Left edge topics in Russian and the processing of anaphoric dependencies

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Abstract

This paper investigates the cost of processing syntactic vs. extra-syntactic dependencies. The results support the hypothesis that syntactic dependencies require less processing effort than discourse-derived dependencies do (Reuland 2001, 2011, Koornneef 2008). The point is made through the analysis of a novel paradigm in Russian in which a preposed nominal stranding a numeral can show number connectivity (PAUCAL) with a gap following the numeral or can appear in a non-agreeing (PLURAL) form:

(1) cathedral-PAUCAL/PLURAL, there were three.PAUCAL__

Numerous syntactic diagnostics confirm that when there is number connectivity, the nominal has been fronted via A'-movement, creating a syntactic A'-chain dependency. In the absence of connectivity, the construction involves a hanging topic related via discourse mechanisms to a base-generated null pronoun. The constructions constitute a minimal pair and Reuland's proposals correctly predict that the A'-movement construction will require less processing effort compared to the hanging topic construction. A self-paced reading study for contrasting pairs as in (1) showed a statistically significant slow down after the gap with the hanging topic as opposed to the moved nominal. We take this to support the claim that a syntactic A'-chain is more easily processed than an anaphoric dependency involving a null pronoun, which must be resolved by discourse-based mechanisms.

Keywords: Russian, hanging topic, A'-movement, scrambling, number agreement, anaphoric dependency, processing

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1 Introduction

Natural languages encode anaphoric dependencies in a number of ways. Safir 2004, 2008 introduces the term COCONSTRUAL as a theory-neutral label for any identity relation between two elements, pronounced or not. Coconstruals include antecedent-anaphor relations, filler-gap dependencies, control relations, variable binding, and independent coreference, among others, as illustrated in (1).

(1) a. *Mike* hurt *himself*.

b. *What* will college cost ~~*what*~~ in 2020?

c. *Sandy* tried *PRO* to water ski.

d. *No waitress* should ignore *her* customers.

e. *A man* walked in. *He* smiled.

Coconstruals can be encoded in syntax, in semantics, or discourse. NARROW SYNTAX (NS) is the core of the syntactic computational system. Within Chomsky's Minimalist Program (Chomsky 1995, 2000, 2001), narrow syntax, also called the computational system of human language or C_{HL} (Chomsky 1995), is invariant across languages and builds syntactic representations. The mechanisms involved in structure building include

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The following glossing abbreviations are used: COLL-collective, PART-partitive, PAUC-paucal. Other abbreviations follow the Leipzig Glossing Rules.

Agree, Merge, and Move. Coconstruals formed in the narrow syntax include at least movement relations (Safir 2008) and co-argument reflexives (Reuland 2011).

Reuland 2011:30-34, following Reinhart 2006, uses the term LOGICAL SYNTAX to refer to the output of narrow syntax augmented with vocabulary required for the structure to be read by the semantic inference system, Chomsky's (1995) Conceptual-Intentional (C-I) interface. It corresponds to logical form in Principles & Parameters frameworks—the syntactic representation enriched by further vocabulary to fully represent logical structure.[1] A prominent element of logical syntax is the representation of bound variable relations, or logical syntax binding (Reuland 2011:31). In logical syntax, pronouns are translated as variables that become operator-bound. Safir 2008 argues that bound variable anaphora is not represented in narrow syntax representations but is done by interpretive mechanisms at the C-I interface. For simplicity, we will call logical syntax coconstruals semantic dependencies, to distinguish them from (narrow) syntactic and discourse construals, but they will not play a significant role here.

The DISCOURSE component of the grammar situates the logical syntax in the larger context that includes world knowledge, speaker intent, and the full linguistic context. Discourse is where reference relations are established and thus it determines coconstruals that are not part of the grammar, such as coreference relations across sentences.[2]

Reuland 2011:125, building on Reinhart 1983, 2006, Grodzinsky and Reinhart 1993, and others, proposes the following hierarchy in the economy of the encoding of coconstruals:

(2) Narrow Syntax < logical syntax (C-I interface) < discourse

[1] Logical form is different from Logical Form (LF) (Chomsky 1976, May 1985), a narrow syntax level of representation that results from application of covert movement.
[2] Evans 1980 specifically argues that co-reference is not part of the grammar (i.e. narrow syntax).

According to Reuland 2011 and Koornneef 2008, coconstruals formed in components farther to the left on the hierarchy in (2) are favored because they are, in some sense, less costly than those towards the right. For example, narrow syntax coconstruals such as movement relations are favored over discourse-formed coconstruals such as coreference. The economy behind the hierarchy in (2) translates into processing preferences; the processing of construals farther to the left should be easier than those to the right. Koornneef 2008:46 formulates the following hypotheses from Reuland's system:

(3) a. The construction of syntactic coconstruals requires less effort than the construction of semantic coconstruals.
b. The construction of semantic coconstruals requires less effort than the construction of discourse coconstruals.
c. The construction of syntactic coconstruals requires less effort than the construction of discourse coconstruals.

One challenge in testing these claims is to find coconstruals of the different types that nonetheless represent minimal pairs. The goal is to avoid differences in the constructions that might influence the time course of processing, independent of the coconstrual type of interest so that any processing differences can be attributed to the form of the coconstrual and not some irrelevant, interfering factor.

For example, Koornneef investigates the processing of English VP ellipsis examples as in (4) to test (3b). Such examples are ambiguous between sloppy and strict readings, in (5a) and (6a), respectively.

(4) The acrobat likes his jokes and the clown does too.

(5) a. The acrobat$_i$ likes his$_i$ jokes and the clown$_k$ likes his$_k$ jokes too.

b. The acrobat (λx (x likes x's jokes)) & the clown (λx (x likes x's jokes))

(6) a. The acrobat$_i$ likes his$_i$ jokes and the clown$_k$ likes the acrobat$_i$'s jokes too.

b. The acrobat (λx (x likes a's jokes)) & the clown (λx (x likes a's jokes))

a = the acrobat

The sloppy reading, in which the acrobat likes his own jokes and the clown likes his own jokes, represents a semantic coconstrual of the pronoun *his* with respect to its antecedent, *the acrobat*. There is a bound variable dependency informally represented as in (5b). Such a representation is required to obtain the appropriate interpretation of the missing pronoun in the second clause, which is interpreted with a different referent than in the first clause. The strict reading is the interpretation in which the acrobat likes his own jokes and the clown likes them too. It represents a simple coreference, a discourse coconstrual. In this representation, the pronoun picks up as its antecedent *the acrobat* and this referent is carried over into the unpronounced VP, as in (6b). Such examples are optimal to investigate from a processing perspective because the meanings and coconstrual types are distinct but the surface forms are identical. Thus, any processing differences can be attributed to the form of the coconstrual. Koorneef 2008 discusses various studies, including his own, showing that speakers prefer the sloppy (bound variable) reading and process it more quickly compared to the strict reading (Shapiro and Hestvik 1995, Frazier and Clifton 2000, Shapiro et al. 2003, Vasić 2006). This supports the claim in (3b) that the construction of semantic coconstruals requires less effort than the construction of discourse coconstruals.

Other studies testing the prediction in (3c) have looked at the processing of reflexives (Burkhardt 2005, Piñango and Burkhardt 2005, Schumacher et al. 2010). As

these studies discuss, languages like English and Dutch allow more than one coconstrual type for anaphors. The interpretive mechanism for reflexives varies between a syntactic coconstrual when they are in argument position, (7a), versus a non-syntactic (semantic or discourse) coconstrual when in non-argument positions, (7b,c).[3] The relevant point is that there are multiple ways in which a reflexive can find its antecedent: syntactically in (7a) versus extra-syntactically in (7b,c).

(7) a. The cellist defended *herself*.
b. The ballerina put a towel next to *herself*.
c. Max boasted that the queen invited Lucie and *himself* to tea.

These works confirm the prediction in (3c), showing that examples such as (7b,c) incur increased processing cost compared to the cost of computing the syntactic coconstrual as in (7a).

The experimental goal of this paper is to test predictions (3a,c) in a novel way. The hypotheses in (3a,c) perhaps counter-intuitively predict that constructions involving movement will be easier to process than similar constructions with no movement. We introduce two syntactic constructions in Russian that will bear on this issue; they appear minimally different on the surface but involve distinct structural histories.

The contrast is illustrated in (8). A nominal is fronted, stranding a modifying numeral. The nominal can appear in a form that agrees in number with the numeral, (8a), or it can appear in a non-agreeing plural form, (8b). We will show that the construction in (8a) involves A'-movement of the fronted element, and thus instantiates a syntactic coconstrual between the nominal and the empty category indicated as a struck-through

[3] The latter use has been variously called an exempt anaphor (Pollard and Sag 1994), a logophor (Reinhart and Reuland 1993), or a d(iscourse)-linked anaphor (Schumacher et al. 2010).

copy. In contrast, (8b) involves coreference between the fronted element and a base-generated empty category, which we propose is a null pronoun, and hence is a discourse coconstrual.

