); Memory cost (MUs)		
	[$_{DP1}$ The information]	[$_{Comp1}$ that]	[$_{DP2}$ the child]
DP_1: VP_1	--	--	--
C_1: VP_2		0; 0.08	1; 0.18
Total cost	0.00	0.08	0.18
	[$_{DP3}$ who]	[$_{DP4}$ the worker]	[$_{V3}$ looked for] t
DP_1: VP_1	--	--	--
C_1: VP_2	2; 0.38	3; 0.62	4; 0.82
DP_3: t	0; 0.08	1; 0.18	*
DP_3:VP_3	0; 0.08	1; 0.18	*
V_3: t			*
Total cost	0.54	0.98	0.82
	[$_{V2}$ survived]	[$_{DP5}$ the crash]	[$_{V1}$ had comforted the woman]
DP_1: VP_1	--	--	*
C_1: IP_2	*		
V_2: DP_5	0; 0.08	*	
Total cost	0.08	0.00	0.00

In this sentence the maximal complexity of M(3) + M(1) + M(1) = 0.98 MUs comes at the point when the most deeply embedded subject (DP4) is processed. The memory cost is associated with the prediction of the verb of the intermediate embedded clause (VP2), which

was made at Comp1 and retained in memory over three intervening thematic elements, and the predictions of the trace (DP5) and the corresponding verb (V3), which were made at the relative pronoun (DP3) and retained in memory over one intervening thematic element. Thus, the maximal complexity of this sentence (0.98 MUs) is much lower than the maximal complexity of the unprocessable (25a) (1.64 MUs), and the theory predicts the contrast in processability, as required.

Put simply, the difference between the two sentences is that in the unprocessable (25a) the prediction of the wh-trace has to be retained in memory over the intervening most deeply embedded clause, while in the processable (25b), this prediction is fulfilled in the same clause where it is made. The asymmetry arises because different predictions are made at the beginning of a relative clause and at the beginning of a CP complement: processing the first element of a relative clause causes the prediction of two categories - the corresponding verb and the wh-trace, but processing the first element of a complement CP causes the prediction of only one category - the verb contained in the clause. The existence of this extra prediction is responsible for the higher complexity of sentences containing a relative clause as their intermediate clause, compared with similar sentences containing a CP complement as their intermediate clause.

To sum up, in this section we have discussed a number of sentence types that are easy and difficult to process. Using both very basic and more complicated examples, we have shown that the data uniformly fulfill the predictions of the processing complexity theory of G & T: the structures that contain a large number of unfulfilled predictions simultaneously and the structures that contain unfulfilled prediction for a long period of time are difficult to

process. In the next section we present some alternative theories of processing, showing how they deal with the same set of data.

2.3 Alternative Frameworks

In this section we present two alternative theories of processing complexity, discussing the accuracy of their predictions compared with those of the framework of G & T.

The first broad class of theories we would like to consider descend from the Principle of Two Sentences, developed in Kimball (1973), given in (28).

28 The Principle of Two Sentences:
The constituents of no more than two sentences can be parsed at one time.
(Kimball (1973):33)

Within Kimball's framework a left-corner parsing algorithm, much like the one we have assumed, is operating, so that an IP node is predicted when a sentence-initial NP (subject) is processed. If there exists a parse state at which more than two IPs have been predicted but their heads (i.e. Vs) have not been processed, processing overload occurs.

Some of the processability contrasts that we have discussed can be explained by the Principle of Two Sentences, for instance, the contrast between the processable (29a) that contains a single center-embedded relative clause and (29b) that contains two right-branching relative clauses and the unprocessable (29c) that contains two center-embedded relative clauses. In (29a), there is no point at which more than two IPs have been predicted but not processed: at the worst point in the sentence, at the embedded subject, only two IPs are predicted - the matrix IP and the embedded IP, so that the sentence is correctly predicted to be processable. Similarly, in (29b) there is no parse state at which more than two IPs are

predicted but not yet processed: at most one subject lacking an IP is present at any point, so that this sentence is correctly predicted to be processable as well.

29 a.The administrator [$_{CP}$ who [$_{IP}$ the intern had bothered t]] lost the medical reports.
b. The nurse supervised the intern [$_{CP}$who [$_{IP}$ t had bothered the administrator [$_{CP}$ who [$_{IP}$ t lost the medical reports]]]].
c. #The administrator [$_{CP}$ who [$_{IP}$ the intern [$_{CP}$ who [$_{IP}$ the nurse supervised t]] had bothered t]] lost the medical reports.

In contrast, in the doubly-center-embedded (29c), there is a point where three IPs are predicted - this happens at the most deeply embedded subject. Thus, the sentence is correctly predicted to be unprocessable.

However, we have already seen some English structures which the Principle of Two Sentences cannot deal with. For instance the processability contrast between singly embedded subject-gap and object-gap relatives, illustrated in (30a,b), proves problematic. Within this theory, the two structures are expected to have the same complexity: in both of them, the worst point occurs after the complementizer 'that' (and, therefore, after the relative clause Operator) has been processed. At this point both structures contain two predicted IPs whose heads have not been encountered, so that their complexity is expected to be identical, contrary to fact.

30 a. The reporter [$_{CP}$ who [$_{IP}$ t attacked the senator]] admitted the error
b. The senator [$_{CP}$ who [$_{IP}$ the reporter attacked t]] admitted the error

This theory also has difficulty accounting for the contrast between the structures containing a sentential complement embedded inside a relative clause (31a) and the structures containing a relative clause embedded inside a sentential complement (31b).

31 a. #The old woman [$_{CP}$who the information [$_{CP}$ that the child survived the crash] had comforted] looked for the rescue worker.
b. The information [$_{CP}$ that the child [$_{CP}$ who the rescue worker looked for] survived the crash] comforted the old woman

Within this framework, the worst point in both structures occurs at the most deeply embedded relative pronoun. At this point, three IPs are predicted in each sentence, one for each incomplete clause. As a result, (31b) is expected to be as difficult to process as (31a), contrary to fact.

Thus, the Principle of Two Sentences proves unable to account for the processability contrasts among many English sentences. Some of its problems are overcome in the two more recent theories of processing complexity that retain the main intuition behind the Principle of Two Sentences, but formalize it in a different fashion. The two theories have been developed in Lewis (1993, 1996) and Stabler (1994). In general terms, they both claim that no more than two incomplete syntactic relations of the same kind may be kept in memory at any given parse state.

For Lewis, no more than two incomplete X-bar relations of the same kind may be stored by the parser without causing processing overload. Both the X-bar level and the type of category are relevant here, so that the elements occupying the Spec of IP position are "the same", but distinct from the elements occupying the Spec of VP position or the elements occupying the Complement of IP position. For Stabler, no more than two incomplete

case-assigning relationships may be present at any given parse state without causing processing overload.[9] If a partial structure contains more than two nominals bearing the same case (e.g. three nominative, accusative, or dative NPs), but not the case-assigners of these elements, processing breakdown is predicted to occur.

Note that for these two theories, only the number of "identical" structural relations matters in calculating the overall complexity of a structure. For instance, to determine the complexity of a partial structure within Lewis's framework, we need to know the number of subjects contained in it or the number of direct objects contained in it, but not the number of all nominals. The human parser is viewed as a device that uses multiple memory bins - one for each type of an incomplete relationship, and processing breakdown occurs if any of the memory bins "overflows" because too many items have been stored there.

The extensions of the Principle of Two Sentences are able to account for the contrasts that the Principle of Two Sentences successfully dealt with. Thus, the contrast between a singly embedded and a doubly-embedded sentence, as in (29a & c), as well as the contrast between the right-branching embedding structure and the center-embedded embedding structure, as in (29b & c) are successfully predicted. The easy (29a,b) are predicted to be processable because at their worst point they do not contain more than two elements in the same structural position (Spec of IP) or bearing the same case (nominative). In contrast, the unacceptable (29c) at its worst point contains three elements in the Spec IP position (or bearing nominative case), so that the limit of two incomplete structural relationships is exceeded and processing breakdown is expected to occur.

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[9] Actually, a wider set of syntactic relationships is assumed to be relevant in determining the processing complexity of a partial structure, but of all those, only Case-assigning relationships are relevant in the examples we will be concerned with here.

These two theories are able to avoid some of the problems that the original formulation of the Principle of the Two Sentences faced: for instance, given a set of specific assumptions, it is now possible to account for the difference in the processing difficulty of a subject-gap relative clause (30a) and an object-gap relative clause (30b). The two structures are repeated in (32a,b).

32 a. The reporter [$_{CP}$ who [$_{IP}$ t attacked the senator]] admitted the error
b. The senator [$_{CP}$ who [$_{IP}$ the reporter attacked t]] admitted the error

The analysis of the object-gap relative clause in (32b) remains unchanged: at the point of the maximal complexity, at the embedded subject 'the reporter', the partial structure contains two nominals in the same structural position (Spec of IP) or bearing the same case (nominative). However, a different analysis can now be given for the subject-gap relative clause in (32a): if the point of maximal complexity occurs at the processing of 'who', then the partial structure at its worst point contains only one element in the Spec of IP position (the matrix subject), the other elements processed occupy a different type of position (the phonologically null Operator is in the Spec of CP and 'that' is in the Comp position). This would derive the desired processabiltiy contrast, predicting (32a) to be easier than (32b).[10] Of course, for this analysis to go through we must rule out the possibility of evaluating the complexity of the partial structure at the point where the embedded subject - the trace - is processed, since at this point the structure contains two elements in the Spec of IP position, just as the

[10] It is not clear that this analysis is possible within the Case-based theory of Stabler: the Operator most likely bears the Case assigned to the position from which it moved, i e. nominative, so that the partial structure contains two incomplete Case-assigning relationships of the same kind, just as the structure of the object-gap relative clause did at its worst point.

object-gap relative clause structure did. This is accomplished by assuming that the trace is not posited in the subject position until the head of the IP (the verb) is processed. As a result, the parse state at which only the embedded subject, but not the embedded verb, is attached into the structure does not exist and the complexity of the partial structure cannot be evaluated there. The assumption that the parser delays in positing traces is rather controversial: it contradicts the considerable body of evidence that supports the Active Filler Hypothesis which states that traces are hypothesized as soon as possible (Frazier and Clifton (1989), de Vincenzi (1993), etc.)).

Several problems faced by the Principle of Two Sentences remain unresolved within the extensions of that theory: for instance, the contrast between (31a), which contains a CP complement embedded inside a relative clause, and (31b), which contains a relative clause embedded inside a CP complement, is still not predicted. Because at their worst point both sentences contain three subjects lacking the corresponding IPs (that is, elements occupying the Spec of IP position and bearing nominative case), they are expected to be equally unprocessable, with the sentence in (31b) being as difficult as the sentence in (31a), contrary to fact

. Thus, while the two extensions of the Principle of Two Sentences manage to improve on the descriptive accuracy of the original, they do not overcome all of the problems that were faced by it. Because the approach of the two theories to the structures we will be examining is very similar, we will usually be referring to only one of them - the X-bar based theory of Lewis - mentioning the case-based theory of Stabler only when it makes distinct predictions.

Let us turn to another theory of processing complexity, the Thematic Dependencies Theory which was developed Gibson & Thomas (1996b) and Babyonyshev and Gibson (1995). This theory makes use of two processing principles that penalize partial structures with certain properties. The first principle, broken up into two parts, deals with structures containing locally incomplete thematic relationships.

33 a. The Property of Thematic Reception:
Associate a short term memory cost to the head of each chain which 1) is confirmed in the input; 2) is in a position that can be associated with a thematic role; 3) does not yet receive a thematic role.
b. The Property of Lexical Requirement:
Associate a short term memory cost to each lexical requirement that is obligatory in the current structure, but is unsatisfied.

The Property of Thematic Reception penalizes structures that contain a theta-receiving element but not the theta-assigning element, and the Property of Lexical Requirement penalizes structures that contain a theta-assigning element, but not the theta-receiving element. Note that this system is similar to that of G & T, except for the fact that it concentrates on a narrower class of incomplete relationships (those involved in theta-assignment), assigns memory cost to each one (not using the notion of interference), and assumes that the memory cost of each incomplete relationship is constant (not incrementing cost with distance).

The framework contains an additional processing principle that penalizes partial structures containing center-embedding of a specific kind (see (34)).

34 a. The Property of Self-Embedding:
Associate a short-term memory cost for a predicted category X1 which is embedded inside another predicted category X2, when the extended projection features of X1 are the same as or a subset of the extended projection features of X2.

(34) deals with structures that contain self-embedding. Intuitively speaking, if the features of X1 are a subset of the features of X2, X1 cannot be distinguished from X2 by any feature, and this makes holding the two predictions in memory difficult. Categorial features are among those that (34) is utilizing: only the structures in which a category is embedded inside a category of the same kind are predicted to be difficult to process (e.g., a CP inside a CP, but not a CP inside a DP). Other features are also relevant: thus, a matrix clause is assumed to be featurally distinct from an embedded clause, so that the features of an embedded clause are not a subset of those of a matrix clause. As a result of this assumption, a structure that contains a predicted embedded clause inside a predicted matrix clause does not violate the Property of Self-Embedding, and is not expected to be difficult to process. In addition, the features of a relative clause CP are assumed to contain a wh-feature (responsible for triggering the movement of the relative pronoun) and the features of a declarative embedded CP are assumed not to contain this feature. As a result, a structure in which a relative clause is predicted inside an embedded CP complement does not violate the Property of Self-Embedding, but a structure in which an embedded CP complement is predicted inside a relative clause does violate this processing principle.

Within this framework, a partial structure that violates any of the processing principles five or more times is generally expected to be unprocessable. The processability threshold of five violations has been set empirically (see Gibson (1991) and Gibson & Thomas (1996b)). A violation of the Thematic Processing Principles in (33) is assumed to be associated with the same memory cost as a violation of the Self-Embedding Processing

Principle in (34). This seems to be the simplest assumption compatible with the data. In general, the larger the number of the violations of the processing principles incurred at any point in processing a sentence, the more difficult it is expected to be.

Note that within this theory, in contrast to the Extended Two Sentence Theories, the number of all incomplete syntactic relationships contained in a partial structure determines the structure's complexity, that is, the human parser is assumed to utilize a single memory bin, in which incomplete relationships of any kind are stored. If their total number exceeds a certain limit, the bin "overflows" and processing breakdown occurs.