(8) a. Sobor-a v gorodke bylo tri ~~sobor-a~~
cathedral-**PAUCAL** in town was three.PAUCAL
b. Sobor-ov v gorodke bylo tri *pro*
cathedral-**GEN.PL** in town was three.PAUCAL
'As for cathedrals, there were three in that town.'

These constructions are ideal for investigating the processing predictions informed by the hierarchy in (2). They are minimally different from each other, maintaining parity in linear and structural distance between the antecedent and the gap, the grammatical role of the antecedent, and the lexical items involved. Only the morphology on the fronted element distinguishes them. Thus, any processing differences at the numeral can reasonably be associated with the coconstrual mechanism involved.

The results of a self-paced reading experiment confirm the processing predictions. The reading time profile for the two constructions is the same until some time shortly after the numeral. At this point, there is a statistically significant increase in reading time in the hanging topic construction as opposed to the movement construction. We take this to be an indicator of the effort required to retrieve a discourse referent for the null pronoun and to support Reuland's overall approach.

The remainder of the paper is organized as follows. Section 2 provides background information on Russian numerical expressions and analyzes the contrast above as a difference between movement and base generation. This contrast has not been analyzed before, so the section contributes to our understanding of Russian syntax.

Section 3 provides evidence for the syntactic analyses. Section 4 discusses the study investigating the processing of the Russian constructions. This study provides experimental evidence in support of increased processing cost for discourse coconstruals over syntactic coconstruals, showing that (8a) is processed more quickly than (8b); thus movement relations are less costly than coreference relations. Section 5 presents our conclusions.

2 Russian Topic Constructions

2.1 Left dislocation

LEFT DISLOCATIONS (LDs) are constructions in which a phrase appears at the left edge of a clause, dislocated from its expected position, and it is related to some clause-internal anaphoric element. English examples are in (9a,b), with the left dislocated phrase italicized and the anaphoric element, if pronounced, bold-faced.

(9) a. *Carambolas*, I don't like __.

b. *Carambolas*, I don't like **them**.

There is much work on LD in the generative literature (see, for example, the collection of papers in Anagnostopoulou et al. 1997, Alexiadou 2006, and references therein) and there is clear consensus that LD constructions are not a unitary phenomenon syntactically or semantically. This is the case both across languages and within a single language. Although our primary concern here is LD in Russian, it will be helpful to survey the LD constructions in some better analyzed languages to understand the space of options. Cross-linguistically, there are two relevant parameters of morphosyntactic variation: i)

the form of the clause-internal anaphoric element and ii) the analysis of the construction as movement or base generation.

Regarding the first, the form of the anaphor varies between a zero, some kind of pronominal element, and an epithet. (10a) illustrates English Topicalization, in which the anaphor is a null element. (10b) illustrates Clitic Left Dislocation (CLLD) in Romance, in which the anaphoric element is a preverbal pronominal clitic. CLLD has been very widely discussed and analyzed (Cinque 1977, 1990, 1997[1983], Anagnostopoulou 1994, 1997, Escobar 1997, Rizzi 1997, Cecchetto 2000, Benincà and Poletto 2004, Lopez 2009, Aoun et al. 2010, and numerous other works). (10c) illustrates Germanic Contrastive Left Dislocation (CLD), in which the anaphoric element is a (displaced) demonstrative pronoun (see Ross 1967, van Riemsdijk and Zwarts 1997[1974], Vat 1997[1981], Zaenen 1997, Wiltschko 1997, and others). In (10d), the anaphoric element is a full pronoun. The construction illustrated is called Hanging Topic Left Dislocation (HTLD),[4] see Cinque 1977, Thrainsson 1979, van Riemsdijk and Zwarts 1997[1974], Vat. 1997[1981]. Finally, (10e) illustrates the use of an epithet as the anaphoric element, an option selectively allowed by some languages, such as French, Lebanese Arabic, and Spanish (Alexiadou 2006).

(10) a. *Carambolas*, I don't like __.

b. *A Gianni*, Maria **gli** ha parlato recentemente
to John Maria 3SG.DAT has speak.PTCP recently
'To John, Maria spoke to him recently.' (Italian, Rizzi 1997:294)

[4] The term Hanging Topic Left Dislocation was originally proposed by Alexander Grosu (Cinque 1977:406).

c. *Die man*, **die** ken ik niet
that man DEM know I not
'That man, I don't know.' (Dutch, Vat 1997:70)

d. *Carambolas*, I don't like **them**.

e. *Paul*, Pierre vient de se battre avec **cet idiot**
Paul Pierre come C REFL fight with this idiot
'Paul, Peter has just fought with that idiot.' (French, Hirschbühler 1997:56)

The second parameter of variation concerns the actual analysis of the construction. LD can be split into movement analyses, in which some element has been dislocated from a clause-internal position, and base-generation analyses, in which the left dislocated element is base-generated and no movement is involved. In the latter, the left dislocated element is linked to its clause-internal position via interpretive mechanisms. HTLD is typically analyzed as base generation (see, for example, Hirschbühler 1997[1974] and de Cat 2007 on French) while CLLD/CLD receive movement analyses.

The distinction between HTLD and movement has been widely explored in Romance and Germanic languages (see Grewendorf 2008 for a comparison of Romance and Germanic). The distinction has also been explored in Mayan (Aissen 1992 and subsequent work on individual languages which builds on this paper). Surprisingly, there has been very little work on LD in Slavic. Sturgeon 2008 discusses the situation in Czech, noting a contrast between HTLD and scrambling with respect to syntax, semantics, and prosody. It is hard to find any other discussion of the contrast in Slavic.

This paper begins to fill that gap by exploring the contrast between base-generated and moved LD elements in Russian. Russian shows a difference between HTLD and movement, which replicates the phenomena seen in better-studied languages.

Unlike other languages, Russian does not use clitics, so the overt expression of the contrast between base-generated and moved LD can be absolutely minimal.

The following subsections start with an overview of relevant aspects of Russian grammar and the constructions under investigation. We then turn to the syntax of these constructions and demonstrate that Russian has both types of LD elements, although the difference is sometimes obscured by morphology.

2.2 Russian numerical expressions

The form of a Russian noun co-occurring with a numeral differs depending on the numeral. When a noun co-occurs with LOWER NUMERALS—1.5, 2-4, and the expression 'both'—it obligatorily takes a special form which is different from the form co-occurring with HIGHER NUMERALS—5 and up. The nominal form co-occurring with lower numerals has received several analyses (see Xiang et al. 2011 for an overview) but, for our purposes, it is sufficient to identify it as PAUC(AL). With numerals 5 and up, Russian requires nouns in GEN(ITIVE) PL(URAL). The difference is morphologically visible when the modified expression appears in the nominative (and in the accusative for inanimates, which is homophonous with the nominative). It is obscured in all other instances. The distinct morphology is shown in (11) for the numerals 'three' versus 'five'. 'Three' requires paucal morphology on the noun while 'five' requires genitive plural morphology. [5]

[5] In this example and next, we show the morphological division of the nouns in question. However, since Russian genitive plural and paucal forms vary by declensional class, in the examples below we will typically only indicate the status of a form in the glosses without showing any morpheme boundaries.

(11) a. V gorodke bylo tri sobor-a/*ov
in town was **three**.NOM cathedral-**PAUC**/GEN.PL
'There were three cathedrals in that town.'

b. V gorodke bylo pjat' sobor-ov/*a
in town was **five**.NOM cathedral-**GEN.PL**/PAUC
'There were five cathedrals in that town.'

The numeral and the nominal can be separated, for instance, the nominal can front stranding the numeral. The fronting has the effect of creating a topic, which we will often translate using English 'as for'. When the stranded numeral is a higher numeral, the left dislocated noun must be in the genitive plural form:

(12) a. Sobor-ov v gorodke bylo pjat'
cathedral-**GEN.PL** in town was five
'As for cathedrals, there were five in that town.'

b. *Sobor-a v gorodke bylo pjat'
cathedral-**PAUC** in town was five
('As for cathedrals, there were five in that town.')

When the stranded numeral is a lower numeral, however, both the expected paucal and genitive plural are possible:[6]

[6] To our knowledge, Isaac Kozinsky (1945-1992) was one of the first people to identify this contrast, in the 1980s. He never published anything on it but he brought it up a number of times in his presentations.

The construction with the fronted genitive plural nominal is discussed in Crockett 1976:Ch. 5, Pesetsky 1982:233-236 (who refers to this construction as Crockett-sentences), House 1982, Franks 1995:186-192, Partee and Borschev 2006, and Choo 2007.