Let us see how the framework outlined above deals with the contrasts among the sentences we are examining in this section. The contrast in the processability of a singly-embedded and a doubly-embedded structures (35a,c) is easy to explain. In the processable (35a), the worst point comes at the embedded subject, 'the intern', where the structure incurs three violations of the Thematic Reception Property, because the three DPs that have been processed lack theta-assigners. The Property of Self-Embedding is not relevant, since this sentence contains only one embedded clause (recall that matrix clauses and embedded clauses are assumed to be featurally distinct).

35 a. The administrator [$_{CP}$ who [$_{IP}$ the intern had bothered t]] lost the medical reports.
b. The nurse supervised the intern [$_{CP}$who [$_{IP}$ t had bothered the administrator [$_{CP}$ who [$_{IP}$ t lost the medical reports]]]].
c. The administrator [$_{CP}$ who [$_{IP}$ the intern [$_{CP}$ who [$_{IP}$ the nurse supervised t]] had bothered t]] lost the medical reports.

Similarly, in the processable right-branching (35b), there is no point where more than one violation of the Thematic processing principles occurs: when a subject DP is processed,

the corresponding verb follows immediately, and when a transitive verb is processed, the direct object is encountered immediately as well. The Property of Self-Embedding is not relevant in this structure, either: while the sentence does contain two embedded clauses, the head of the first one (i.e. the verb) is processed by the time the second embedded clause is predicted.

In contrast, at the worst point of the unprocessable (35c), which occurs at the most deeply embedded subject, 'the nurse', there are five violations of the thematic processing principles, caused by the five DPs whose theta-assigners have not been encountered yet. In addition, there is one violation of the Property of Self-Embedding, caused by the two relative clauses that have been predicted at this point. The total number of violations incurred by the partial structure is six, which is more than enough to cause processing overload.

The contrast between the sentences that contain a CP complement inside a relative clause (36a) and the sentences that contain a relative clause inside a CP complement (36b) is also predicted under this theory. As before, the worst point in these sentences occurs at the most deeply embedded subject - 'the child' in (36a) and 'the rescue worker' in (36b) - where the partial structure contains four DPs lacking theta-assigners (the three subjects and the relative pronoun). Note that while the head noun 'information' assigns a theta-role to its complement CP, the head of that CP - the Complementizer 'that' - is already processed at the point we are considering, and the thematic relationship is complete. Four violations of the thematic processing principles is not enough to cause processing overload, so that if the structure does not violate the Property of Self-embedding, it is expected to be processable.

36 a. #The old woman [$_{CP}$who the information [$_{CP}$ that the child survived the crash] had comforted] looked for the rescue worker.

b. The information [$_{CP}$ that the child [$_{CP}$ who the rescue worker looked for] survived the crash] comforted the old woman

The processable (36b) does not violate the Property of Self-Embedding at the point we are considering: it contains a predicted relative clause embedded inside a predicted CP complement, but because the features of a relative clause are not a subset of the features of a CP complement, this configuration does not constitute an instance of self-embedding. Thus, (36b) incurs only four violations of the processing principles at its worst point and is correctly predicted to be acceptable. In contrast, the unprocessable (36a) does violate the Property of Self-Embedding at the point we are considering: it contains a predicted CP complement embedded inside a predicted relative clause. Since the features of a CP complement are a subset of the features of a relative clause, this configuration is considered an instance of self-embedding, the total number of processing principles' violations associated with the partial structure reaches five, and the sentence is correctly predicted to be unprocessable.

This theory may also explain the difference between sentences containing a singly-embedded subject-gap relative clause (37a) and those containing a singly-embedded object-gap relative clause (37b), given the same assumptions that were necessary within the Extended Two Sentence Theory, namely, that the wh-trace is not posited in the structure until the verb following it is processed. If this is so, the worst point in processing a subject-gap relative clause in (37a) occurs at 'who', where the structure contains two DPs lacking theta-assigners (the matrix subject and the Operator). Since the structure contains only one embedded clause, the Property of Self-Embedding plays no role here. At the worst point in processing an object-gap relative clause in (37b), which occurs at the embedded

subject, the structure contains three DPs lacking theta-assigners (the two subjects and the Operator), with the Property of Self-Embedding being irrelevant, as before. Thus, the sentence containing the object-gap relative clause incurs more violations of the Processing Principles than the sentence containing the subject-gap relative clause, as a result of which it is expected to be more difficult to process.

37 a. The reporter [$_{CP}$ that [$_{IP}$ t attacked the senator]] admitted the error
b. The senator [$_{CP}$ that [$_{IP}$ the reporter attacked]] admitted the error

As we have noted in the discussion of this contrast within the Extended Two Sentence Theory, the assumption about the point at which the wh-trace is posited is not very plausible and contradict a large body of research that shows that traces are hypothesized as soon as possible.

To sum up, in this section we have presented two types of theories of processing complexity - a family of theories stemming from the Principle of Two Sentences and the Thematic Dependency/Self Embedding Theory. Note that all of the theories we have discussed differ in terms of what syntactic relations they assume to play a role in processing: case-assigning relationships, X-bar positions, and theta-assigning (and receiving) relationships are proposed to be the basic units considered. In addition, the theories differ in whether they assume that only the same kind of syntactic relations of the appropriate sort may increase processing difficulty, or not. Finally, the theories differ in whether they allow for syntactic factors other than the basic syntactic relation (be it case-assignment, X-bar relations, or theta-relations) to increase the processing complexity of the structure being processed: for

instance, for Lewis, the difficulty of center-embedded structures is due only to the number of "stacked" nominals occupying the same type of position, while for Gibson & Thomas, it is due to both the number of "stacked" nominals and the presence of self-embedding. These three parameters are logically independent - we could "mix and match" them to create all possible combinations, e.g. a theory in which the processing difficulty of a structure is measured in terms of the total number of incomplete case-assigning relationships (of any kind) and the number of embeddings contained in it. Ultimately, the question of which approach is right is an empirical one, although a theory in which processing complexity is reduced to a single syntactic property seems preferable.[11] In the next few chapters we will test the predictions of the theories we have presented above against Japanese processing complexity data, paying attention to which of the theories' assumptions make them succeed or fail in each particular instance.

[11] See Gibson & Thomas (1996b) for experimental evidence from English against both the Principle of Self-Embedding and the Two Sentence Theories.

3 Applying the Locality of Syntactic Dependencies Theory to Japanese Structures

In this chapter, we demonstrate how the Locality of Syntactic Dependencies Theory operates in an SOV language like Japanese, going through some simple examples in detail to arm the reader for the discussion of the more complicated structures that will follow.

Consider the pair of sentences in (38). (38a) contains an embedded clause that is acting as a complement of the matrix verb *itta*, 'said', and (38b) contains an object-gap relative clause that is modifying the matrix direct object *imooto*, 'younger sister'.

38 a. Titi-ga [$_{CP}$ [$_{IP}$ ani-ga imooto-o ijimeta] to] itta
father-nom older-brother-nom younger-sister-acc teased that said
'My father said that my older brother teased my younger sister'
b. Titi-ga [$_{CP}$ [$_{IP}$ ani-ga t ijimeta]] imooto-o hihansita
father-nom older-brother-nom t teased younger-sister-acc criticized
'My father criticized my younger sister who my older brother teased'

Before we turn to a discussion of how the complexity of these sentences is evaluated, let us say a few words about their ambiguity and explain how the parsing algorithm adopted here deals with it. Because Japanese is a head-final language, a complement CP occurs before the corresponding verb and a relative clause occurs before the head noun. While from the syntactic point of view this may be a trivial property, from the point of view of language processing it is extremely important. Since relative pronouns are not phonologically realized in Japanese, even the rather simple structures we are considering here remain ambiguous up to the point where the first verb is processed. In other words, on encountering the first two

DPs of (38a) or (38b) the parser has received no clues about whether the input string will be continued as a relative clause or a CP complement.[12]

There exists a large body of evidence showing that the parser works incrementally in head-final languages like Japanese, just as it does in head-initial languages like English (e g. Inoue & Fodor (1993), Suh (1993)). In other words, it does not wait for unambiguous clues, such as the sentence-final verb, to build structure for the input string. Moreover, because sentences in (38) do not cause any processing difficulty (such as a conscious garden path effect), we know that the parser manages to create and retain the appropriate structure up to the point of disambiguation. Of course, given the way the parsing algorithm described in section 2.1 works, this is expected: recall that all structures compatible with the input string are created and retained, unless one of them becomes significantly more expensive than the others or stops being compatible with the input.

With respect to the examples in (38), this means that on processing an input string of 'titi-ga ani-ga...' the parser constructs the partial structures in (39a) and (39b) (among others)[13].

39 a. $[_{IP1}$ titi-ga $[_{I'1}\ [_{VP1}\ [_{V'1}\ [_{CP2}[_{IP2}$ ani-ga $[_{I'2}\ [_{VP2}\ [_{V2}\ ]]\ [_{I2}\ ]]]\ [_{Comp2}\ ]]\ [_{V1}\ ]]]\ [_{I1}\ ]]]$

b. $[_{IP1}$ titi-ga $[_{I'1}\ [_{VP1}\ [_{V'1}\ [_{NP1}\ [_{CP2}$ 0p $[_{IP2}$ ani-ga $[_{I'2}\ [_{VP2}\ [_{V'2}$ t $[_{V2}\ ]]]\ [_{I2}\ ]]]\ [_{Comp2}\ ]]$ $[_{NP1}\ ]]\ [_{V1}\ ]]]\ [_{I1}\ ]]]$

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[12] At this point we are ignoring several other potential ambiguities: for instance, the two DPs could turn out to be part of the matrix clause - the first one may be a subject, and the second one may be a direct object (stative predicates can assign nominative case to their direct objects in Japanese). Other types of ambiguities may be caused the presence of pro's in the target sentence. Thus, our structure may contain a third clause, whose subject is pro. These ambiguities are resolved in the same way as the two we will discuss shortly, and to simplify the discussion we will pretend that they do not exist.

[13] For the moment we give Japanese relative clauses the structure of their English counterparts. This is not necessarily right, as we will explain shortly.

(39a) represents the structure in which the first nominative DP is attached as the matrix subject and the second nominative DP is attached as the embedded subject: this requires the prediction of the matrix VP and the embedded CP and VP.[14] (39b) represents the structure in which the first nominative DP is attached as the matrix subject and the second nominative DP is attached as a subject of a relative clause. A phonologically null relative clause operator has been posited and attached in the Spec of the relative clause CP and a trace of the operator has been posited and attached in the direct object position of the relative clause. In this structure, just as in the previous one, the matrix VP and the embedded CP and VP have been predicted. The head noun, which the relative clause is modifying, has been predicted as well. Note that all of these predictions are "obligatory" in the sense relevant for our system: these hypothesized nodes will have to be filled with lexical items for the sentences to become complete, grammatical structures. Thus, these predictions can potentially be associated with memory cost.

For the remainder of this work, we will be concerned with the complexity of the actual structures built for the examples under consideration. However, it might help to remember that at various points of each sentence (especially early on) a number of other structures are also being considered and evaluated. The "correct" structure that we will be examining is simply the one that remains compatible with the completed input string.

With this in mind, let us see how the complexity of the two sentences in (38) is calculated. (40) gives the memory cost table for sentence (39a).

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[14] We are assuming that the matrix clause is projected only up to an IP, not a CP. This is done for the sake of explicitness, and does not crucially affect the discussion that follows. As in English, IP and VP are treated as a single unit by the parser.

40.

Processed category; Predicted category	Lexical input; number of intervening thematic elements; memory cost (MUs)		
	[$_{DP1}$ father-nom]	[$_{DP2}$ brother-nom]	[$_{DP3}$ sister-acc]
DP_1: V_1	--	--	--
DP_2: V_2		0; 0.08	1; 0.18
DP_2: $Comp_1$		0 ; 0.08	1; 0.18
Total cost	0.00	0.16	0.36
	[$_{V2}$ teased]	[$_{Comp1}$ that]	[$_{V1}$ said]
DP_1: V_1	--	--	*
DP_2: V_2	*		
DP_2: $Comp_1$	2; 0.38	*	
Total cost	0.38	0.00	0.00

Just as in English, the matrix verb (V1) is predicted once the matrix subject (DP1) is attached into the partial structure. However, since this is the only predicted category at this point, it is not associated with memory cost. As the embedded subject (DP2) is processed, two predictions are made - that of the embedded verb (V2) and the Complementizer (Comp1) (corresponding to the extended projections of IP/VP and CP, respectively). Both predictions are associated with memory cost, as shown in (40). No new predictions are made at the next element in the input string - the embedded direct object (DP3) - but as it is processed, the cost of the two existing predictions increases (to M(1) from M(0)). The embedded verb (V2) is encountered next. As a result, the first prediction made at the embedded subject is satisfied, and the cost of the second prediction increases once again (to M(2) from M(1)). This prediction is satisfied at the next element processed - the Complementizer (Comp1). Finally, as the matrix verb is encountered, the "costless" prediction made at the matrix subject is satisfied.

This is a good point to review two features of the framework we are adopting here. First, in an SOV language like Japanese, processing the head of a direct object (regardless of whether it is a DP or a CP) does not cause any new predictions - the only obligatory prediction that could be made at this point is that of the verb which takes the direct object as an argument, but this verb has already been predicted at the point where the subject was processed. However, the presence of the direct object does make a difference: in an SOV structure, the verb complex is predicted at the subject and retained in working memory over the object, while in an SV(O) structure, the verb is also predicted at the subject, but does not have to be retained in memory while the object is being processed. Second, in Japanese, just as in English, the parser is assumed to operate on words as units, that is, only the categories that are consistently realized as separate morphological items (and are not members of a chain) constitute distinct obligatory predicted categories. Specifically, Nouns (together with their case particles), Verbs (together with the tense and other inflectional morphemes), and Complementizers can be considered obligatory predictions. In addition, in Japanese, just as in English, the nominal and verbal projections are taken to be thematic elements, as a function of which the memory cost of a given prediction is calculated.

Before we examine the processing complexity of sentences containing relative clauses, such as (38b), we should make our assumptions about the structure of Japanese relative clauses more explicit. This is an area where different syntactic assumptions produce structures with different expected processing difficulty. As a result, empirical evidence from language processing may be used to settle a syntax-internal question.