(13) a. Sobor-a v gorodke bylo tri
cathedral-**PAUC** in town was three
b. Sobor-ov v gorodke bylo tri
cathedral-**GEN.PL** in town was three
'As for cathedrals, there were three in that town.'

The generalization is the following:

(14) A left dislocated nominal that strands a numeral can show number connectivity—the number that would be appropriate were it not left dislocated—or it can appear in the (genitive) plural form.

The behavior of 'one' conforms to this pattern. A noun modified by the numeral 'one' appears in the singular, (15a). When the noun is left dislocated, it can remain in the singular form or appear in the genitive plural form, (16a,b). It may not be in the paucal form, (16c).

(15) a. Maša kupila odin kalendar'
Masha bought one.ACC calendar.SG.ACC
'Masha bought one calendar.'

(16) a. Kalendar' Maša kupila odin
calendar.ACC.SG Masha bought one.ACC
'As for calendars, Masha bought one.'
b. Kalendarej Maša kupila odin
calendar.GEN.PL Masha bought one.ACC
'As for calendars, Masha bought one.'

c. *Kalendarja Maša kupila odin
calendar.PAUC Masha bought one.ACC

Analytically, the presence of number connectivity with paucal in the above data points towards a movement analysis while the absence of connectivity with genitive plural suggests a base-generated HTLD analysis. In what follows we will provide evidence for the following:

(17) a. For lower numerals, the left dislocated nominal has undergone movement when there is number connectivity (paucal) and it is HTLD when there is no connectivity (genitive plural)
b. For higher numerals, the left dislocation construction is structurally ambiguous between movement and HTLD

To make these proposals concrete, we assume a structure for numeral-modified nominals in Russian as in (18) (Bošković 2006). The numeral is a QP in the specifier of a functional projection FP that dominates NP. One might identify FP as NumP.

(18) $[_{FP}$ QP $[_{F'}$ F NP]]

Under the movement analysis, the NP complement to the functional head F° moves to a clause-initial position. We take this to be an instance of the widely discussed Russian scrambling (King 1995, Bailyn 1995, 2001, 2003, 2007, 2012, Sekerina 1997, and others) and an instance of A' movement. We assume that scrambled elements adjoin to any maximal projection. To generate a left-peripheral element, scrambling of NP can target CP or TP. In the case of a base-generated hanging topic, we propose that the topic phrase

can adjoin only to CP (Alexiadou 2006) and the complement of F° position is occupied by a null pronominal, *pro*: [$_{FP}$ QP [$_{F'}$ F *pro*]].[7]

In terms of the earlier discussion, the relationship between the scrambled paucal phrase and its trace is subject to syntactic coconstrual. The relationship between the hanging topic phrase and *pro* belongs to discourse coconstrual. The interpretation of *pro* is not determined until the discourse component, where pronouns receive their referents. At this point, *pro* takes as its antecedent a salient entity, the hanging topic. The alternative would be that the hanging topic construction represents a variable binding configuration and thus instantiates a semantic coconstrual, but we believe that this is not

[7] Both constructions—with the fronted nominal showing number agreement or genitive plural—function as topic marking constructions, either a plain topic or contrastive topic. The latter is underscored by the use of the overt contrastive particle *to*:

(i) dači/dač-to u nix tri,
country.house.PAUC/country.house.GEN.PL-CONTRAST by them three
a kvartir ni odnoj
but apartment.GEN.PL not one.GEN
'While they have three country houses they don't have a single apartment.'

The degree of contrastiveness, however, seems different. In her insightful comparison of hanging and scrambled topics in Czech, Sturgeon (2008) shows that the two are associated with different intonation contours. The scrambled type is characterized by a significantly greater rise than the hanging type. In further comparing hanging and scrambling topics, Sturgeon writes: "I conclude that the [hanging topic] construction is a topic promotion device. Hanging topics have been evoked (either overtly or as members of a previously evoked set) in the preceding discourse, but are, as yet, non-topical. Appearing in the left edge hanging topic position promotes them to sentence topic status. Their status as sentence topic is confirmed by the fact that they perseverate in the following discourse. [Scrambled] elements, on the other hand, exhibit a contrastive topic discourse function. The discourse referents of [scrambled] elements do not perseverate in the discourse, but, are, instead, contrasted with other members of a set of alternatives with respect to an open proposition." (Sturgeon 2008:146). In order to verify these observations for Russian, one would need to conduct an extensive corpus study, something that is beyond the scope of this paper.

the case for two reasons.[8] First, *pro* following a numeral need not have a binder. The antecedent may be in another sentence in the discourse, (19). *Pro* here cannot be a bound variable.

(19) a. A: U vas est' žurnaly?
by you is magazine.NOM.PL
B: Da, četyre/odin/devjat' *pro*
yes four/one/nine
'A: Do you have magazines? B: Yes, four/one/nine.'

b. A: Ja obyčno kladu desjat' ogurcov
1SG usually put ten cucumber.GEN.PL
B: A ja vsego dva/šest'/odin *pro*
and 1SG only two/six/one
'A: I usually use ten cucumbers (for this recipe).
B: And I only use two/six/one.'

Second, the genitive plural hanging topic need not have a bindee. It can be what van Riemskijk 1997:4 calls a LOOSE ABOUTNESS LEFT DISLOCATION. Although such examples seem somewhat difficult to construct, they are possible. Some examples in (20) are based on Choo et al. 2007; see also Crockett 1976: 318-335; Franks 1995: 187.

[8] Wiltschko 1997:331 also claims for Dutch HTLD that it is not a variable binding construction.

(20) a. Podrug v to vremja u menja ostalos’
girlfriend.GEN.PL in that time by me remained
vsego liš’ odna Tanja
only one.NOM.FEM Tanya
‘Of girlfriends at that time I was just friends with Tanya alone.’

b. Vremeni prošlo dve nedeli
time.GEN.SG passed two weeks.PAUC
‘The amount of time that passed was two weeks.’

c. Narodu bylo devjat’ čelovek
people.COLL.PART was nine person.GEN.PL
‘The number of people was nine persons.’

d. Živnosti u nix dve zolotye rybki
animals.COLL.GEN by them two gold fish.PAUC
‘Of pets, they have two goldfish.’

To summarize, our analyses can be represented as follows:

(21) *lower numerals*

a. *left dislocation with number connectivity: movement*
Sobor-a v gorodke bylo tri ~~sobor-a~~
cathedral-PAUC in town was three

b. *left dislocation without number connectivity: HTLD*

Sobor-ov$_i$	v	gorodke	bylo	tri	*pro*$_i$
cathedral-GEN.PL	in	town	was	three	

'As for cathedrals, there were three in that town.'[9]

(22) *higher numerals: structural ambiguity*

a. *movement*

Sobor-ov	v	gorodke	bylo	pjat'	~~sobor-ov~~
cathedral-GEN.PL	in	town	was	five	

b. *HTLD*

Sobor-ov$_i$	v	gorodke	bylo	pjat'	*pro*$_i$
cathedral-GEN.PL	in	town	was	five	

'As for cathedrals, there were five of them in that town.'

In what follows, we will explore the proposal in (17) as it relates to lower numerals—the contrast in (21)—because number morphology on the dislocated element unambiguously identifies the construction involved.[10]

[9] The acceptability of these two patterns is different: While HTLD as in (21b) is always acceptable, the acceptability of the movement variant in (21a) varies with the lexical items. For instance, masculine nouns seem preferable to feminine nouns. This variability certainly warrants further investigation but is beyond the scope of this paper. The examples used below are limited to those that were accepted by all or most of our consultants.

[10] We will not be discussing the structurally ambiguous cases such as (22); however, the predictions are clear: if a structure is well-formed under either the hanging topic or movement analysis, then such sentences with higher numerals should be grammatical.

3 Syntactic evidence

The evidence in favor of the proposal in (17) comes from a wide range of phenomena. The arguments form two sets. One set is based on diagnostics of movement (section 3.1). These phenomena, which include island effects, reconstruction, and parasitic gaps, confirm that the left dislocated paucal construction involves A' movement while the genitive plural one does not. The second set of arguments in section 3.2 appeals to characteristics of HTLD to conversely show that the genitive plural construction is HTLD, while the paucal construction is not.