It has been known for a long time that relativized NP arguments do not obey subjacency in Japanese (see (41a)). The standard explanation of this fact, first proposed by Perlmutter (1972) and later developed by many others (Saito (1985), S.Saito et al (1988), Murasugi (1991), etc.)), is that these structures are not derived via Operator movement, but, rather, involve a *pro* base-generated in the position of the gap in the relative clause. Since no movement is involved, no subjacency violation can take place. A *pro* may occur in a gap corresponding to a relativized argument or a "quasi adjunct" (time and location PPs), but not in a gap corresponding to a "pure adjunct" (reason and manner PPs), or, to put it somewhat differently, in Japanese there is no *pro* corresponding to pure adjuncts. Thus, within the analysis of Murasugi (1991), relativized quasi adjunct PPs are not necessarily formed by Operator movement and do not exhibit subjacency effects, similarly to relativized arguments (see (41b)), but relativized pure adjunct PPs must be formed by Operator movement, and do obey subjacency (see (41c)). Note that this analysis cannot settle the question of how arguments are relativized in structures where no subjacency violation is involved: it is possible that a *pro* is base-generated in the gap, just as in the case of movement out of an island, but it is also possible that these structures are formed by Operator movement, since nothing excludes this possibility.

41 a. [[[[e_i e_j kiteiru] yoohuku$_i$] ga yogorete iru] sinsi$_i$
wearing suit-nom dirty gentleman
"A gentleman who the suit that (he) is wearing is dirty"
(Kuno (1973))

b. [[[[e_i e_j sensetu-o uketa] gakusei$_j$] ga minna ukaru] hi$_j$
job-interview-acc received students-nom all passed day
"The day$_j$ that all of the students that received job interview t_j passed"

c. *[[[[e_i e_j kubi ni natta] $hito_i$] ga minna okotteiru] $riyuu_i$
fired person-nom all get-angry reason
"The $reason_i$ that all of the people who got fired t_i got angry"
(Murasugi (1991))

Rather unexpectedly, processing data provide evidence demonstrating that Japanese relative clauses with argument gaps are not formed via Operator movement, even in those cases where Subjacency is not relevant.[15] It is a well-known fact that the human parser has difficulty with center-embedded structures, but not right-branching or left-branching structures. We have already seen an illustration of this pattern for English sentences in section 2.2. A large number of researchers (Kimball (1975), Cowper (1976), Hakuta (1981), Mazuka & Lust (1990)) have discussed the fact that the same pattern can be reproduced in Japanese: according to these works, a sentence containing two relative clauses that modify subjects is easy to process (see (42a)), because it has a left-branching, rather than a center-embedded structure, thus contrasting with its English translation.

42 a. [[imooto-ga e mita] tomodati-ga e ijimeta] kodomo-ga gakkoo-o deta
younger-sister-nom saw friend-nom teased child-nom school-acc left
'The child who the friend who my younger sister saw teased left school'
b.[[0p [[[0p [imooto-ga t mita]] tomodati-ga] t ijimeta]] kodomo-ga] gakkoo-o deta
c. [[[[[[imooto-ga *pro* mita]] tomodati-ga] *pro* ijimeta]] kodomo-ga] gakkoo-o deta

Consider the two structures for sentence (42a) given in (42b) and (42c). (42b) represents the derivation involving Operator movement, and (42c) represents the derivation involving a *pro* base-generated at the site of the gap. Since the sentence contains no islands out of which the Operator would have to move, the derivation in (42b) cannot be ruled out

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[15] The evidence concerns sentences with doubly-embedded relative clauses. This still leaves open the possibility that in "simple" relative clauses, where neither subjacency nor processing complexity are relevant, Operator movement may be involved.

on syntactic grounds. However, this derivation creates a center-embedded structure, with the Operator of the intermediate relative clause preceding the material of the most deeply embedded clause.[16] If it were the correct syntactic representation of (42a), then this sentence would be very difficult to process, just as its English translation is. Since (42a) is quite easy to process, we must conclude that (42b) is not the correct representation for this sentence. In contrast, the structure in (42c), corresponding to the derivation without Operator movement, is a left-branching structure: if it is the correct syntactic representation of (42a), than the sentence is correctly expected to be quite easy to process.[17] Thus, well-established processing data show that relative clauses with argument gaps have left-branching structures and are not formed by Operator movement even in the structures where Subjacency is not relevant. Note that this conclusion is theory-neutral: it must be drawn within any theory of processing complexity that accounts for the difficulty of center-embedded structures, whatever the specific mechanism it utilizes to do so.[18]

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[16] Here, it is important that the Operator occupies the Spec of CP, which occurs to the left of C' - otherwise no center-embedded structure would be created. In Japanese, Specifieres uniformly preceed X' constituents, and both Topicalization and scrambling processes move constituents to the left. Thus, this seems a safe assumption.

[17] Note that some sort of a relation must be established between the nominal head of the relative clause and the gap, regardless of whether Operator movement is involved or not. However, this is not necessarily the sort of relation that affects processing complexity.

[18] Interestingly, the two syntactic analyses of "pure adjunct" relativizations that have been proposed in the literature make distinct predictions about the processing complexity of these structures. Murasugi (1992) argues that these relativizations must always involve Operator movement. If this is correct, then a sharp contrast in difficulty is expected between a sentence with two argument-gap relative clauses (i) and a sentence with two adjunct-gap relative clauses (ii). Since (ii) is a center-embedded structure, it should be much more difficult to process than the left-branching (i). Miyagawa (1993) argues that pure adjunct relativizations do not involve Operator movement, or movement of any kind at all. If this approach is correct, no contrast in difficulty is expected between sentences (i) and (ii). This prediction has not been tested to our knowledge.

The upshot of this discussion is that we assume that a *pro* is base-generated in the position of the gap in sentence (41b), which contains an object-gap relative clause modifying the matrix direct object, as well as in all other sentences containing relative clauses that we will discuss later.[19]

The structure of (41b) that incorporates the points discussed above is given in (42a). (42b) provides the memory cost table for this sentence.

42 a. titi-ga [$_{IP}$ ani-ga *pro* ijimeta] imooto-o hihansita
father-nom older-brother-nom t teased younger-sister-acc criticized
'My father criticized my younger sister, who my older brother teased'

(i) [[imooto-ga *pro* ani-o syookaisita] tomodati-ga *pro* ijimeta] kodomo-ga gakkoo-o deta
younger-sister-nom older-brother-acc introduced friend-nom teased child-nom school-acc left
'The child who the friend who my younger sister introduced to my older brother teased left school'

(ii) [0p [0p [imooto-ga t ringo-o muita] naihu-ga t kowareta] riyuu-ga ani-ni wakaranai
younger-sister-nom apple-acc peeled knife-nom broke reason-nom older-brother-dat understand-neg
"My older brother does not understand the reason why the knife with which my younger sister peeled an apple broke"

[19] Note that all of the relative clauses we discuss modify objects, rather than subjects, and, therefore, are instances of center-embedding regardless of whether Operator movement occurs in them or not.

b.

Processed category; Predicted category	Lexical input; number of intervening thematic elements (n); memory cost (MUs)		
	[$_{DP1}$ father-nom]	[$_{DP2}$ brother-nom] [$_{DP3}$ pro]	[$_{V2}$ teased]
DP_1: V_1	--	--	--
DP_2: V_2		1; 0.18	*
DP_2: CP_2		1; 0.18	*
DP_2: DP_4		1; 0.18	2; 0.38
Total cost	0.00	0.54	0.38
	[$_{DP4}$ sister-acc]	[$_{V1}$ criticized]	
DP_1: V_1	--	*	
DP_2: DP_4	*		
Total cost	0.00	0.00	

The prediction of the matrix verb (V1) made at the subject is not associated with any memory cost, since it is the first one made in the structure. The next point at which the complexity of the structure is evaluated is after the embedded subject (DP2) is processed and attached into the structure. As this is done, a pro (DP3) is posited in the direct object position. Three categories are predicted at the embedded subject: the embedded verb, the CP of the relative clause, and the head noun for the relative clause. Since the partial structure already contains one predicted category, all of these new predictions are associated with memory cost. No new predictions are made at the *pro* (DP3), but the cost of the existing predictions increases (to M(1) from M(0)) . Next, the embedded verb (V2) is processed, so that the prediction of V2 and the prediction of CP2 are satisfied. The prediction of the head noun (DP4) remains unsatisfied at this point; the cost associated with it increases (to M(2) from M(1)) because it has to be retained in memory over a thematic element (V2). This prediction is satisfied at the next parse state, where the head noun is processed, so that no predicted categories associated

with memory cost remain in the structure. In this structure the maximal complexity of M(1)+M(1)+M(1) = 0.54 MUs occurs at the embedded direct object (DP3). It is caused by the predictions of the embedded verb, the embedded clause, and the head noun that were retained in memory over one intervening thematic category.

At this point we should note that within this processing framework, a relative clause turns out to be slightly more complex than an embedded clause acting as a complement of a verb, as in the sentence (38a): the maximal complexity of our relative clause example is 0.54 MUs, which is greater than the 0.38 MUs complexity of our CP complement example. This difference is due to the fact that at the subject of a CP complement no categories of the matrix clause are predicted: only the matrix verb, which takes the CP as a direct object could be predicted here, but it has already been predicted at the matrix subject. In contrast, at the subject of a relative clause one category of the matrix clause, namely the head noun, is predicted: once the parser has encountered a relative clause, it "knows" that the head noun must follow - if it does not, the sentence will not be a complete grammatical utterance. This is a new prediction, which could not be made at the matrix subject. The greater complexity of structures containing relative clauses is caused by the presence of this "extra" prediction in them. Note that sentential complements of nouns behave as relative clauses in our system, with the head noun being predicted at the embedded subject, and the complexity of the sentence increasing as a consequence of this.

Let us now consider an example that causes processing difficulty. The sentence in (43) contains two CP complements of verbs and the center-embedded structure thus created is quite difficult to process (Kimball (1975), Cowper (1976), Gibson (1991)). The

corresponding example in English involves a right-branching structure and does not cause processing difficulty, as can be seen from the translation of (43).

43 a. #Taroo-ga [$_{CP1}$ Akira-ga [$_{CP2}$ Hajime-ga Hanako-o sukida to] itta] to omotteiru
Taroo-nom Akira-nom Hajime-nom Hanako-acc likes that said that thinks
"Taroo thinks that Akira said that Hajime likes Hanako"
(Gibson (1991))

The memory cost table for (43) is provided in (44).

44

Processed category; Predicted category — Lexical input; number of intervening elements (n); memory cost (MUs)

	[$_{DP1}$ Taroo-nom]	[$_{DP2}$ Akira-nom]	[$_{DP3}$ Hajime-nom]
DP_1: V_1	--	--	--
DP_2: V_2		0; 0.08	1; 0.18
DP_2: CP_1		0 ; 0.08	1; 0.18
DP_3: V_3			0; 0.08
DP_3: CP_2			0; 0.08
Total cost	0.00	0.16	0.52
	[$_{DP4}$ Hanako-acc]	[$_{V3}$ likes]	[$_{Comp2}$ that]
DP_1: V_1	--	--	--
DP_2: V_2	2; 0.38	3; 0.62	3; 0.62
DP_2: CP_1	2; 0.38	3; 0.62	3; 0.62
DP_3: V_3	1; 0.18	*	
DP_3: CP_2	1; 0.18	2; 0.38	*
Total cost	1.12	1.62	1.24
	[$_{V2}$ said]	[$_{Comp1}$ that]	[$_{V1}$ thinks]
DP_1: V_1	--	--	*
DP_2: V_2	*		
DP_2: CP_1	4; 0.82	*	
Total cost	0.82	0.00	

Within this sentence the maximal complexity is M(3) + M(3) + M(2) = 1.62 MUs, reached at the most deeply embedded verb. It is caused by the two predictions that were made at the subject of the intermediate clause (V2 and Comp1) and retained in memory over the lexical material of both embedded clauses and one prediction made at the subject of the most deeply embedded clause (Comp2) and retained in memory over the material of that clause.

In this section we have seen how the processing framework of G & T works in a head-final SOV language like Japanese. Now we are in a position to discuss the predictions the theory makes for this language and to examine the evidence that bears them out.

4. A Single Memory Bin or Multiple Memory Bins: Experimental Evidence

4.1 The Issues

In section 2.3 we have presented two alternative theories of processing complexity: the Thematic Dependency/Self-Embedding Theory and the Extended Two Sentence Theory. From a very general point of view, the three theories of processing we are considering fall into two classes: the Locality Theory and the Thematic Dependency Theory can be termed the "single memory bin" theories and the Extended Two Sentence Theories can be termed the "multiple memory bins" theories. For the single memory bin theories, all incomplete relationships within a partial structure contribute to its complexity, that is, the human parser utilizes only one memory bin, in which incomplete relationships of every kind are stored, and the greater their total number, the more memory resources are required to process a sentence. For the multiple memory bin theories, only incomplete relationships of the same kind contribute to the complexity of a partial structure, that is, the human parser stores incomplete relationships of one kind in one memory bin and incomplete relationships of another kind in another memory bin, so that the greater the number of incomplete relationships of the same kind, the more difficult it becomes to process the sentence.

The word order of Japanese allows us to construct examples that test the predictions of the two classes of theories in a very direct fashion. Recall that within the Extended Two Sentence Theory, a partial structure that contains more than two elements occupying the same type of X-bar position is predicted to be unacceptable. Moreover, it is irrelevant whether the structure in question contains any other elements occupying a different type of

X-bar position (provided there are less than two of them). Thus, for the sentence in (45a), which contains a doubly center-embedded structure with an intransitive verb in the most deeply embedded clause, the theory is concerned with the total number of subjects (elements occupying the Specifier of IP position). Since there is a parse state (occurring before the first verb is processed) where their number is three, the sentence is expected to be unprocessable. For the sentence in (45b), which differs from (45a) only in having a transitive verb in the most deeply embedded clause, the predictions of the theory are the same: the number of subjects contained in the sentence is three and the presence of the direct object in the most deeply embedded clause is irrelevant, since it is occupying a different type of position (Complement of V).[20] Thus, the theory makes an explicit prediction with respect to sentences of this type: the processing complexity of the two structures is exactly the same. Additionally, it predicts that both are beyond the processability threshold and should cause processing breakdown.