3.1 Movement diagnostics

3.1.1 Island sensitivity

Island (in)sensitivity is a classic diagnostic for movement (Ross 1967) and it is widely used in the LD literature to help decide between movement and HTLD. HTLD is generally insensitive to islands, being a base-generated structure.[11] The expectation for Russian is that paucal LD elements should not be able to relate to gaps inside islands but the corresponding genitive plural forms should be able to do so. The data confirm this prediction. (23) and (24) illustrate weak factive islands and wh-islands, respectively. (25) illustrates a strong complex noun phrase island.[12]

[11] The diagnostic occasionally yields conflicting results. For example, Cinque 1990 claims that Italian CLLD, a movement construction, is sensitive only to strong islands, and not weak ones (see Szabolcsi 2006 for discussion of the difference). However, Lopez 2009 shows that this conclusion is mistaken and CLLD elements can actually be shown to be sensitive to all kinds of islands, as long as the right contextual conditions are met.

[12] A number of examples presented here and further below are judged "colloquial", and some would be unacceptable from the prescriptivist standpoint.

(23) a. Udivitel'no, čto oni našli vsego dva slučaja
surprising that they found only two case.PAUC
'It is surprising that they found only two instances.'

b. *Slučaja udivitel'no, čto oni našli vsego dva
case.PAUC surprising that they found only two

c. Slučaev udivitel'no, čto oni našli vsego dva
case.GEN.PL surprising that they found only two
'Of instances, it is surprising that they found only two.'

(24) a. Maša sprosila gde my našli tri čemodana
Masha asked where we found three suitcase.PAUC
'Masha asked where we found three suitcases.'

b. *čemodana Maša sprosila gde my našli tri
suitcase.PAUC Masha asked where we found three

c. čemodanov Maša sprosila gde my našli tri
suitcase.GEN.PL Masha asked where we found three
'Masha asked where we found three suitcases.'

(25) a. Ty pomniš' [vremja [kogda u nee bylo tri ženixa]]?
2SG remember time when by her was three suitor.PAUC
'Do you remember the time when she had three suitors?'

b. *ženixa ja pomnju vremja kogda u nee bylo tri
suitor.PAUC 1SG remember time when by her was three

c. ženixov ja pomnju vremja kogda u nee bylo tri
suitor.GEN.PL 1SG remember time when by her was three
'Speaking of suitors, I remember the time when she had three.'

3.1.2 Coordinate Structure Constraint and Across-the-board movement

Although coordinate structures are often categorized as strong islands, the unique behavior of extraction from coordinate structures allows us to formulate a slightly more nuanced argument for our analyses. Ross (1967) first formulated the Coordinate Structure Constraint (CSC) in (26) which prohibits movement from coordinating conjuncts but he observed that violations of clause (ii) of the CSC could be voided if the same element was extracted from both conjuncts—so called across-the-board (ATB) movement (Williams 1978, Bošković and Franks 2000).

(26) *Coordinate Structure Constraint* (Ross 1967)
In a coordinate structure, (i) no conjunct may be moved, (ii) nor may any element contained in a conjunct be moved out of the conjunct.

With respect to the Russian LD construction, if the number of the fronted element is appropriate for both conjunct positions, the result is grammatical:

(27) a. Derev'jev Maša posadila tri, a Petja dva
tree.GEN.PL Masha planted three and Petya two
b. Dereva Maša posadila tri, a Petja dva
tree.PAUC Masha planted three and Petya two
'As for trees, Masha planted three and Petya, two.'

Under our analysis, (27a) is base-generated as show in (28a). The hanging topic is coreferential with *pro* in each of the conjuncts. (27b) is derived by ATB movement with the derivation in (28b).

(28) a. Derev'jev [[Maša posadila tri *pro*], a [Petja dva *pro*]]
tree.GEN.PL Masha planted three and Petya two

b. Dereva [[Maša posadila tri ~~dereva~~] a [Petja dva ~~dereva~~]]
tree.PAUC Masha planted three and Petya two
'As for trees, Masha planted three and Petya, two.'

When the numerals in the two conjuncts differ, however, our analyses correctly lead us to expect a difference in grammaticality. Genitive plural should still be acceptable because both *pro*s are bound by the hanging topic, (29a). Paucal is unacceptable, (29b), because movement out of one conjunct only violates the Coordinate Structure Constraint, as shown in (30).

(29) a. Derev'jev Maša posadila tri *pro*, a Petja pjat' *pro*
tree.GEN.PL Masha planted three and Petya five
'As for trees, Masha planted three and Petya five.'

b. *Dereva Maša posadila tri, a Petja pjat'
tree.PAUC Masha planted three and Petya five
('As for trees, Masha planted three and Petya, five.')

(30) *Dereva [[Maša posadila tri ~~dereva~~], a [Petja pjat' *pro*]]
tree.PAUC Masha planted three and Petya five
('As for trees, Masha planted three and Petya, five.')

A relevant restriction on ATB movement is that, despite certain exceptions (Kasai 2004), gaps created by ATB movement should normally occupy syntactically parallel positions (Franks 1993). This prediction holds for the gaps created by movement of the paucal nominal. In (31a), both gaps are in the object position and the result is acceptable.

In (31b), the first gap is in the object position and the second is in the subject position and the resulting sentence is ungrammatical.

(31) a. Romana on tri ~~romana~~ uže izdal
novel.PAUC he three already published
a dva ~~romana~~ ešče dopisyvaet
but two still is_writing_up
'He has already published three novels and is still working on another two.'

b. */??Romana on tri ~~romana~~ uže izdal
novel.PAUC he three already published
a dva ~~romana~~ nikak ne dajutsja
but two in no way not happen
('He has already published three novels but two more are causing a block.')

In contrast, hanging topics can strand numerals even if they are not in syntactically parallel positions:

(32) Romanov on tri uže izdal a dva nikak ne dajutsja
novel.GEN.PL he three already published but two in no way not happen
'He has already published three novels but two more are causing a block.'

The behavior of coordinate structures thus yields the expected differences between movement and base generation.

3.1.3 Number connectivity

Reconstruction, or connectivity, is another standard hallmark of movement. The term refers to phenomena in which a moved element behaves as though it were in its unmoved

(reconstructed) position for various morphological, syntactic, semantic, and thematic purposes. The appearance of paucal morphology on a LD element, which we used as motivation for proposing a movement analysis, is an instance of number connectivity. The appearance of paucal morphology is determined by the position of nominal before movement. Similarly, the lack of connectivity for number in HTLD argues against movement in that construction; genitive plural morphology is not licensed on the nominal in it post-numeral position, suggesting that the dislocated element did not originate there.

A particularly clear case supporting our contention that the paucal marking on left dislocated elements arises from reconstruction comes from *pluralia tantum*. These are nouns, such as *nožnicy* 'scissors', *sani* 'sled', or *brjuki* 'pants' that have no morphologically singular form and only occur in the plural, (33a). In Russian, they are incompatible with paucal morphology as well, (33b).[13]

(33) a. Na stole ležali odni/*odna nožnicy/*nožnica
on table lay one.PL/one.SG scissor.PL/scissor.SG
'A pair of scissors was on the table.'

b. *Na stole ležalo tri nožnicy
on table lay three scissors.PAUC

Given this morphological restriction, we correctly expect that a left dislocated paucal element will be impossible with such nouns, because the paucal number arises from reconstruction on our analysis. (34a) is ungrammatical precisely because (33b) is. (34b) is acceptable and is structurally ambiguous between a movement and a HTLD analysis.

[13] The situation can be rectified by using a measure noun *para* 'pair' or a collective numeral (*troe*) but that is irrelevant to our point. However, the preference for the collective numeral may be the reason why (34b) below is degraded.

(34) a. *Nožnicy na stole ležalo tri
scissors.PAUC on table lay three
b. ?Nožnic na stole ležalo tri
scissors.GEN.PL on table lay three
'As for scissors, there were three on the table.'

3.1.4 Binding Theory reconstruction

Binding Theory reconstruction also supports our analyses. Principle C of the Binding Theory (Chomsky 1981) requires that R-expressions such as names be free. Russian obeys Principle C. Only the non-coreferential interpretation is allowed in (35b).

(35) a. Maša_i stesnjaetsja kogda ee_i xvaljat
Masha is.embarrassed when she.ACC praise.3PL
'Masha_i feels embarrassed when $\text{she}_{i,k}$ gets praised.'
b. $\text{Ona}_{k,*i}$ stesnjaetsja kogda Mašu_i xvaljat
she is.embarrassed when Masha.ACC praise.3PL
'$\text{She}_{k,*i}$ is embarrassed when Masha_i gets praised.'

Now compare the following facts involving LD:

(36) a. $\text{Ona}_{k,*i}$ nasčitala tri [raza kogda Mašu_i xvalili]
she counted three time.PAUC when Masha.ACC praised.PL
'$\text{She}_{k,*i}$ found three times when Masha_i got praised.'
b. [Raza kogda Mašu_i xvalili] $\text{ona}_{k,*i}$ nasčitala tri
time.PAUC when Masha.ACC praised she counted three
'$\text{She}_{k,*i}$ found three times when Masha_i got praised.'

c. [Raz kogda Mašu$_i$ xvalili] ona$_{k,i}$ nasčitala tri
time.GEN.PL when Masha.ACC praised she counted three
'As for times when Masha$_i$ got praised, she$_{k,i}$ counted three.'