45 a. Haha-ga [titi-ga [ani-ga naita to] itta to] omotteiru
mother-nom [father-nom [older-brother-nom cried that] said that] thinks
'My mother thinks that my father said that my older brother cried'
b. Haha-ga [titi-ga [ani-ga imooto-o ijimeta to] itta to] omotteiru
mother-nom [father-nom [older-brother-nom younger-sister-acc teased that] said that] thinks
'My mother thinks that my father said that my older brother teased my younger sister'

Let us contrast this with the analysis the pair of sentences in (45) receive within the single bin family of theories. Within the Thematic Dependency Theory, the parser is concerned with all incomplete theta-relations and all self-embedded structures. At the worst

[20] Note the transitive structure contains only one element in the Complement of V position at the point we are considering: while the two embedded clauses are acting as complements of the verb, they have not been processed yet (that is, their heads have not been encountered), and so at this point they are not elements in the Complement of V position waiting for attachment.

point of (45a) - at the most deeply embedded subject - the partial structure contains three nominals lacking theta-roles, and one instance of self-embedding, caused by the two predicted embedded clauses. The total number of violations of processing principles is four, which is below the processability threshold, so that the structure is expected to be processable. In contrast, at the worst point of (45b) - at the direct object of the most deeply embedded clause - the partial structure contains four nominals lacking theta-roles, along with one instance of self-embedding. The total number of violations of processing principles is five, which is beyond the processability threshold, so that the sentence is expected to be unprocessable. Again, the predictions of the theory with respect to this pair of sentences are quite clear: the sentence containing an intransitive verb is expected to be easier to process than the sentence containing a transitive one; the intransitive example should be processable, while the transitive example should be unprocessable.

Within the Locality Theory, sentences like those in (45a) and (45b) are expected to contrast in processing difficulty, as well. To see why this is so, consider the memory cost table for the intransitive example (45a), given in (46).

46.

Processed category; Predicted category	Lexical input; Number of intervening elements (n); Memory cost (MUs)		
	$[_{DP1}$ mother-nom]	$[_{DP2}$ father-nom]	$[_{DP3}$ brother-nom]
DP_1: V_1	--	--	--
DP_2: V_2		0; 0.08	1; 0.18
DP_2: CP_1		0 ; 0.08	1; 0.18
DP_3: V_3			0; 0.08
DP_3: CP_2			0; 0.08
Total cost	0.00	0.16	0.52

	$[_{V3}$ cried]	$[_{Comp2}$ that]	$[_{V2}$ said]
DP_1: V_1	--	--	--
DP_2: V_2	2; 0.38	2; 0.38	*
DP_2: CP_1	2; 0.38	2; 0.38	3; 0.62
DP_3: V_3	*		
DP_3: CP_2	1; 0.18	*	
Total cost	0.94	0.76	0.62
	$[_{Comp1}$ that]	$[_{V1}$ thinks]	
DP_1: V_1	--	*	
DP_2: CP_1	*		
Total cost	0.00	0.00	

The maximal complexity of this structure is M(2) + M(2) + M(1) = 0.94 MUs, associated with the two predictions that were made at the subject of the intermediate clause (V2 and CP1) and retained over the lexical material of both embedded clauses and one prediction that was made at the subject of the most deeply embedded clause (C2P) and retained over the material of that clause. Recall that we have already worked through a sentence with the structure of (45b) (see (44)). Its maximal complexity was M(3) + M(3) + M(2) = 1.62 MUs, also caused by the two predictions that were made at the intermediate subject and one prediction made at the most deeply embedded subject. Thus, the sentence containing a transitive verb has a higher maximal complexity, because in it the predictions made early on have to be retained over an additional thematic element - the direct object. The maximal complexity of the intransitive sentence is below the processability threshold, so it is expected to be processable, and the maximal complexity of the transitive sentence falls right on the processability threshold, so that it is expected to cause processing difficulty.

To sum up, within the multiple memory bin theories, such as the Extended Two Sentence Theory, no processability contrast is predicted to exist between sentences

containing an embedded intransitive verb, like that in (45a), and sentences containing an embedded transitive verb, like that in (45b). Within the single memory bin theories, such as the Thematic Dependency Theory and the Locality of Syntactic Dependencies Theory, the intransitive sentence is expected to be easier to process than the transitive one. Let us now present some experimental evidence that tests these expectations.

4.2 Experimental Data

Our evidence comes from an off-line questionnaire study. In the study the subjects were asked to rate sentences presented to them, based on how easy they were to understand and process. A five point scale was used for the ratings, with 1 being the easiest and 5 being the most difficult. The study contained 14 conditions, with four versions of each condition; the test sentences were combined with 54 filler sentences, so that the total number of sentences appearing on a questionnaire was 110. A single (non-counterbalanced) list of sentences was constructed and used with every subject. The same verbs were used in each version of the conditions whenever that was possible, and no proper names or pronouns were used. The plausibility of the sentences was controlled for as much as possible. 37 native speakers of Japanese from the Boston area took part in the study; they were paid a small fee for their participation. They were instructed to read each sentence once at a natural pace, without returning and rereading it, and then to provide the appropriate rating.[21]

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[21] The study was designed to test the predictions of the Thematic dependencies Theory, rather than the Locality Theory. As a result, some of the conditions are not directly relevant to the discussion here and some of the predictions of the Locality Theory have not been tested experimentally.

Four of the conditions were relevant to the contrast between transitive and intransitive sentences. A representative example of each is given in (47). All conditions contained two center-embedded clauses. The first factor varied was the transitivity of the verb in the most deeply embedded clause: two of the conditions contained a transitive verb (47a,c), and two contained an intransitive verb (47 b,d). The second factor varied was the presence of topicalization: in two of the conditions the matrix subject was topicalized (47c,d) and in two it was not (47a,b).

47 a. Obasan-ga syoojikina bebiisitaa-ga ani-ga imooto-o ijimeta to itta to omotteiru
aunt-nom honest babysitter-nom older-brother-nom younger-sister-acc teased that said that thinks
"My aunt thinks that the honest babysitter said that my older brother teased my younger sister"

b. Haha-ga titi-ga hukigana akatyan-ga naita to itta to omotteiru
mother-nom father-nom fussy baby-nom cried that said that thinks
"My mother thinks that my father said that the fussy baby cried

c. Ounaa-wa t sihainin-ga kyaku-ga wazato ueitaa-o osita to itta to omotteiru
owner-top t manager-nom guest-nom waiter-acc deliberately pushed that said that thinks
"As for the owner, he thinks that the manager said that a customer deliberately pushed the waiter"

d. Eegakantoku-wa t puroduusaa-ga kireena joyuu-ga koronda to itta to omotteiru
film-director-top prodcier-nom pretty actress-nom fell that said that thinks
"As for the film director, he thinks that the producer said that the pretty actress fell"

The mean acceptability ratings for the transitive and the intransitive conditions are given in (48). As can be seen from this table, the intransitive conditions were judged to be significantly easier to process than the transitive ones ($F(1, 36) = 15.4$, $p < .001$).

48.

Condition	Unacceptability rating (standard error)
intransitive (3 subjects)	3.10 (0.12)
transitive (3 subjects, 1 direct object)	3.38 (0.12)

These data strikingly confirm the predictions of the single memory bin family of theories and disconfirm the predictions of the multiple memory bin family of theories. The presence of a direct object does make a sentence more difficult to process; the difficulty of a structure depends on the total number of incomplete relationships in it, rather than on the number of incomplete relationships of the same kind.[22]

4.3 Absolute Processability of Transitive and Intransitive Sentences: Intuitive Data

Recall that the processing theories we are considering made two types of predictions about the pair of sentences in (45) (which we repeat here as (49)): in addition to their relative acceptability, their absolute acceptability was also predicted. Thus, within the Extended Two

[22] The presence of Topicalization also had a significant effect on the processability of the sentences: the topicalized conditions were significantly easier than the non-topicalized ones. This difference should be attributed to the effects of Case Confusability - a string of nominals bearing the same case-marker causes greater processing difficulty than a string of nominals bearing distinct case-markers. Uehara (1996) provides evidence that this is true in a number of Japanese structures. Hagstrom & Rhee (1996) show that in Korean a sentence containing two subjects with the same phonological realization of the nominative case-marker is more difficult to process than a sentence containing two subjects with different phonological realizations of the same case-marker. A number of intriguing questions about Case Confusability remain open - does it refer to abstract Case, to morphemes, or to their surface phonological realization? Does it play a role in a language like English, where for the majority of nominals the case-markers have no phonological realization? Are only case-markers relevant or other inflectional morphemes as well? Some of these questions are addressed in Babyonyshev (1996).

Sentences Theory, both (49a) and (49b) were expected to be unprocessable, within the Thematic Dependency Theory (and probably, the Locality Theory), (49a) was expected to be processable, while (49b) was expected to be unprocessable.

The experimental data we have just presented cannot be used to determine whether any given sentence type causes processing breakdown: the absolute ratings within questionnaire studies are largely determined by the difficulty of the filler sentences, and do not address this issue.[23] Thus, we will have to turn to the judgements given in the processing literature. Gibson (1991) quotes the transitive sentence in (50a) as unprocessable. Lewis (1993) produces the intransitive sentence in (50b) in support of his claim that a partial structure containing three subjects is not processable. Let us say a few words about where these judgements come from. (50a) represents the intuition of native speakers that were consulted by Gibson informally. The majority of the native speakers we have consulted agree with it, although for some the sentence is marginally processable. (50b) comes from an on-line study in Mazuka et al (1989), within which the reading times of a number of doubly center-embedded structures were measured. It was found that the reading time per character in the doubly center-embedded structures was significantly higher than in the singly center-embedded structures or in the control structures.

50 a #Taroo-ga [$_{CP1}$ Akira-ga [$_{CP2}$ Hajime-ga Hanako-o sukida to] itta] to omotteiru
Taroo-nom Akira-nom Hajime-nom Hanako-acc likes that said that thinks
"Taroo thinks that Akira said that Hajime likes Hanako"

b. #Akira-ga [$_{CP1}$Tosiko-ga [$_{CP1}$ Hajime-ga nakidasita toki] okidasita no-ni] kizuita
Akira-nom Toshiko-nom Hajime-nom started crying time got-up fact-dat noticed
"Akira noticed the fact that Toshiko got up at the time when Hajime started crying"

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[23] Gibson & Thomas (1996) gives evidence that this is the case: when the same set of experimental sentences was combined with two different sets of filler sentences, the absolute ratings changed, but the contrasts in processabilty remained constant.

c. #Yoko-ga [$_{CP1}$Hiromi-ga [$_{CP1}$Asako-ga e kaita] genkoo-o kakinaosita] syorui-o yonda
Yoko-nom Hiromi-nom Asako-nom t wrote draft-acc rewrote papers read
"Yoko read the papers that Hiromi rewrote based on the draft Asako wrote"

d. #Yuuko-ga [$_{CP1}$ Akio-ga [$_{CP1}$ Satoru-ga e katte kita] mame-o hiite e ireta] koohii-o nonda
Yuuko-nom Akio-nom Satoru-nom t buy went beans-acc ground t coffee-acc drank
"Yuuko drank the coffee which Asako made with the beans that Satoru bought"

There is a problem with interpreting these data, however: the study used five types of structures that had very little in common, except the fact that they contained (at least) two levels of embedding. Since only the reading times averaged across all of the structures are reported, we do not know how difficult each specific structure was. Two representative examples of the structures that were used appear in (50c) and (50d). It is immediately clear that they contain a number of factors that contribute to processing complexity in addition to the presence of two center-embedded clauses. Thus, the most deeply embedded clause in (50c,d) is an object-gap relative, which means that not only the three subjects, but also the direct object trace, is processed before the first verb is encountered. The second structural property that causes processing difficulty and is shared by all of the sentences in (50b-d) is that they contain an additional level of self-embedding, besides that created by the embedded CPs: in (50b) it is caused by the presence of the two nominals that take the embedded clauses as complements, and in (50c,d) it is caused by the presence of the head nouns which the relative clauses are modifying[24].

The upshot of this discussion is that the sentence quoted by Lewis (appearing in (50b)) comes from a study that examined very complicated structures that are not parallel to

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[24] The structure of (50b) can be analyzed in a couple of ways: the clause appearing with 'toki' could be a relative clause in which a time adjunct has been relativized, in which case 'toki' is a head noun, or it could be an adjunct CP, in which case 'toki' is a complementizer. The clause appearing with 'no' could be a modifier of this "formal noun" or its complement. The point we are making is not affected by the choice among these alternatives.

the more simple examples we have been considering. (50b) differs from (50a) in ways other than the transitivity of the most deeply embedded verb. The processing difficulty associated with additional levels of self-embedding is an interesting topic which we will address in detail in Chapter 6. For now, let us leave it aside and construct an example that forms a true minimal pair with (50a). We have already seen sentences like that. One of them is repeated here as (51a) along with its transitive counterpart (50a).

51 a Taroo-ga [$_{CP1}$ Akira-ga [$_{CP2}$ Hanako-ga nakidasita to] itta] to omotteiru
Taroo-nom Akira-nom Hanako-nom started-crying that said that thinks
'Taroo thinks that Akira said that Hanako started crying"

b. #Taroo-ga [$_{CP1}$ Akira-ga [$_{CP2}$ Hajime-ga Hanako-o sukida to] itta] to omotteiru
Taroo-nom Akira-nom Hajime-nom Hanako-acc likes that said that thinks
"Taroo thinks that Akira said that Hajime likes Hanako"

Not surprisingly, there is a striking contrast between the intransitive sentence in (51a) and the sentences in (50b-d): for the majority of speakers we have consulted, the intransitive (51a) does not cause processing difficulty. Thus, once the right structures are considered, the expectations of the Extended Two Sentence Theory are shown to be wrong: a sentence containing two levels of center-embedding and three sentence-initial subjects is generally judged to be processable, in contrast to a sentence with two levels of center-embedding, three sentence-initial subjects, and one direct object.

Let us consider what sort of revisions might be made within the Extended Two Sentence Theory to account for the acceptability of (51a) and the unacceptability of (51b). The minimal revision necessary for the acceptability of (51a) is quite drastic: it would have to be assumed that in Japanese (but not in English) three elements may occupy the same type of

X-bar position without causing processing breakdown. While incorporating cross-linguistic variation of this sort into a processing theory is clearly a last resort operation, perhaps in this case it could be argued to be unavoidable. The Extended Two Sentence Theory revised in this fashion would still be an internally consistent theory that makes explicit predictions. The sentence (51a) would now be expected to be processable because it does not at any point contain more than three elements occupying the same type of X-bar position (Spec of IP). However, the theory is still not able to account for the complexity contrast between (51a) and (51b): (51b) does not contain more than three elements occupying the same type of X-bar position, and so should be exactly as processable as (51a) is. Thus, the theory cannot be revised so that it makes the correct predictions with respect to this pair of sentences: they are expected to have the same processing complexity, which can be put above or below the processability threshold, depending on the assumptions about the number of incomplete relations the human parser can deal with.

Both the experimental and the intuitive data presented in this section have confirmed the predictions of the single memory-bin family of processing theories, showing that the total number of thematic elements, rather than the number of thematic elements of the same kind, determines the processing complexity of a structure. In more general terms, the data suggest that the human parser is concerned with all aspects of a partial structure that may contribute towards processing complexity, so that its difficulty is determined by how many such "problematic" properties it has. In addition, intuitive evidence has been produced to directly disconfirm the central claim of all versions of the Two Sentence Theory: that processing breakdown occurs whenever more than two elements of the same kind are present in a partial

structure. Of course, this raises the question of how the Two Sentence Theory was able to account for a number of processability contrasts we have seen in English. The data of this section suggests that whenever processing difficulty coincides with the predictions of the Two Sentence Theory, the structure has additional properties that contribute towards its difficulty. In particular, the partial structures with more than two subjects that are difficult to process are instances of self-embedding, discussed in chapter 6. In the next chapter we examine a broader range of Japanese structures, which will allow us to pull apart the predictions of the two single memory bin theories.

5. Inherently and Structurally Cased DPs

5.1 The Issues

All of the Japanese examples we have examined so far were deliberately limited in a specific way: the nominals contained in them were either nominative subjects or accusative objects. Of course, this is hardly realistic: the actual sentences produced and comprehended by the speakers of Japanese every day contain nominals that bear a wider range of case-markings (dative, instrumental, locative, etc.) and occupy a wider range of argument and adjunct positions. The processing complexity literature contains very little discussion of structures with nominals other than subjects and objects, the limited information that is available concerns indirect objects and proves quite interesting.

Gibson (1991) produces sentences like those in (52a), mentioning that their acceptability is problematic for the Thematic Dependency Theory. Lewis (1993) quotes (52b) as a processable sentence and discusses its status as support for the Extended Two Sentence Theory. We should note that while the judgements given in (52) represent informally collected intuitive judgements, rather then experimental data, they agree with the judgements of the native speakers we have consulted.

52 a. Taroo-ga [Akira-ga Hajime-ni biiru-o ageta to] itta
Taroo-nom Akira-nom Hajime-dat beer-acc gave that said
Taroo said that Akira gave a beer to Hajime'

b. Taroo-ga Hanako-ni [Akira-ga Hajime-ni Takako-o syookaisita to] itta
Taroo-nom Hanako-dat Akira-nom Hajime-dat Takako-acc introduced that said
'Taroo said to Hanako that Akira introduced Takako to Hajime'

The acceptability of (52b), which contains five sentence-initial stacked nominals, is quite striking (and surprising to speakers of English). Let us see what the analysis of this sentence is within our three theories.

The Extended Two Sentence Theory does not have any problems accounting for its acceptability. At the worst point in the structure, which comes right before the first verb, two subjects (elements in the Spec of IP), two indirect objects (elements in the Spec of VP) and one direct object (element in the Complement of V position) have been processed. Because the structure does not contain more than two elements occupying the same X-bar position, it is correctly predicted to be acceptable. No adjustments need to be made in the system to account for the acceptability of this example or other similar examples.

In contrast, within the Thematic Dependency Theory the acceptability of (52b) is quite unexpected: before the first verb is encountered, five DPs lacking theta-assigners have been processed and attached into the partial structure. Therefore, five violations of the thematic processing principles have been incurred and the sentence is predicted to be unprocessable. Note that the Property of Self-Embedding plays no role here, since (52b) contains only one embedded clause. However, it is possible to construct examples where the Property of Self-Embedding is involved, and the same problem surfaces in a slightly different guise. Thus, (53) contains a sentence with four sentence-initial stacked nominals - three subjects and one indirect object.

53 a. Taroo-ga Hanako-ni [Akira-ga [Hajime-ga naita to] omotteiru to] itta
Taroo-nom Hanako-dat Akira-nom Hajime-nom cried that thinks that said
"Taroo said to Hanako that Akira thinks that Hajime cried"

Here, four nominals lacking theta-roles have been processed, and one instance of self-embedding is present before the first verb is encountered, so that this structure, associated with five violations of processing principles, is expected to be unprocessable. Yet, according to the intuition of native speakers, (53) does not cause processing breakdown.

Note that two of the characteristics of the Thematic Dependency Theory could be responsible for its inability to account for this example: its "single bin" nature, or the syntactic relation that it takes to be relevant for processing complexity. The five stacked nominals in (52b) have the same theta-role properties: they are arguments of verbs, and there is no principled way to distinguish among them.

A solution to this problem developed in Babyonyshev and Gibson (1995) takes the track of fine-tuning the definition of "the basic syntactic relation". It is argued that inherently cased nominals lacking a theta-assigner are not associated with memory cost in the same way as structurally cased nominals are. Intuitively speaking, because of the tight connection between inherent case assignment and theta-role assignment, as soon as the parser processes an inherently cased nominal, it knows enough about its theta-role to not consider it "theta-less". The assumption that processing inherently cased nominals does not increase the processing load is quite natural within this system, which penalizes incomplete thematic relationships. The hypothesis adopted in Babyonyshev and Gibson (1995) is that inherently cased nominals processed before the corresponding verb are not associated with any memory cost, although a slightly weaker hypothesis - that such nominals are associated with a relatively low memory cost, is also compatible with the data examined there. Within this system, the nominative, accusative, and genitive case-markings and the topicalization particle

wa are treated as realizations of structural case, and all other case-markers are treated as realizations of inherent case. Note that the analysis of the English data is not affected by this assumption, since English makes very limited use of inherent case.

Let us see how this system accounts for the acceptability of (52b) and (53). At the worst point of (52b), the partial structure contains only three structurally-cased nominals, and no instance of self-embedding, so that the total number of violations of the processing principles is three, which is well below the processability threshold. As a result, the sentence is now correctly predicted to be processable. Similarly, at the worst point of (53), the structure contains only three structurally cased nominals and one instance of self-embedding, so that the total number of violations of the processing principles is four, and the sentence is expected to be processable, as well.

Finally, let us see how the example in (52b) is analyzed within the Locality Theory. Consider its memory cost table, provided in (54).

54.

Processed Category; Lexical input; number of intervening elements (n);
Predicted Category; Memory cost (MUs)

	$[_{DP1}$ Taroo-nom]	$[_{DP2}$ Hanako-dat]	$[_{DP3}$ Akira-nom]
DP_1: V_1	--	--	--
DP_3: V_2			0; 0.08
DP_3: CP_1			0; 0.08
Total cost	0.00	0.00	0.16
	$[_{DP4}$ Hajime-dat]	$[_{DP5}$ Takako-acc]	$[_{V2}$ introduced]
DP_1: V_1	--	--	--
DP_3: V_2	1; 0.18	2; 0.38	*
DP_3: CP_1	1; 0.18	2; 0.38	3; 0.62
Total cost	0.36	0.76	0.62

	$[_{Comp1}$ that]	$[_{V1}$ said]	
DP_1: V_1	--	*	
DP_3: CP_1	*		
Total cost	0.00	0.00	

The maximal complexity of this sentence is M(2) + M(2) = 0.76 MUs; it is associated with the prediction of the embedded VP and CP, made at the embedded subject. This is much lower than the processability threshold, so that the sentence is predicted to be quite easy to process. The complexity of the structure is so low because the prediction of the matrix predicate is costless and no additional prediction is made at the matrix indirect object. Memory cost begins to build only at the beginning of the embedded clause, which is quite short. Thus, the acceptability of sentences containing indirect objects, such as the one in (52b), can be handled by this framework without any difficulties. Note that within this theory it is not the presence of inherently Cased nominals that makes sentences like (52b) easy to process, but rather the fact that inherently Cased nominals are attached to the predicates that have to be present in the structure in any sentence, even one with only a subject argument, and so they do not affect the number of obligatory predicted categories.

Now we are in a position to construct a set of examples for which each of the three processing theories makes a distinct prediction. Consider the schematic structures in (55). All of them contain two levels of center-embedding. (55a) has an intransitive verb in the most deeply embedded clause, (55b) has a transitive verb that assigns structural case (e.g. accusative) to its nominal argument, and (55c) has a transitive verb that assigns inherent case (e.g. dative) to its argument.

55 a. DP-nom [$_{CP}$ DP-nom [$_{CP}$ DP-nom V] V] V
b. DP-nom [$_{CP}$ DP-nom [$_{CP}$ DP-nom [$_{V'}$ DP-acc V]] V] V
c. DP-nom [$_{CP}$ DP-nom [$_{CP}$ DP-nom [$_{VP}$ DP-dat V]] V] V

Within the Extended Two Sentence Theory, the three structures are expected to be equally easy or difficult to process, since they contain the same number of elements occupying the Spec of IP position and the extra nominals present in (55b) and (55c) occupy a different type of position and so do not contribute to the complexity of the structure. Within the Thematic Dependency Theory, the sentence with four structurally cased nominals in (55b) is expected to be the most difficult, and the sentence containing three structurally cased nominals and one inherently cased nominal (55c) is expected to be much easier to process, being comparable to the sentence containing only three structurally cased nominals (55a). Within the Locality Theory, the sentence containing three sentence-initial nominals (55a) is expected to be the easiest; while (55b) and (55c), which contain four sentence-initial nominals are expected to be of equal complexity, and more difficult than (55a) is.

5.2 Experimental Data

Five of the conditions in the study previously described tested the predictions regarding these types of sentences. All contained two levels of center-embedding. The first had an intransitive verb in the most deeply embedded clause, as in the example (56a). The second contained a verb assigning structural accusative case, as in (56b). We have already discussed these two conditions as part of the transitive-intransitive comparison in the previous section. The third condition contained a verb assigning inherent accusative case, as illustrated in (56c). The

fourth contained a verb assigning inherent dative case, as illustrated in (56d). The fifth contained a verb assigning quirky dative case, as in (56e).

56 a.wakai kyooju-ga [TA-ga [gakusei-ga konransita to] sengensita to] utagatta
young professor-nom TA-nom students-nom panicked that announced that doubted
"The young professor doubted that the TA announced that the students panicked"
b.kankyaku-ga [rajioanaunsaa-ga [yuumeena sukeetosensyu-ga sukeetogutu-o kowasita to] sengensita to] utagatta
spectator-nom radio announcer-nom famous iceskater-nom skate-acc broke that announced that doubted
"The spectator doubted that the radio announcer announced that the famous ice skater broke a skate"
c. manukena hannin-ga [kisya-ga [keesatukan-ga siryooteekyousya-o atenisita to] sengensita to] utagatta
foolish criminal-nom journalist-nom policeman-nom informant-acc counted on that announced that doubted
"The foolish criminal doubted that the journalist announced that the policeman counted on the informant"
d.syutujoosya-ga [hyooronka-ga [zuuzuusii kontestokuiin-ga sinsain-ni kisusita to] sengensita to] utagatta
runner-up-nom announcer-nom impudent contest-winner-nom judge-dat kissed that announced that doubted.
"The runner-up doubted that the commentator announced that the impudent contest winner kissed the judge"
e. hyooronka-ga [supookusuman-ga [syoodootekina senkyokoohosya-ga kyoosooaite-ni denwasita to] sengensita to] utagatta
commentator-nom spokesman-nom impulsive candidate-nom opponent-dat called that announced that doubted
"The commentator doubted that the spokesman announced that the impulsive candidate called his opponent"

Let us describe the four "transitive" conditions in a bit more detail. In the first two conditions, the case-marking that appears on the fourth nominal is accusative. The accusative case-marking within the first condition (exemplified in (56b)) is the realization of structural case: it is not connected to the theta-role of the direct object, being checked in the Spec of AgrOP in the familiar fashion, and passing all the standard tests for structural case, such as

disappearing under passivization, and being able to host a floated quantifier separated from it (57a,b) .

The accusative case-marking appearing on the fourth nominal in the second condition (exemplified in (56c)) is the realization of inherent case. Let us make the definition of inherent case relevant here more explicit. Recall that the experiment is designed to address the predictions of the Thematic Dependency Theory, within which the connection between a case-marking and a theta-role is the crucial factor in determining whether a nominal bearing the case-marking is considered "theta-less" or not. For instance, the instrumental case-marking that uniformly surfaces on arguments that have the theta-role of Instrument is a realization of inherent case in the relevant sense. A specific case morpheme has no special status in this view: the morpheme that usually serves as a realization of structural Case may also serve as a realization of inherent Case, and conversely. Thus, the accusative case particle in (56c) is a realization of inherent case: it is connected with a specific theta-role, born by the nominal, appearing on the Goal and Source arguments of motion verbs, e.g., *deru* - 'leave' and *tazuneru* - 'to visit', and psych-verbs, e.g., *atenisuru* -'count on' and *tayoru* - 'rely on'. Inherently cased accusative nominals fail the standard structural case tests: they are unable to act as subjects of passive verbs, and cannot host floated quantifiers separated from (57c,d).[25]

57. a Sukeetogutu-ga Biru-ni kowasareta
ice skate-nom Bill-dat break-passive
'The skate was broken by Bill'
b. kuruma-o Biru-ga t ni-dai kowasita
car-acc Bil-nom two-CL broke
'Bill broke two cars'

[25] The judgements are taken from Okada (1989). For some speakers (57c,d) are not quite ungrammatical, but even they find these sentences less acceptable than (57a,b).

c.*Mary-ga Biru-ni tazunerareta
Mary-nom Bill-dat visit-pass-past
'Mary was visited by Bill'
d. *Gakusei-o Biru-ga t 6-nin tazuneta
Students-acc Bill-nom six-CL visited
'Bill visited six people'

Note that the structural position of the inherently cased accusative argument does not affect the predictions of the three theories under consideration: within the Extended Two Sentence Theory, the only thing that is important is that this nominal does not occupy the same position as the subjects do (or bear the same case as they do); within the Thematic Dependency Theory, the only thing that is important is that the nominal bears inherent, rather than structural case; within the Locality Theory, the only thing that is important is that the nominal is an argument of the same predicate as the previously encountered subject. It is possible that the inherently Cased argument is occupying the standard direct object position, occurring in the position where direct objects are base-generated, not undergoing movement to AgrP to check their case-features, or occupying the indirect object position, as other Goal arguments are. We will not take a stand on this issue, since this is not necessary for our purposes here.