(36a) confirms a Principle C violation triggered by the pronominal subject c-commanding a name in the number-modified nominal in brackets. In (36b), the paucal nominal is fronted and coreference is still impossible. This can be accounted for because the pronominal subject c-commands the R-expression under reconstruction, again yielding a Condition C violation. In (36c), however, coreference between the name and the pronoun is possible with the genitive plural HTLD element. This is permitted because neither the pronoun nor the name c-commands the other and, in addition, there is no reconstruction to restrict the interpretation, because HTLD does not involve movement.[14]

3.1.5 Weak Crossover (WCO)

Weak Crossover prohibits a moving element from crossing over a non-c-commanding pronoun which it is coindexed with:

(37) ??Mike$_i$, I told his$_i$ mother that the police caught ~~Mike~~ smoking pot.

We can explore weak crossover in the Russian LD constructions by including another number higher in the clause. This is shown schematically in (38).

(38) NP$_i$ [... [# *ec*$_i$] ... [# *ec*$_i$]]

[14] In theory, Principle A could also be used as a diagnostic. Russian reflexive binding is subject to not-well-understood constraints, however, and judgments change significantly under scrambling (see Bailyn 2007 and references therein). Thus, we avoid it.

There are two possibilities for the identification of the empty categories in (38), *pro* or trace/copy. If both empty categories are *pro*, then we have HTLD and the result is expected to be grammatical with a genitive plural topic. There is no movement, and the hanging topic is simply coreferential with both *pro*s:

(39) NP.GEN.PL$_i$ [... [# *pro*$_i$] ... [# *pro*$_i$]]

The data confirm this prediction:

(40) %Muzejev oni proinformirovali vse pjat' *pro*
museum.GEN.PL they informed all five
čto delegacija posetit vsego dva *pro*
that delegation will.visit only two
'As for museums, they informed all five that the delegation will visit only two.'

If the left dislocated element is paucal, the representation is as follows:

(41) NP.PAUC$_i$ [... [# *pro*$_i$] ... [# ~~NP.PAUC~~$_i$]]

We correctly expect that the result will be ungrammatical because (41) is a weak crossover violation. The moved NP crosses over *pro* that it is coindexed with.

(42) *Muzeja oni proinformirovali vse pjat'
museum.PAUC they informed all five
čto delegacija posetit vsego dva
that delegation will.visit only two
('As for museums, they informed all five that the delegation will visit only two.')

3.1.6 Parasitic gaps

Parasitic gaps are another standard diagnostic of movement (Engdahl 1983, Culicover 2001). Several researchers suggest that Russian has parasitic gaps (Franks 1992, Culicover 2001, Ivlieva 2007), although their appearance is more limited than in English. For example, Russian parasitic gaps are constrained by the surface identity of case forms such that both extracted elements must be phonologically identical (for instance, the accusative and the genitive can form a chain if they are homophonous; see Franks 1992, 1993, 1995). An example follows:

(43) a. Kritik otpravil etot roman$_i$ v izdatel'stvo
critic sent this novel in publishing_house
do togo kak on ego pročital
before he it read
'The critic sent the novel to the publisher before he read it.'

b. Kakoj roman kritik otpravil ~~kakoj roman~~ v izdatel'stvo
what novel critic sent in publishing_house
do togo kak pročital *pg*?
before read
'Which novel did the critic send to the publisher before reading?'

Our analysis leads to the expectation that only paucal left dislocated elements will license a parasitic gap. The data confirm this prediction:

(44) a. Kostjuma on otložil srazu tri ~~kostjuma~~ daže ne merjaja *pg/*?ix
suit.PAUC he set.aside at.once three even not try.on.GERUND
b. Kostjumov on otložil srazu tri *pro* daže ne merjaja *pro/*ix
suit.GEN.PL he set.aside at.once three even not trying.on them
'As for suits, he picked three right away without even trying them on.'

On the assumption that (44a) involves movement, as shown, the parasitic gap in the gerundial adjunct is licensed. A pronoun in place of the parasitic gap is only inconsistently accepted by speakers. This patterns with Ross's (1967) original observation that the relative acceptability of a parasitic gap versus a pronoun is roughly inversely correlated. Where a parasitic gap is acceptable, an overt pronoun is less good. In (44b), the gap inside the adjunct clause is a null pronoun, but an overt pronoun is equally possible. A trace is illicit here because the gap is inside an island.

3.2 HTLD diagnostics

In this section, we capitalize on cross-linguistic properties of hanging topics to support our contention that left dislocated genitive plural nominals are hanging topics. These characteristics include peripheral positioning and co-occurrence with epithets.

3.2.1 Peripheral positioning

Further differences between the movement and HTLD constructions appear when we consider the linear positions of the LD elements. An investigation of linear order is complicated by the fact that Russian is extremely generous with scrambling. Assuming a constituent is left dislocated, it is always possible that another constituent can scramble over it, placing the LD element in a non-peripheral position. Nevertheless, certain

patterns appear when we look at the position of LD elements with respect to wh-phrases. Such examples are rather hard to construct, and most of them sound marginal, but inasmuch as they are interpretable, the preference is for the LD element to precede the wh-phrase:

(45) a. Maše nado segodnja posmotret' celyx tri fil'ma
Masha.DAT necessary today see.INF entire three movie.PAUC
'Masha has to watch an entire three movies today.'

b. %fil'm-a/ov komu segodnja nado posmotret' celyx tri?
movie-PAUC/GEN.PL who.DAT today necessary see.INF entire three
'Of movies, who has to watch an entire three today?'

c. %fil'm-a/ov kogda Maše nado posmotret' celyx tri?
movie-PAUC/GEN.PL when Masha.DAT necessary see.INF entire three
'Of movies, when does Masha have to watch an entire three?'

Such data indicate that both hanging topics and moved elements can occur quite high in the clause. Assuming that wh-phrases are in spec,CP, they are above that position. We hypothesize they are both adjoined to CP. Where the two constructions differ is in the possibility of the LD element appearing in positions further to the right. Moved elements, but not hanging topics can occur after the wh-phrase. For example, the hanging topic is degraded after a wh-phrase, (46b), and ungrammatical after the subject, (46c). These positions are permitted for the paucal nominal.

(46) a. Maša dala Pete tri apel'sina i dva banana
Masha gave Petja.DAT three orange.PAUC and two banana.PAUC
'Masha gave Petya three oranges and two bananas.'

b. Komu apel'sina/?apel'sinov Maša dala tri,
who.DAT orange.PAUC/orange.GEN.PL Masha gave three
a banana tol'ko dva?
but banana only two

c. Komu Maša apel'sina/*apel'sinov dala tri,
who.DAT Masha orange.PAUC/orange.GEN.PL gave three
a banana tol'ko dva?
but banana only two
'Whom did Masha give three oranges but only two bananas?'

The freedom of positioning for the paucal element follows if it has undergone scrambling, which can target numerous adjunction positions in the clause, including positions after a fronted wh-phrase and after the subject. The hanging topic, in contrast, is restricted to the clause-peripheral position under our assumptions. The marginal acceptability of (46b) is likely due to the ability of wh-phrases to themselves undergo scrambling.

3.2.2 Doubling

Because hanging topics relate to a null pronominal, it is expected that they can be replaced by overt expressions, whereas traces generally cannot be.[15] This predicts that the

[15] Cases in which traces are realized as pronouns, epithets, or full copies exist. See, for example, the CLLD literature cited above, and also Boeckx 2003, Nunes 2004, and Aoun and Choueiri 2000 on traces realized as epithets in Lebanese Arabic. We ignore this

hanging topic should be resumable by an overt pronoun, a count word, or an epithet but the moved element should not allow such doubling. This prediction is confirmed by the data. (47), (48), and (49), show that the gap can be replaced by a count word, an epithet, or a pronoun, respectively, only in the HTLD construction with the fronted genitive plural.

(47) a. U Peti bylo tri želanija
by Petya was three wish.PAUC
'Petya had three wishes.'

b. Želanija u Peti bylo tri (*štuki)
wish.PAUC by Petya was three piece.PAUC

c. Želanij u Peti bylo tri (štuki)
wish.GEN.PL by Petya was three piece.PAUC
'Wishes, Petya had three'.

(48) a. U generala bylo četyre soldata
by general was four soldiers.PAUC

b. soldata u generala bylo četyre (*bugaja)
soldier.PAUC by general was four yokel.PAUC

c. soldat u generala bylo četyre (bugaja)
soldier.GEN.PL by general was four yokel.PAUC
'The general commanded four soldiers.'

---

possibility as Russian does not seem to allow this; scrambling in Russian obligatorily leaves a gap.

(49) a. U etogo generala ostalos' četyre soldata
by this general remained four soldier.PAUC
'This general had four soldiers left.'

b. Soldata u etogo generala ostalos' (*ix) četyre
soldier.PAUC by this general remained them four

c. Soldat u etogo generala ostalos' (ix) četyre
soldier.GEN.PL by this general remained them four
'Of soldiers, this general had four left.'

3.3 Summary

To conclude, we have examined arguments from a number of quarters that show a systematic difference between left dislocated paucal nominals and genitive plural nominals which strand a low numeral. These differences are summarized in Table 1.

Table 1. Syntactic properties of paucal vs. genitive plural forms appearing at the left edge of a clause

	Paucal form	Genitive plural
Shows island sensitivity	Yes	No
Obeys CSC	Yes	No
Requires number connectivity	Yes	No
Reconstructs for Binding Theory	Yes	No
Shows crossover effects	Yes	No
Licenses parasitic gaps	Yes	No
Can occupy intermediate scrambled positions	Yes	No
Can be doubled by a pro-form or epithet	No	Yes

The directionality and systematicity of these diagnostics confirm that the paucal form stranding a numeral is derived with movement, while the genitive plural form is base-generated. Hence, our initial proposal, repeated below, is validated.

(50) For lower numerals, the left dislocated nominal has undergone movement when there is number connectivity (paucal) and it is HTLD when there is no connectivity (genitive plural)

(51) *lower numerals*

a. *left dislocation with number connectivity: movement*

Sobor-a v gorodke bylo tri ~~sobor-a~~

cathedral-PAUC in town was three

b. *left dislocation without number connectivity: HTLD*

Sobor-ov v gorodke bylo tri *pro*

cathedral-GEN.PL in town was three

'As for cathedrals, there were three in that town.'

Thus, Russian, like a number of other languages, shows a difference between base-generated and scrambled left dislocated elements, and this difference has a very clear morphological exponent in some contexts. Syntactically, the difference between these two constructions mirrors differences observed in other languages.

The minimal surface difference in (51) also makes this Russian contrast a promising object for a processing study. In particular, these constructions are suitable for testing the processing hypothesis in (3c), repeated below.

(52) The construction of syntactic coconstruals requires less effort than the construction of discourse coconstruals.

4 Experimental evidence: Self-paced reading

The minimal morphosyntactic differences between the scrambling and HTLD constructions analyzed in section 3 provide an ideal testing ground for the relative processing ease of different coconstruals. What we will see from the self-paced reading study is that the movement construction is indeed processed more quickly than the base-generated HTLD construction. We attribute this difference to the coconstrual type. As predicted, discourse coconstruals are processed more slowly than syntactic coconstruals. We reject an alternative explanation according to which the mismatch in number connectivity is the source of the increased processing load.

4.1 Materials

We conducted a self-paced reading study of Russian sentences contrasting examples such as the pair repeated below:

(53) a. *scrambled topic*

Sobor-a v gorodke bylo tri ~~sobor-a~~

cathedral-PAUC in town was three

b. *base-generated topic*

Sobor-ov v gorodke bylo tri *pro*

cathedral-GEN.PL in town was three

'As for cathedrals, there were three in that town.'

Sentences were embedded under an introductory sequence so that the paucal/plural word appeared as the fourth word (W4) in reading. The nominal was separated by the numeral at W9 by four words, and the spillover after the numeral included at least four more words (W10 – W14). Thus:

(54) Maša skazala, čto sobor-a/ov zdes' snačala sobiralis' postroit'
Masha said that cathedral-PAUC/GEN.PL here at_first intended to_build
W1 W2 W3 W4 W5 W6 W7 W8
dva, no potom ne xvatilo sredstv
two but then not sufficed means
W9 W10 W11 W12 W13 W14
'Masha said that at first they were planning to build two cathedrals here but then they ran out money.'

The stimuli maintained the Russian punctuation, which is crucial for native Russian readers (see the commas in (54)).[16] In choosing the nouns for comparison, we used only masculine inanimates, and selected the most common nouns that appeared in both forms, based on the Russian national corpus http://ruscorpora.ru/index.html. The noun choice was further narrowed down in such a way that each noun occurred a comparable number of times in the forms corresponding to the paucal and genitive plural (thus, we excluded the nouns which occurred mostly in one form or the other). The stimuli were then normed by 27 native speakers who were asked to rate them on a 1-5 scale. All stimuli with average ratings below 3.5 were excluded. We ended up with 24 pairs of stimuli accompanied by 36 fillers. Each sentence was followed up by a comprehension question. The self-paced reading experiment was conducted using the platform LINGER (http://tedlab.mit.edu/~dr/Linger/), with a high sensitivity keyboard. Subjects were tested in a quiet room.

[16] In a study on Russian relative clauses by Levy et al. (2008, 2012), the absence of punctuation marks may have caused an extra slowdown in reading. It is therefore critical to maintain the standard punctuation for literate readers. The importance of punctuation may differ across languages; it is critical in Russian (Valgina 1979; Rozental' 1994) and it should be part of best practices in the experimental design for Russian reading.

4.2 Subjects

We tested 37 subjects. Out of these, eight subjects were below the 85% threshold of correct answers on the comprehension questions and were therefore excluded from the analysis. This left us with 29 subjects, avg. age 26.6, all right-handed, 17 females.

4.3 Results

Self-paced reading times were analyzed using linear mixed models with random intercepts for subjects and items and log(raw reading time) as the dependent variable. Tokens more then two standard deviations away from the mean raw reading time of all subjects were excluded from the analysis (89 tokens, 2.1%). Reading time was predicted using the contrast between PAUCAL (scrambled topic) and GENITIVE PLURAL (base-generated topic).

Individual models were fitted for log(raw reading time) of the right edge of the left dislocated nominal (W4), the intervening material (W5 – W8), the numeral (critical word = W9), and the spill-over region (W10 and W11). The reason for including a two-word spillover region is that in self-paced reading, it is common for effects—especially stronger ones—to be delayed by a word or to spread over onto later regions (Ueno and Garnsey, 2008:665, Xiang et al. 2011, Polinsky et al. 2012). Such a delay is particularly relevant for highly literate readers who go through words very quickly. In the case of our stimuli, the possibility of a delay is particularly likely because the critical word (W9) is very short (three to six letters) and the next word (W10) is also extremely short (two to four letters).

Word-by-word reading times are shown in Figure 1.

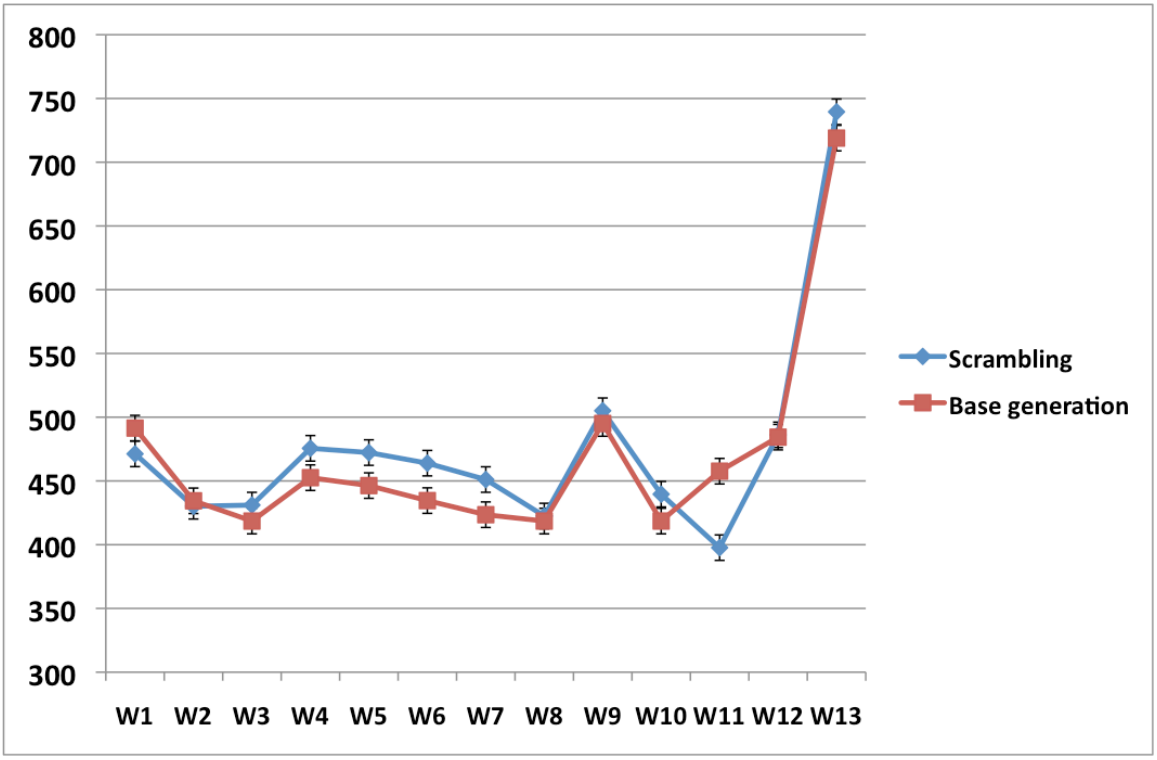

Figure 1. Word-by-word reading times (residual RTs, ms) for hanging topic constructions with scrambling and base generation (29 subjects)