Within the last two conditions, the fourth nominal appears with a dative case-marking. In one of them (exemplified in (56d)) the dative case-marking is the realization of quirky case, i.e. structural Case assigned to a direct object, which gets morphologically realized as non-accusative case-marking, because of idiosyncratic lexical properties of the predicate. Most crucially for us, the appearance of quirky case on a nominal is not connected to (or predictable from) its theta-role. Under the most natural syntactic assumptions, such nominals occupy the standard direct object position. In the last condition (56e), the dative

case-marking is the realization of inherent case. The nominals bearing it are Goal arguments of such verbs as *hanasu* - 'to talk to' or *denwasuru* - 'to call (on the phone)'.[26] These nominals are assumed to occupy the standard indirect object position. Thus, the sructural-inherent case distinction is reproduced twice: once within the nominals bearing the accusative case-marking, and once within the nominals bearing the dative case-marking.

The mean acceptability ratings for the five conditions are given in (58).

58.

Condition	Mean Acceptability Rating (standard error)
3 NPs	3.51 (0.16)
4 NPs (structural accusative)	3.72 (0.16)
4 NPs (inherent accusative)	3.84 (0.13)
4 NPs (structural dative)	3.85 (0.14)
4 NPs (inherent dative)	4.00 (0.14)

The intransitive condition (3 NP in the table above) was significantly easier to process than any of the transitive (4 NP) conditions ($p < .001$). This means that the 4NP conditions containing inherently cased nominals were significantly more difficult than the 3 NP condition, just as the 4 NP conditions containing structurally cased nominals. In fact, the conditions containing inherently cased nominals were shown to be slightly more difficult to process than conditions containing structurally cased nominals ($F(1, 36) = 6.07$, $p < .05$). There was no significant difference between the conditions containing nominals with

[26] In Japanese, the dative case born by the Goal arguments of ditransitive verbs appears to have properties of both structural and inherent Case, passing some tests for structural Case status, and failing others. However, within the Thematic Dependency Theory it must be analyzed as inherent, since it is predictable from the theta-role of the argument bearing it.

accusative case-marking and those containing nominals with dative case-marking ($F(1, 36) = 2.66$, $p > 0.1$).

5.3 Discussion

These findings confirm the predictions of the Locality Theory, within which it is expected that an embedded clause containing no arguments other than the subject should be easier to process than an embedded clause containing any type of argument besides the subject. In addition, within this theory it is expected that embedded clauses containing an inherently cased argument should pattern with clauses containing a structurally cased argument, the clauses containing an argument in the direct object position should pattern with clauses containing an argument in the indirect object position, and the clauses containing an argument with accusative case-marking should pattern with the clauses containing an argument with dative case-marking. These patterns are expected because the parser does not make use of the syntactic properties distinguishing the nominals. This expectation turns out to be correct: no such differences are revealed by the data.

The data disconfirm the predictions of the Thematic Dependency Theory. Within this theory, a clause containing an inherently cased argument in addition to the subject is expected to pattern with a clause containing no arguments besides the subject. This expectation is not born out by the data. Moreover, both types of clauses are expected to be much easier to process than the clauses containing a structurally cased argument in addition to the subject. Only half of this prediction is born out by the data: while clauses containing no argument besides the subject were found to be easier to process than clauses containing a structurally

cased argument, the clauses containing an inherently cased argument were found to be just as difficult to process as clauses containing a structurally cased argument, and possibly even more so. Thus, the most general pattern emerging from the data - that for the purposes of processing complexity, the type of case born by a nominal is irrelevant - is incompatible with the predictions of the Thematic Dependency Theory. Here, it is important to note that the expected contrast was found neither within the two accusative conditions, nor within the two dative conditions. Even if we compare the two clearest cases - that of a direct object bearing structural accusative case and the indirect object bearing inherent dative case - the pattern expected under the Thematic Dependency Theory does not show up: the conditions with inherently cased dative nominals are judged to be more difficult than the conditions with structurally cased accusative nominals. Thus, the Thematic Dependency Theory is faced with two choices: it can remain in its present form and fail to deal with the experimental data of this section, or retreat to its original form, within which no distinctions were drawn between inherently and structurally cased nominals, and fail to deal with the acceptability of sentences that contain inherently cased nominals in the matrix clause.

Finally, the data also disconfirm the predictions of the Extended Two Sentence Theory. This is essentially the situation we have seen in the previous section, reproduced with a slightly larger set of sentences. Within this theory, no difference in processing complexity is expected between a clause containing no nominal arguments besides the subject and a clause containing any type of argument in addition to the subject. Previously, we have seen that adding a structurally cased accusative direct object makes a clause more difficult to process. Now, we are in a position to say that adding an inherently cased Goal argument (presumably,

occupying the indirect object position) or a direct object bearing quirky dative case increases the processing complexity of a sentence as well.

It is important to note that the complexity contrast unexpected within this theory showed up in all of our 4 NP conditions. Thus, both the sentences with the fourth nominal in the direct object position and the sentences with the fourth nominal in the indirect object position were found more difficult to process than the sentences lacking the fourth nominal. As we have discussed in the previous section, assuming that in Japanese the number of elements that can occupy the same type of X-bar position without causing processing breakdown is three, rather than two, will not allow the theory to account for this complexity contrast.

5.4 Conclusions and Further Predictions of the Locality Theory

In the previous chapter, we have examined experimental evidence addressing the question of whether the single memory bin approach or the multiple memory bin approach is appropriate for a theory of complexity interested in dealing with data from a head-final language. In this chapter, we have presented additional evidence in favor of the single bin family of theories. However, the evidence presented here also touches on the question of what type of a syntactic relation is relevant in determining processing complexity: we could have a theory in which all of X-bar relations, all of Case-assigning relations, all theta-relations, or all of the more general type of relation corresponding to obligatory predictions could contribute to processing complexity of a structure. In this section we have seen that the structural position of a nominal or the type of case born by it does not matter to the human parser. It is

concerned with more general properties of structures, such as the number of nominals that it contains. The only theory of processing complexity, within which this state of affairs is expected, is the Locality Theory.

Note that within this theory there is one property of a nominal that is expected to affect the complexity of the structure in which it occurs, namely, whether it belongs to the matrix or to the embedded clause. Recall that the prediction of the matrix predicate is "costless" in this system, so that the occurrence of additional arguments in the matrix clause does not affect the total complexity of the structure. In contrast, the prediction of an embedded predicate is associated with memory cost, and the more arguments occur between the subject (where the predicate is predicted) and the predicate (where the prediction is fulfilled), the longer the prediction will have to be retained in memory and the more complex the structure will be. This predicted contrast is illustrated with the pair of sentences in (59a,b). The contrast can be recreated within structures that contain an additional level of embedding, as in (59c,d). The prediction remains the same: the structure in which the dative Goal argument appears in the matrix clause will be easier than the structure in which the dative Goal argument appears in the embedded clause.

59 a. Taroo-ga Hanako-ni [Hajime-ga puresento-o okutta to] itta
Taroo-nom Hanako-dat Hajime-nom present-acc sent that said
-- -- M(0)+M(0) M(1)+M(1) M(2) * *
"Taroo said to Hanako that Hajime sent a present"

b. Taroo-ga [Hajime-ga Hanako-ni puresento-o okutta to] itta
Taroo-nom Hajime-nom Hanako-dat present-acc sent that said
-- M(0)+M(0) M(1)+M(1) M(2)+M(2) M(3) * *
"Taroo said that Hajime sent a present to Hanako"

c. Taroo-ga Hanako-ni [Hajime-ga [Akira-ga hanasita to] omotteiru to] itta
Taroo-nom Hanako-dat Hajime-nom Akira-nom spoke that thinks that said
"Taroo said to Hanako that Hajime thinks that Akira spoke"

d. Taroo-ga [Hajime-ga [Akira-ga Hanako-ni hanasita to] omotteiru to] itta
Taroo-nom Hajime-nom Akira-nom Hanako-dat spoke that thinks that said
"Taroo said that Hajime thinks that Akira spoke to Hanako"

This set of contrasts is not predicted under any other processing theory, since the distinction between the arguments of the matrix and the arguments of the embedded clause does not play a role anywhere else. Although this prediction has not been tested, the judgements of native speakers seem to confirm to it, providing more evidence in favor of the Locality Theory.

6. Center-Embedding Structures

6.1 Center-Embedding Structures I: Asymmetries between Relative Clauses and CP Complements

6.1.1 The Issues

In this chapter we turn to examining the processing complexity contrasts created by the presence of additional levels of embedding, rather than additional nominals, within a structure. Once again, the word order of Japanese allows us to test the predictions of various processing theories in a very direct fashion.

Recall that in section 2.3 we saw that English sentences that contain a CP complement embedded inside a relative clause are more difficult to process than sentences that contain a relative clause embedded inside a CP complement (see (60)).

60 a. The information [$_{CP}$ that the child [$_{RC}$ who the rescue worker looked for t] survived the crash] had comforted the old woman.
b. #The old woman [$_{RC}$ who the information [$_{CP}$ that the child survived the crash] had comforted t] looked for the rescue worker.

This contrast in difficulty is predicted within the Thematic Dependency Theory and the Locality Theory, but not within the Extended Two Sentence Theory. The latter fails to predict the contrast, because at the worst point in the two structures - at the most deeply embedded subject - both structures contain three elements occupying the subject (Spec of IP) position, and so they are expected to be equally unprocessable. Within the Thematic Dependency Theory, (60a) is predicted to be processable because at its worst point its partial structure contains only four nominals lacking theta-roles, and no instances of self-embedding

(recall that the features of a relative clause are not a subset of those of a CP complement). (60b) differs in containing one instance of self-embedding in addition to four theta-less nominals, so that it is correctly predicted to be unprocessable. Within the Locality Theory, the contrast is predicted because processing the first element in a relative clause causes three predictions - one more than processing the first element in a CP complement does. As a result, in a sentence like the difficult (60b) three predictions have to be retained over the material of the most deeply embedded clause, while in a sentence like the easy (60a), only two predictions have to be retained in memory for this length of time.

The three processing theories make the same predictions for the Japanese counterparts of (60a) and (60b). (61a) contains a relative clause inside a CP complement and (61b) contains a CP complement inside a relative clause. Anticipating the discussion of the experimental data in the next section, we mark (61b) as unprocessable.

61 a. oji-ga [musuko-ga [[haha-ga pro hanasita] hito-ni] situmonsita to syutyoosita
uncle-nom [son-nom [[mother-nom pro talked] person-dat] questioned] that insisted
"My uncle insisted that the son asked a question of the person to whom my mother spoke"

b. #gekai-ga [[kangohu-ga pro [kanja-ga okita to] syutyoosita] masuii-ni] situmonsita
surgeon-nom [[nurse-nom pro [patient-nom woke up that] insisted] anesthesiologist-dat] questioned
"The surgeon asked a question of the anesthesiologist to whom the nurse insisted that the patient woke up"

Let us first consider the analysis these two structures receive within the Locality Theory. (62) gives the memory cost table for (61a), which contains a relative clause inside a CP complement.

62.

Processed Category; Predicted Category — Lexical input; Number of intervening thematic elements (n); Memory Cost (MUs)

	[$_{DP1}$ uncle-nom]	[$_{DP2}$ son-nom]	[$_{DP3}$ mother-nom] [$_{DP4}$ pro]
DP_1: V_1	--	--	--
DP_2: V_2		0; 0.08	2; 0.38
DP_2: CP_1		0; 0.08	2; 0.38
DP_3: V_3			1; 0.18
DP_3: CP_3			1; 0.18
DP_3: DP_5			1; 0.18
Total cost	0.00	0.16	1.30
	[$_{V3}$ spoke]	[$_{DP5}$ person-dat]	[$_{V2}$ questioned]
DP_1: V_1	--	--	--
DP_2: V_2	3; 0.62	4; 0.82	*
DP_2: CP_1	3; 0.62	4; 0.82	5; 0.92
DP_3: V_3	*		
DP_3: CP_3	*		
DP_3: DP_5	2; 0.38	*	
Total cost	1.62	1.64	0.92
	[$_{Comp1}$ that]	[$_{V1}$ insisted]	
DP_1: V_1	--	*	
DP_2: CP_1	*		
Total cost	0.00	0.00	

The maximal complexity of this sentence is M(4) + M(4) = 1.64 MUs, which occurs at the head noun of the relative clause (DP5). The cost is associated with the two predictions that were made at the subject of the intermediate clause (DP2) and retained in memory over the material of the most deeply embedded clause.

Compare this with the memory cost table for (61b), which contains a CP complement embedded inside a relative clause:

63

Processed category; Lexical input; Number of intervening thematic elements (n);
Predicted category; Memory cost (MUs)

	[$_{DP1}$ surgeon-nom]	[$_{DP2}$ nurse-nom] [$_{DP3}$ pro]	[$_{DP4}$ patient-nom]
DP_1: V_1	--	--	--
DP_2: V_2		1; 0.18	2; 0.38
DP_2: CP_2		1; 0.18	2; 0.38
DP_2: DP_5		1; 0.18	2; 0.38
DP_4: V_3			0; 0.08
DP_4: CP_2			0; 0.08
Total cost	0.00	0.54	1.28
	[$_{V3}$ woke up]	[$_{Comp2}$ that]	[$_{V2}$ reported]
DP_1: V_1	--	--	--
DP_2: V_2	3; 0.62	3; 0.62	*
DP_2: CP_2	3; 0.62	3; 0.62	*
DP_2: DP_5	3; 0.62	3; 0.62	4; 0.82
DP_4: V_3	*		
DP_4: CP_2	1; 0.18	*	
Total cost	2.04	1.86	0.82
	[$_{DP5}$anesthesiologist-d]	[$_{V1}$ questioned]	
DP_1: V_1	--	*	
DP_2: DP_5	*		
Total cost	0.00	0.00	

The maximal complexity of this sentence is M(3) + M(3) + M(3) + M(1) = 2.04 MUs; it occurs at the Verb of the most deeply embedded clause and is associated with the three predictions that were made at the subject of the intermediate clause (DP2) and one prediction that was made at the subject of the most deeply embedded clause (DP4). Thus, as in English, a sentence that contains a relative clause embedded inside a CP complement is expected to be easier to process than a sentence that contains a CP complement embedded inside a relative clause. This asymmetry occurs in Japanese for the same reason it occurs in English: at the first element of a CP complement, two predictions are made (the embedded verb and the

embedded clause), but at the first element of a relative clause, three predictions are made (the verb, the clause, and the head noun). As a result, in sentences like (61b), there is an extra prediction being retained in memory over the material of the most deeply embedded clause. The memory cost associated with this extra prediction is responsible for (61b) being more difficult to process than (61a).

Within the Thematic Dependency Theory, the contrast between (61a) and (61b) is handled exactly as the contrast between the corresponding English sentences. At the worst point of the easy (61a), it contains four nominals lacking theta-roles - the three subjects and a *pro* that occupies the position of the gap. Because the syntactic features of Japanese relative clauses are assumed to be a superset of those of Japanese CP complements, the structure of (61a), in which a predicted relative clause occurs inside a predicted CP complement, does not constitute an instance of self-embedding associated with additional memory cost. In contrast, the difficult (61b) at its worst point contains four nominals lacking theta-roles (the three subjects and the *pro*) and one instance of self-embedding, caused by the predicted CP complement that occurs inside a predicted relative clause. This extra violation of the processing principles is responsible for putting (61b) beyond the processability threshold.

Note that while for English it is quite natural to say that the features of relative clauses are a superset of the features of CP complements (both are CPs and relative clauses must have a wh-feature responsible for triggering Operator movement), for Japanese this position is somewhat less plausible. First, in one of the prominent analyses of Japanese relative clauses, that of Murasugi (1991), it is claimed that they are IPs, not CPs; if this is right, relative clauses and sentential complements may be expected to be categorially distinct

with the Principle of Self-Embedding being inapplicable. This problem may be overcome with various assumptions - for instance, it could be claimed that both CP and IP are part of the verbal extended projection, and so are similar enough to be treated as identical by the parser. Second, if Japanese relative clauses with argument gaps do not involve Operator movement, they should not have the "additional" feature responsible for this movement operation that distinguishes them from sentential complements. Thus, to maintain an approach in terms of the Principle of Self-Embedding, we are forced to assume the existence of some (non-wh) features, whose syntactic function is not clear, that a relative clause, but not a CP complement, has.

Within the Extended Two Sentence Theory, (61a) and (61b) receive identical analyses: at the worst point in both structures - before the first verb is encountered - three elements occupying the same structural position (Spec of IP) have been processed. Thus, both sentences are expected to be equally unprocessable. The fourth element that has been encountered in both structures occupies a different type of position (Spec of VP) and so does not contribute to the processing complexity.

6.1.2 Experimental Results

Four conditions of the experiment previously described involved asymmetries between relative clauses and CP complements in embedded contexts. Two of the conditions contained relativized indirect objects illustrated in (61) and repeated here as (64a,b), and two of the conditions contained relativized direct objects, as illustrated in (64c,d). Within each pair, one

condition contained a relative clause embedded inside a sentential complement (64a,c), and one condition contained a sentential complement embedded inside a relative clause (64b,d).

64 a.oji-ga [musuko-ga [[haha-ga pro hanasita] hito-ni] situmonsita to syutyoosita
uncle-nom [son-nom [[mother-nom pro talked] person-dat] questioned] that insisted
"My uncle insisted that the son asked a question of the person to whom my mother spoke"

b. gekai-ga [[kangohu-ga pro [kanja-ga okita to] syutyoosita] masuii-ni] situmonsita
surgeon-nom [[nurse-nom pro [patient-nom woke up that] insisted] anesthesiologist-dat] questioned
"The surgeon asked a question of the anesthesiologist to whom the nurse insisted that the patient woke up"

c. dooryoo-ga [kowai joosi-ga [raikyaku-ga pro musisita] hisho-o hihansita to] itta
coworker-nom strict boss-nom visitor-nom ignored secretary-acc criticized that said
"The coworker said that the strict boss criticized the secretary whom the visitor ignored"

d. kootyoo-ga [[sensei-ga [syoojo-ga pro tunetta to] itta] otonasii syoonen-o] semeta
principal-nom teacher-nom girl-nom pinched that said well-behaved boy-acc blamed
"The principal blamed the well-behaved boy whom the teacher said that the girl pinched"

Two points should be noted about the structure of these conditions: first, the sentences were constructed so that the gap in the relative clause and the head noun had the same syntactic position - either both were direct objects or both were indirect objects. This was done because structures with head noun-gap mismatches appear to cause additional processing difficulty, which we wished to avoid. Second, the condition exemplified in (64d), which contained a sentential complement embedded inside an object-gap relative clause, involved long-distance relativization, that is, contained a gap in the most deeply embedded clause. This construction is grammatical in Japanese. It had to be used here because the position of the direct object of the intermediate verb - *itta* - is occupied by a CP, so that only the position of the direct object of the most deeply embedded verb can be occupied by a *pro*.[27]

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[27] The most deeply embedded clause is a CP complement, even though one of its arguments is a gap, because it as a complement of a verb and projects up to a CP (as

The mean acceptability ratings for the four conditions are given in (65).

65.

Condition	Mean acceptability rating (standard error)
CP/RC indirect object	3.26 (.37)
RC/CP indirect object	3.84 (.21)
CP/RC direct object	3.86 (.12)
RC/CP direct object	4.13 (.08)

The conditions that contained a relative clause embedded inside a CP complement were found to be significantly easier to process than the conditions that contained a CP complement embedded inside a relative clause ($F(1,36) = 16.76$, $p < 0.001$). This pattern occurred in both the direct object and the indirect object conditions. In addition, the direct object conditions were found to be significantly harder to process than the indirect object conditions ($F(1,36) = 29.96$, $p < 0.001$).

As these findings show, the same the same type of embedding structures cause processing difficulty in Japanese as in English. In both languages a relative clause embedded inside a CP complement is much easier to process than a CP complement embedded inside a relative clause. The pattern is especially striking if we consider the radically different properties of the relevant structures in English and Japanese (word order, the presence of overt wh-words, the presence of movement, etc.). The presence of this processing complexity contrast in both languages suggests that the complexity metric used by the human parser must be based on sufficiently general syntactic relations to disregard such differences.

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evidenced by the presence of a Complementizer in it). The intermediate clause is a relative clause, even though none of its arguments is a gap, because it is a modifier of a noun and does not project up to a CP (as evidenced by the impossibility of a Complementizer in it).

6.1.3 Discussion

Our first finding - that relative clauses embedded inside sentential complements are much easier to process than sentential complements embedded inside relative clauses - disconfirms the predictions of the Extended Two Sentence Theory, within which the two types of structures were expected to have identical processing complexity. The finding confirms the predictions of the Thematic Dependency Theory and the Locality Theory, both of which expect an asymmetry of this sort to emerge. However, within the Thematic Dependency Theory this contrast in complexity can be predicted only under specific, and not entirely plausible, assumptions about the syntax of Japanese relative clauses. In English, the features of relative clauses are assumed to be a superset of the features of sentential complements, because the feature triggering the Operator movement is present. In Japanese, the same assumption has to be maintained in the absence of Operator movement (and, thus, the corresponding feature) in relative clauses. The Locality Theory does not face such problems, since within it the contrast is predicted based on the fact that as soon as a relative clause is hypothesized by the parser, the head noun becomes an obligatory predicted category.

Note that there exists another type of a center-embedded structure that has not been discussed so far, for which the three theories make explicit predictions, as well: a sentence containing a relative clause inside a relative clause (see (66a)). For the Extended Two Sentence Theory the analysis of this sentence is no different than the analysis of any other sentence with four initial nominals, such as the four experimental conditions of this section, or a simple double-embedded sentence, such as (66b).

66. a. #oji-ga [[musuko-ga [[haha-ga pro hanasita] hito-ni] pro ageta] puresento-o] katta
uncle-nom [[son-nom [[mother-nom pro talked] person-dat pro gave] present-acc] bought
"My uncle bought the present which the son gave to the person to whom my mother spoke"

b.oji-ga [musuko-ga [haha-ga henna hito-ni hanasita to] omotteiru to] itta
uncle-nom [son-nom [mother-nom strange person-dat spoke that] thinks that] said
"My uncle said that the son thinks that my mother spoke to a strange person"

c.#oji-ga [musuko-ga [[haha-ga pro hanasita] hito-ni] situmonsita to syutyoosita
uncle-nom [son-nom [[mother-nom pro talked] person-dat] questioned] that insisted
"My uncle insisted that the son asked a question of the person to whom my mother spoke"

Within the Thematic Dependency Theory, this type of structure is expected to be by far the most difficult type of center-embedding. This is so because before the first verb is processed, in addition to four theta-less nominals, the structure contains two instances of self-embedding: one caused by the two predicted relative clauses and one caused by the two predicted head nouns. Thus, the partial structure contains six violations of the processing principles, and is expected to be very difficult to process, more so than the sentence in (66c), which contains a CP complement inside a relative clause. Within the Locality Theory, a contrast between sentences like (66a) and (66c) is expected as well, because in (66a) more material has to be processed before the intermediate verb is encountered and the predictions made at the subject of the intermediate clause are satisfied. Sentences like (66a) have not been tested in our study: they are expected to be more difficult than the nearly unprocessable (66c), so it is very likely that a ceiling effect would prevent any differences between these structures from showing up. While the contrast between processable and unprocessable sentences is easy to detect, the contrasts between unprocessable sentences tend to be much

more elusive. In the next section we discuss structures that recreate the same type of contrast while avoiding the ceiling effect.

The second finding - that relative clauses with indirect object gaps are easier to process than relative clauses with direct object gaps - has no obvious explanation within any of the processing theories considered here. If only the condition with a sentential complement embedded inside an object-gap relative clause (see (64d)) was found to be more difficult to process than its indirect-object counterpart, then we could attribute this difficulty to the long-distance relativization that it contains. However, since the opposite order of embedding, with an object-gap relative clause occurring inside a sentential complement (see (64c)), was also found to be more difficult to process, in spite of the fact that it does not contain long-distance relativization, we must reject this explanation.

The only other way in which the two types of relative clauses differ is the syntactic position (and case) of the gap and the head noun. Within the Extended Two Sentence Theory this factor does not play a role: at the point where either the direct object gap or the indirect object gap is encountered, no other elements in the direct object position or the indirect object position have been processed, so that the presence of the *pro* should not increase the overall complexity of the structure in both cases. Within the Locality Theory, the syntactic position of the gap does not make any difference in terms of overall complexity of the structure: no new predictions are made either at a direct object or at an indirect object, and the cost of the existing predictions increases by the same amount when a direct object or an indirect object is processed.

Explaining this contrast looks most hopeful within the Thematic Dependency Theory: within it, nominals bearing inherent case are expected to be easier to process than nominals bearing structural case. The easier type of relative clause contains a gap in the indirect object position, which is normally assigned inherent dative case, while the harder type of relative clause contains a gap in the direct object position, which is normally assigned structural accusative case, so that the contrast is exactly what we might expect to see if processing a *pro* marked with inherent dative case, did not increase the memory cost of the structure. However, this approach is not entirely plausible: recall that phonologically realized indirect objects that bear overt dative case-marking increase the complexity of a structure, just as phonologically realized direct objects do. Therefore, this theory would have to maintain that inherent case makes phonologically null, but not phonologically realized, nominals easy to process. This is a dubious claim. Thus, in Babyonyshev and Gibson (1995), it is assumed that phonologically null nominals occurring in positions that are assigned inherent case are treated as "theta-less" by the parser, just as nominals with structural case are. This assumption is based on the intuition that processing an element whose case-marking is not overt provides as little information about the theta-role of the element, as processing an element whose case-marking is structural. Thus, the complexity contrast between direct object-gap relative clauses and indirect object-gap relative clauses does not lend itself easily to an explanation within the Thematic Dependency Theory, either, and remains mysterious.

6.2 Center-Embedded Structures II: CP complements of Nouns

6.2.1. The Structures and Intuitive Data

In this section we turn to another type of center-embedding that shares some properties of relative clauses and some properties of CP complements, and allows us to re-create the contrast discussed in the previous section with simpler structures. The structures we will examine involve CP complements of nouns, illustrated in (67a).

67 a.Hanako-ga [Akira-ga rikkonsita (toiu)] uwasa-o kiita
Hanako-nom [Akira-nom got-divorced (that)] rumor-acc heard
"Hanako heard the rumor that Akira got divorced"

The embedded clause in such structures does not contain a gap and it is projecting up to a CP level, as evidenced by the possibility of using an overt Complementizer in (67a). Thus, the ticklish issue of the syntactic analysis of Japanese relative clauses does not arise here: the embedded clause is definitely a CP, and should be treated as a CP complement of a verb by the Principle of Self-Embedding within the Thematic Dependency Theory. In addition, because no gaps need to occur in this structures, the number of pre-verbal nominals can be kept low even if more than one level of embedding is considered. This will allow us to examine center-embedded structures whose overall complexity is not very high, so that no ceiling effect occurs and the predicted contrasts are not obscured.

Consider the simple doubly center-embedded structure, illustrated in (68a). Recall that this structure is judged to be processable by the majority of native speakers. Its memory cost table is given in (69), which shows that the maximal complexity of the structure (M(2) + M(2) + M(1) = 0.94 MUs) is not very high. Let us compare this with the sentence in (68b),

where the two embedded clauses occur as complements of the nouns *uwasa* - 'rumor' - and *zizitu* - 'fact'. This sentence is typically judged to be more difficult to process than (68a).

68 a. Kaunseraa-ga [wakai josee-ga [tomodati-ga kekkonsita to] omotteiru to] itta
counselor-nom [young woman-nom [friend-nom married that] thought that] said
"The counselor said that the young woman thought that the friend got married"

b.#Kaunseraa-ga [[wakai josee-ga [[tomodati-ga kekkonsita] uwasa-o] sinjitteiru]
counselor-nom [[young woman-nom [[friend-nom married] rumor-acc] believes]
zizitu-o] setumeisita
fact-acc explained
"The counselor explained the fact that the young woman believes the rumor that the friend got married"

69

Processed category; Lexical input; Number of intervening thematic elements (n);
Processed category; Memory cost (MUs)

	$[_{DP1}$ counselor-nom]	$[_{DP2}$ woman-nom]	$[_{DP3}$ friend-nom]
DP_1: V_1	--	--	--
DP_2: V_2		0; 0.08	1; 0.18
DP_2: CP_1		0 ; 0.08	1; 0.18
DP_3: V_3	0.00		0; 0.08
DP_3: CP_2			0; 0.08
Total cost		0.16	0.52
	$[_{V3}$ got married]	$[_{Comp2}$ that]	$[_{V2}$ thinks]
DP_1: V_1	--	--	--
DP_2: V_2	2; 0.38	2; 0.38	*
DP_2: CP_1	2; 0.38	2; 0.38	3; 0.62
DP_3: V_3	*		
DP_3: CP_2	1; 0.18	*	
Total cost	0.94	0.76	0.62
	$[_{Comp1}$ that]	$[_{V1}$ said]	
DP_1: V_1	--	*	
DP_2: CP_1	*		
Total cost	0.00	0.00	

This contrast in processability is expected within the Locality Theory. As can be seen from the table in (70), the maximal complexity of this sentence is M(3) + M(3) + M(3) = 1.86 MUs, which is greater than the maximal complexity of (68a), and high enough for (68b) to be unprocessable. The difference in complexity is due to two factors: first, three predictions are made at the first element of a sentential complement of a noun (the embedded verb, the embedded clause, and the head noun), but only two predictions are made at the first element of a sentential complement of a verb (the embedded verb and the embedded clause), so that more predictions have to be retained in memory as (68b) is processed. Second, because of the presence of the head nouns in the structure, the predictions made at the subject of the intermediate clause have to be retained in memory over more thematic elements in (68b), than in (68a).