At the left dislocated nominal (W4), there was no statistically significant difference in reading times between the two case forms. This lack of effect confirms our efforts to equalize the frequency of the two case forms and suggests that the parser cannot anticipate the remainder of the sentence based on the case form. At the numeral (W9), there was again no effect in the two conditions. There was equally no effect at the first spillover word (W10), which is likely due to the fact that it was very short (two or three letters). At the second spillover word (W11), there was a strong effect of the case difference (β=-.1, t=-2.1, p_{MCMC}=0.0085), with the genitive plural (base-generated) condition being read much more slowly than the paucal (movement) condition.

We attribute the slower processing in the HTLD case to the discourse coconstrual involved, in contrast to the syntactic coconstrual in the scrambling case.

4.4 Alternative interpretation

Before accepting our conclusion regarding processing differences between the two left dislocation strategies, it is important to rule out an alternative explanation of the increased reading time for HTLD over movement. There may be a morphological explanation, namely, that the base-generation condition represents a morphological mismatch, which causes increased reading times. Once the reader reaches the numeral 2, 3, or 4, s/he realizes that s/he needs the paucal form of the nominal but instead has the genitive plural. This mismatch causes the slowdown reported above.

The effects of agreement mismatches on processing have been noted by a number of studies (see Molinaro et al. 2011 for a summary of the ERP literature). Wagers et al. 2009, among others, document slowdowns in behavioral measures for subject-verb misagreement in person, number, and/or gender. Fanselow and Frisch 2006 document

effects of disagreement in number within German discontinuous nominals. The reason for such a slowdown can be attributed to the general parsing strategy of fixating upon the unexpected. The majority of work on the processing effect of mismatches utilizes mismatches in case and/or number. Thus, an explanation according to which number mismatch causes a slowdown would have independent support from the processing literature and would make our own explanation superfluous. We believe that this is not a viable alternative however.

There are two reasons to doubt the number mismatch explanation. The first comes from the acceptability ratings. Recall that our normers rated all the sentences as comparable, and we did not include any sentences rated lower than 3.5 on a 5-point scale. This is different from the agreement mismatch data reported in the above studies, where the mismatch results in significantly lower acceptability ratings (see esp. Fanselow and Frisch 2006 for German).

The second reason for doubting mismatch as an explanation for the increased reading time comes from results reported in Xiang et al. 2011 on the processing of morphological mismatches in Russian numerical expressions. One study looked at reading times when different numerals were followed by a nominal with appropriate or inappropriate morphology. For paucals, the following paradigm was investigated:

(55) V xore tri malen'kix mal'čik-a/*ø/*i/*ov
in choir three little.GEN.PL boy-PAUCAL/NOM.SG/NOM.PL/GEN.PL
v očkax stojali vperedi vsex
in glasses stood.PL before all

Despite acceptability ratings confirming that only the paucal form is acceptable in (55), reading times showed no statistically significant slow down at the head noun or the

following word for any of the ungrammatical morphological forms compared to the grammatical paucal form. That is, there did not appear to be any processing effect due to morphological mismatch with paucal numerals.[17]

5 Conclusions

In this paper we analyzed a contrast in Russian between two constructions with a clause-initial nominal and a stranded paucal numeral. In one the nominal appears in a non-agreeing (PLURAL) form, in the other, the nominal shows number connectivity (PAUCAL) with a gap following the numeral:

(56) a. cathedral-PLURAL, there were three.PAUCAL *pro*

b. cathedral-PAUCAL, there were three.PAUCAL *ec*

We have shown, using numerous syntactic diagnostics, that in the absence of connectivity, the construction involves a hanging topic related via discourse mechanisms to a base-generated null pronoun. Under number connectivity, the nominal has been fronted via A'-movement, creating a syntactic dependency. Thus, the two constructions constitute an excellent syntactic minimal pair.

We used the Russian contrast to test the hypothesis that syntactic dependencies require less processing effort than discourse-derived dependencies do (Reuland 2001, 2011, Koornneef 2008), in particular, that movement is less burdensome for processing than pronominalization (see also Hornstein 2001). We conducted a self-paced reading

[17] The explanation for that effect is that the paucal form of the noun is almost always homophonous with the genitive singular form and a morphologically ambiguous phonological form requires a longer processing time.

Slower reading times were found with morphological mismatches following the numeral 'one' and the higher numeral 'five'. This is not relevant for us because our experiment used only paucal numerals.

study using sentences that instantiate the contrast in (60) and found a statistically significant slowdown after the gap in constructions with the hanging topic as opposed to the moved nominal. This supports the claim that a syntactic A'-chain is more easily processed than an anaphoric dependency involving a null pronoun; the latter must be resolved by discourse-based mechanisms which require relatively more resources.

References

Aissen, Judith. 1992. Topic and focus in Mayan. *Language* 68, 43-80.

Alexiadou, Artemis. 2006. Left dislocation (including CLLD). In Martin Everaert and Henk van Riemsdijk (eds.). *The Blackwell companion to syntax, volume II*, 668-699. Malden: Blackwell.

Anagnostopoulou, Elena. 1994. Clitic dependencies in Modern Greek. University of Salzburg PhD dissertation.

Anagnostopoulou, Elena. 1997. Clitic left dislocation and contrastive left dislocation. In Elena, Anagnostopoulou, Henk van Riemsdijk, and Frans Zwarts (eds.). *Materials on left dislocation*, 151-192. Amsterdam: John Benjamins.

Anagnostopoulou, Elena, Henk van Riemsdijk, and Frans Zwarts (eds.). 1997. *Materials on left dislocation*. Amsterdam: John Benjamins.

Aoun, Joseph, Abbas Benmamoun, and Lina Choueiri. 2010. *The syntax of Arabic*. Cambridge: Cambridge University Press.

Aoun, Joseph and Lina Choueiri. 2000. Epithets. *Natural Language and Linguistic Theory* 18, 1-39.

Bailyn, John. 1995. Underlying phrase structure and short verb movement in Russian. *Journal of Slavic Linguistics* 3, 13-58.

Bailyn, John. 2001. On scrambling: A reply to Bošković and Takahashi. *Linguistic Inquiry* 32, 635-658.

Bailyn, John. 2003. Does Russian scrambling exist? In Simin Karimi (ed.). *Word order and scrambling*, 156-176. Malden: Blackwell.

Bailyn, John. 2007. A derivational approach to micro-variation in Slavic binding. In Richard Compton, Magdalena Goledzinowska, and Ulyana Savchenko (eds.). *Annual Workshop on Formal Approaches to Slavic Linguistics 15*, 25-41. Ann Arbor: Michigan Slavic Publications.

Bailyn, John. 2012. *The syntax of Russian*. Cambridge: Cambridge University Press.

Benincà, Paola and Cecilia Poletto. 2004. Topic, focus and V2: Defining the CP sublayers. In Luigi Rizzi (ed.) *The structure of CP and IP: The cartography of syntactic structures, vol. 2*, 52-75. New York: Oxford University Press.

Boeckx, Cedric. 2003. *Islands and chains: Resumption as stranding*. Amsterdam: John Benjamins.

Bošković, Željko, 2006. Case and agreement with genitive of quantification in Russian. In Cedric Boeckx (ed.). *Agreement systems,* 99-121. Amsterdam: John Benjamins.

Bošković, Željko, and Steven Franks. 2000. Across the board movement and LF. *Syntax* 3, 107-128.

Burkhardt, Petra. 2005. *The syntax-discourse interface: Representing and interpreting dependencies.* Amsterdam: John Benjamins.

Cecchetto, Carlo. 2000. Doubling structures and reconstruction. *Probus* 12, 93-126.

Chomsky, Noam. 1976. Conditions on rules of grammar. *Linguistic Analysis* 2, 303-351.

Chomsky, Noam. 1981. *Lectures on government and binding*. Dordrecht: Foris.

Chomsky, Noam. 1995. *The minimalist program.* Cambridge, Ma.: MIT Press.