70.

Processed category — Lexical input; Number of intervening thematic items (n);
Predicted category; — Memory cost (MUs)

	$[_{DP1}$ counselor-nom]	$[_{DP2}$ woman-nom]	$[_{DP3}$ friend-nom]
DP_1: V_1	--	--	--
DP_2: V_2		0; 0.08	1; 0.18
DP_2: CP_1		0 ; 0.08	1; 0.18
DP_2: DP_5		0; 0.08	1; 0.18
DP_3: V_3			0; 0.08
DP_3: CP_2			0; 0.08
DP_3: DP_4			0; 0.08
To. l cost	0.00	0.24	0.78

	[$_{V3}$ got married] [$_{Comp2}$ e]	[$_{DP4}$ rumor-acc]	[$_{V2}$ believes] [$_{Comp1}$ e]
DP_1: V_1	--	--	--
DP_2: V_2	2; 0.38	3; 0.62	*
DP_2: CP_1	2; 0.38	3; 0.62	*
DP_2: DP_5	2; 0.38	3; 0.62	4; 0.82
DP_3: V_3	*		
DP_3: CP_2	*		
DP_3: DP_4	1; 0.18	*	
Total cost	1.32	1.86	0.82
	[$_{DP5}$ fact-acc]	[$_{V1}$ explained]	
DP_1: V_1	--	*	
DP_2: DP_5	*		
Total cost	0.00	0.00	

The other processing theories deal with this contrast in a way already familiar from the preceding section. Within the Extended Two Sentence Theory, (68a) and (68b) are expected to have identical processing complexity, contrary to fact, because at their worst point both structures have three elements occupying the same type of position - Spec of IP. Within the Thematic Dependency Theory, (68b) is correctly predicted to be more difficult to process than (68a): before the first verb is encountered, both structures contain three theta-less nominals and one instance of self-embedding (caused by the predicted embedded CPs), but (68b) also contains a second instance of self-embedding (caused by the predicted head nouns). Thus, the partial structure of (68a) is associated with four violations of the processing principles and is expected to be processable, but the partial structure of (68b) contains five violations, and is expected to be unprocessable.

The expectations of the Thematic Dependency Theory and the Locality Theory diverge, once a more complete set of structures is considered. (71a) has the most deeply

embedded clause occurring as a complement of a noun, and (71b) has the intermediate clause occurring as a complement of a noun.

71 a. Kaunseraa-ga [wakai josee-ga [[tomodati-ga kekkonsita] uwasa-o]
counselor-nom [young woman-nom [[friend-nom married] rumor-acc]
sinjiteiru to] itta
believes that] said
"The counselor said that the young woman beiieves the rumor that her friend got married"

b. Kaunseraa-ga [[wakai josee-ga [tomodati-ga kekkonsita to] omotteiru]
counselor-nom [[young woman-nom [friend-nom married that] thinks]
zizitu-o] setumeisita
fact-acc] explained
"The counselor explained the fact that the young woman thinks that her friend got married"

Within the Thematic Locality Theory, the maximal complexity of (71a) is M(3) + M(3) = 1.24 MUs, as the table in (72) shows. This is greater than the maximal complexity of the "simple" doubly center-embedded sentence in (68a), which is 0.94 MUs. The difference is due to the fact that the predictions made at the subject of the intermediate clause have to be retained in memory over one additional thematic element in (71a) (the head noun), which is not present in (68a). The maximal complexity of (71a) is less than that of (68b), which is 1.86 MUs. (71a) is less complex, because at the subject of its intermediate clause only two predictions are made, compared with the three predictions made at this point in (68b). Thus, one extra prediction has to be retained in memory over the length of the most deeply embedded clause in (68b), and the memory cost is correspondingly greater.

72.

Processed category; Lexical input; Number of intervening thematic items (n);
Predicted category; Memory cost (MUs)

	[$_{DP1}$ counselor-nom]	[$_{DP2}$ woman-nom]	[$_{DP3}$ friend-nom]
DP_1: V_1	--	--	--
DP_2: V_2		0; 0.08	1; 0.18
DP_2: CP_1		0 ; 0.08	1; 0.18
DP_3: V_3			0; 0.08
DP_3: CP_2			0; 0.08
DP_3: DP_4			0; 0.08
Total cost	0.00	0.16	0.60
	[$_{V3}$ got married] [$_{Comp2}$ e]	[$_{DP4}$ rumor-acc]	[$_{V2}$ believes]
DP_1: V_1	--	--	--
DP_2: V_2	2; 0.38	3; 0.62	*
DP_2: CP_1	2; 0.38	3; 0.62	4; 0.82
DP_3: V_3	*		
DP_3: CP_2	*		
DP_3: DP_4	1; 0.18	*	
Total cost	0.94	1.24	0.82
	[$_{Comp1}$ that]	[$_{V1}$ said]	
DP_1: V_1	--	--	
DP_2: CP_1	*		
Total cost	0.00	0.00	

The sentence in (71b), where the intermediate clause occurs as a complement of a noun, is expected to be somewhat more difficult to process. As can be seen from its memory cost table, given in (73), the maximal complexity of this sentence is M(2) + M(2) + M(2) + M(1) = 1.32 MUs, which is slightly higher than the maximal complexity of (71a) (1.24 MUs). In this structure, three predictions are made at the subject of the intermediate clause, compared to the two that are made in (71a), but they have to be retained in memory over fewer intervening thematic elements, because there is no head noun associated with the most deeply embedded clause. The maximal complexity of this sentence is still less than the

maximal complexity of the (68b), where both embedded clauses occurred as complements of nouns.

73

Processed category; Lexical input; Number of intervening thematic elements (n);
Predicted category; Memory coast (MUs)

	$[_{DP1}$ counselor-nom]	$[_{DP2}$ woman-nom]	$[_{DP3}$ friend-nom]
DP_1: V_1	--	--	--
DP_2: V_2		0; 0.08	1; 0.18
DP_2: CP_1		0; 0.08	1; 0.18
DP_2: DP_4		0; 0.08	1; 0.18
DP_3: V_3			0; 0.08
DP_3: CP_2			0; 0.08
Total cost	0.00	0.24	0.70
	$[_{V3}$ got married]	$[_{Comp2}$ that]	$[_{V2}$ thinks] $[_{Comp1}$ e]
DP_1: V_1	--	--	--
DP_2: V_2	2; 0.38	2; 0.38	*
DP_2: CP_1	2; 0.38	2; 0.38	*
DP_2: DP_4	2; 0.38	2; 0.38	3, 0.62
DP_3: V_3	*		
DP_3: CP_2	1; 0.18	*	
Total cost	1.32	1.14	0.62
	$[_{DP4}$ fact-acc]	$[_{V1}$ explained]	
DP_1: V_1	--	*	
DP_2: DP_4	*		
Total cost	0.00	0.00	

Thus, within the Locality of Syntactic Dependencies Theory, the four types of center-embedded structures are ordered in terms of their processing difficulty: the sentence where both embedded clauses are complements of verbs is predicted to be the easiest, the sentence where the most deeply embedded clause is a complement of a noun should be somewhat more difficult, the sentence where the intermediate clause is a complement of a

noun should be more difficult still, and the sentence where both embedded clauses are complements of nouns should be the most difficult.[28] In terms of absolute processability, the sentence in (68b), which contains two embedded clauses acting as complements of nouns, is expected to be unprocessable, while the sentences in (71), which contain one embedded clause acting as a complement of a noun are expected to be right on the processability borderline.

The predictions of the Thematic Dependency Theory differ. The sentences in (71a) and (71b), where only one of the embedded clauses occurs as a complement of a noun, are expected to be as easy to process as the sentence in (68a), where both embedded clauses occurred as complements of verbs. At the worst point of (71a), before the first verb is processed, the partial structure contains three nominals lacking theta-roles and one instance of self-embedding, caused by the two predicted embedded clauses. Since only one predicted head noun is present in the structure, no self-embedding may be associated with it. Similarly, at the worst point of (71b), the structure contains three nouns lacking theta-roles and one instance of self-embedding, caused by the embedded clauses. Since only one predicted noun is present, it does not contribute to the complexity of the sentence.

Within the Extended Two Sentence Theory, the pair of sentences in (71) is not expected to differ in processing complexity: just as the pair of sentences in (68), these structures contain three elements occupying the Spec of IP position at their worst point. Thus, all of the sentences considered in this section are expected to be equally unprocessable.

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[28] Note that the complexity difference between the sentences in (71a,b), where only one of the embedded clauses is a complement of a noun, is very slight (.08 MUs). It is not clear that such a difference should affect intuitive judgements on processing complexity. Thus, perhaps, the theory only predicts a three-way contrast, with (68a) being the easiest, (71a,b) being somewhat more difficult, and (68b) being the most difficult.

While no experimental data on the processability of these structures are available, in our experience the intuitions of native speakers correspond most closely to the predictions of the Locality Theory. While the judgements are not clear-cut, sentences like that in (68a) are judged to be processable, sentences like that in (68b) are judged to be much more difficult, and the sentences in (71) are judged to have intermediate difficulty by the majority of speakers.

6.2.2 Discussion

In this chapter we have examined a number of structures that differ in the type of center-embedding they contain, rather than in the number of "stacked" pre-verbal nominals. Both intuitive and experimental data show that the processing complexity of such structures can be dramatically different. For instance, in the two sentences in (74), the number and type of pre-verbal nominals is the same - both structures have three subjects and an indirect object (*pro*). Yet, (74a) is much easier to process than (74b).

74. a. oji-ga [musuko-ga [[haha-ga pro hanasita] hito-ni] situmonsita to syutyoosita
uncle-nom [son-nom [[mother-nom pro talked] person-dat] questioned] that insisted
"My uncle insisted that the son asked a question of the person to whom my mother spoke"

b.#gekai-ga [[kangohu-ga pro [kanja-ga okita to] syutyoosita] masuii-ni] situmonsita
surgeon-nom [[nurse-nom pro [patient-nom woke up that] insisted] anesthesiologist-dat] questioned
"The surgeon asked a question of the anesthesiologist to whom the nurse insisted that the patient woke up"

The obvious conclusion that must be drawn from contrasts like this is that the presence of stacked nominals is not the only factor that can contribute to the complexity of a sentence:

the presence of certain types of center-embedding can increase processing difficulty as well. While this intuition may be formalized in many different ways, some version of it must be incorporated into any successful processing theory: if only the number of "unattached" or theta-less elements is considered in determining the complexity of a structure, a large number of processability contrasts cannot be accounted for.

The second conclusion to be drawn from processability contrasts discussed in the last two sections is that the complexity of a structure can be affected by elements that are hypothesized, rather than (or, perhaps, in addition to) the elements that have already been processed. Consider the pair of sentences in (75).

75 a. Kaunseraa-ga [wakai josee-ga [tomodati-ga kekkonsita to] omotteiru to] itta
counselor-nom [young woman-nom [friend-nom married that] thought that] said
"The counselor said that the young woman thought that the friend got married"
b.#Kaunseraa-ga [[wakai josee-ga [[tomodati-ga kekkonsita] uwasa-o] sinjitteiru]
counselor-nom [[young woman-nom [[friend-nom married] rumor-acc] believes]
zizitu-o] setumeisita
fact-acc explained
"The counselor explained the fact that the young woman believes the rumor that the friend got married"

Within the three processing theories we are concerned with here (as well as most others), the point of maximal complexity of (75b) occurs within the most deeply embedded clause. This is the point where the X-bar, theta-role, and case-assigning relations of the nominals that have been processed are incomplete. At this point, the categories that create the level of center-embedding that distinguishes this structure from (75a) (e.g.,. the head nouns) have not been encountered. And yet, they must be contributing towards the complexity of the structure: if they did not, the structure could not become unprocessable. A successful

processing theory must evaluate the complexity of structures based on hypothesized categories, either exclusively (as the Locality Theory does) or at least in part (as the Thematic Dependency Theory does). If a theory evaluates the complexity of a structure based only on the elements that have been processed and incorporated into the structure (as the Extended Two Sentence Theory does), it will not be able to deal with a large number of processing contrasts produced in a head-final language like Japanese.

7. Conclusions

In this work we have presented an explicit theory of processing complexity that is capable of accounting for a large number of processing contrasts in both a head-initial language like English and a head-final language like Japanese - the Locality of Syntactic Dependencies Theory of G & T. The main distinguishing property of this theory is that it assumes that the operation of working memory in the domain of language processing is governed by the same principles as its operation in other domains. In particular, the notions of interference among similar items retained in working memory and the notion of locality play a central role in this theory.

In our discussion of the contrasts exhibited by the Japanese data we have attempted to point out which of the assumptions of the processing theories we are considering were responsible for their success or failure in accounting for the contrasts. We have demonstrated that to deal with the data presented here, a theory must assume a "single memory bin", that is, it must allow elements with distinct syntactic properties to contribute towards the processing complexity of a structure. In addition, we have shown that formulating the complexity in terms of theta-role relations, case-assigning relations, or X-bar structure relations does not allow a theory to make the appropriate distinctions among structures. Finally, we have provided evidence for the necessity of allowing elements that have not yet been processed, but only hypothesized, to affect the complexity of a structure.

The Locality Theory presented here has all of these necessary properties. Moreover, they are neither stipulated nor added on, but follow naturally from the way the single

processing principle assumed within this framework is formulated. The most general point we have made in this work is that human language processing can be viewed as universal to the same degree as the Universal Grammar or the mechanisms of working memory are.

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