Chomsky, Noam. 2000. Minimalist inquiries. In Roger Martin, David Michaels, and Juan Uriagereka (eds.). *Step by step: Essays in minimalist syntax in honor of Howard Lasnik*, 89-155. Cambridge: MIT Press.

Chomsky, Noam. 2001. Derivation by phase. In Michael Kenstowicz (ed.). *Ken Hale: A life in language*, 1-52. Cambridge, Ma.: MIT Press.

Choo, Suk-hoon, Jun-hee Hong, Ji-young Hwang. 2007. Genitive-initial sentences in Russian and the typology of case assignment. *Language and Linguistics*, 153-174

Cinque, Guglielmo. 1977. The movement nature of Left Dislocation. *Linguistic Inquiry* 8, 397-411.

Cinque, Guglielmo. 1990. *Types of A'-dependencies*. Cambridge, Mass.: MIT Press.

Cinque, Guglielmo. 1997[1983]. 'Topic' constructions in some European languages and 'connectedness'. In Elena Anagnostopoulou, Henk van Riemsdijk, and Frans Zwarts (eds.). *Materials on left dislocation*, 93-118. Amsterdam: John Benjamins.

Crockett, Dina. 1976. Agreement in Contemporary Standard Russian. Cambridge: Slavica.

Culicover, Peter. 2001. Parasitic gaps: A history. In Peter Culicover and Paul Postal (eds.). *Parasitic gaps*, 3-68. Cambridge: MIT Press.

De Cat, Cecile. 2007. *French dislocation: Interpretation, syntax, acquisition*. Oxford: Oxford University Press.

Escobar, Linda. 1997. Clitic left dislocation and other relatives. In Elena, Anagnostopoulou, Henk van Riemsdijk, and Frans Zwarts (eds.). *Materials on left dislocation*, 233-274. Amsterdam: John Benjamins.

Engdahl, Elisabet. 1983. Parasitic gaps. *Linguistics and Philosophy* 6, 5-34.

Evans, Gareth. 1980. Pronouns. *Linguistic Inquiry* 11, 337-362.

Fanselow, Gisbert, and Stefan Frisch. 2006. Effects of processing difficulty on judgments of acceptability. In G. Fanselow, C. Féry, M. Schlesewsky & R. Vogel. *Gradience in grammar,* 291-316. Oxford: Oxford University Press.

Franks, Steven. 1992. A prominence constraint on null operator constructions. *Lingua* 87, 35-54.

Franks, Steven. 1993. On parallelism in across-the-board dependencies. *Linguistic Inquiry* 24, 509-529.

Franks, Steven 1995. *Parameters of Slavic morphosyntax*. New York: Oxford University Press.

Frazier, Lyn and Charles Clifton. 2000. On bound variable interpretations: The LF-only hypothesis. *Journal of Psycholinguistic Research* 29, 125-139.

Grewendorf, Gunther. 2008. The left clausal periphery: Clitic left dislocation in Italian and left dislocation in German. In Benjamin Shaer, Philippa Cook, Werner Frey, and Claudia Maienborn (eds.). *Dislocated elements in discourse: Syntactic, semantic, and pragmatic perspectives*, 49-94. New York: Routledge.

Grodzinsky, Yosef, and Tanya Reinhart. 1993. The innateness of binding and coreference. *Linguistic Inquiry* 24, 69-101.

Hirschbühler, Paul. 1997. On the source of lefthand NPs in French. In Elena Anagnostopoulou, Henk van Riemsdijk, and Frans Zwarts (eds.). *Materials on left dislocation*, 151-192. Amsterdam: John Benjamins.

Hornstein, Norbert. 2001. *Move! A minimalist theory of construal*. London: Blackwell.

House, Richard. 1982. The use of genitive initial sentences for the specification of quantity in Russian. Cornell University PhD dissertation.

Ivlieva, Natalia. 2007. Parasitic gaps in Russian. In Richard Compton, Magdalena Goledzinowska, and Ulyana Savchenko (eds.). *Annual Workshop on Formal*

Approaches to Slavic Linguistics 15, 132-140. Ann Arbor: Michigan Slavic Publications.

Kasai, Hironobu. 2004. Two notes on ATB movement. *Language and Linguistics* 5, 167-188.

King, Tracy Holloway. 1995. *Configuring topic and focus in Russian.* Stanford: CSLI Publications.

Koornneef, Arnout. 2008. *Eye-catching anaphora*. Utrecht: LOT International Dissertation Series.

Levy, Roger, Edward Gibson, and Evelina Fedorenko. 2008. Expectation-based processing of extraposed structures in English. Poster presentation given at the 2008 CUNY Sentence Processing Conference.

Levy, Roger, Evelina Fedorenko, and Edward Gibson. 2012. The syntactic complexity of Russian relative clauses. Manuscript, UCSD and MIT.

Lopez, Luis. 2009. *A derivational syntax for information structure.* Oxford: Oxford University Press.

May, Robert. 1985. *Logical Form: Its structure and derivation*. Cambridge, Ma.: MIT Press.

Molinaro, Nicola, Horacio Barber, and Manuel Carreiras. 2011. Grammatical agreement processing in reading: ERP findings and future directions. *Cortex* 47, 908-930.

Nunes, Jairo. 2004. *Linearization of chains and sideward movement.* Cambridge, Ma.: MIT Press.

Partee, Barbara, and Vladimir Borschev. 2006. Information structure, perspectival structure, diathesis alternation, and the Russian genitive of negation. Proceedings of the Ninth Symposium on Logic and Language (*LoLa* 9), 120-129. Budapest: Hungarian Academy of Sciences.

Pesetsky, David. 1982. *Paths and categories.* Cambridge, Ma.: MIT Press.

Piñango, Maria, and Petra Burkhardt. 2005. Pronominal interpretation and the syntax-discourse interface: Real time comprehension and neurological properties. In A. Branco, T. McEnery, and R. Mitkov (eds.). *Anaphora processing: Linguistic cognitive and computational modeling*, 221-238. Amsterdam: John Benjamins.

Polinsky, Maria, Carlos Gomez-Gallo, Peter Graff, and Ekaterina Kravtchenko. 2012. Subject preference and ergativity. *Lingua* 122, 267-277.

Pollard, Carl, and Ivan Sag. 1994. *Head driven phrase structure grammar.* Chicago: CSLI Publications.

Reinhart, Tanya. 1983. *Anaphora and semantic interpretation*. London: Croom Helm.

Reinhart, Tanya. 2006. *Interface strategies: Optimal and costly computations*. Cambridge, Ma.: MIT Press.

Reinhart, Tanya, and Eric Reuland. 1993. Reflexivity. *Linguistic Inquiry* 24, 657-720.

Reuland, Eric. 2001. Primitives of binding. *Linguistic Inquiry* 32, 439-492.

Reuland, Eric. 2011. *Anaphora and language design.* Cambridge, Ma.: MIT Press.

Rizzi, Luigi. 1997 .The fine structure of the left periphery. In Liliane Haegeman (ed.). *Elements of grammar. A handbook in generative syntax*, 281-337. Dordrecht: Kluwer.

Ross, John Robert. 1967. Constraints on variables in syntax. MIT PhD dissertation.

Rozental', Ditmar. 1994. *Russkaja orfografija i punktuacija*. 2 ed. Moscow: Russkij jazyk.

Safir, Ken. 2004. *The syntax of (in)dependence.* Cambridge, Ma.: MIT Press.

Safir, Ken. 2008. Coconstrual and narrow syntax. *Syntax* 11, 330-355.

Schumacher, Petra, Maria Piñango, Esther Ruigendijk, and Sergey Avrutin. 2010. Reference assignment in Dutch: Evidence for the syntax-discourse divide. *Lingua* 120, 1738-1763.

Sekerina, Irina. 1997. The syntax and processing of scrambling constructions in Russian. CUNY Graduate Center PhD dissertation.

Shapiro, Lewis, and Arild Hestvik. 1995. On-line comprehension of VP ellipsis: Syntactic reconstruction and the semantic influence. *Journal of Psycholinguistic Research* 24, 517-532.

Shapiro, Lewis, Hestvik, Arild, Lesan Lesli, and Garcia, A. Rachel. 2003. Charting the time-course of VP-ellipsis sentence comprehension: Evidence for an initial and independent structural analysis. *Journal of Memory and Language* 49, 1-19.

Sturgeon, Anne. 2008. *The left periphery: the interaction of syntax, pragmatics and prosody in Czech.* Amsterdam: John Benjamins.

Szabolcsi, Anna. 2006. Strong vs. weak islands. In Martin Everaert and Henk van Riemsdijk (eds.). *Blackwell companion to syntax vol. 4*, 479-531. Malden, Ma.: Blackwell.

Thráinsson, Höskuldur. 1979. *On complementation in Icelandic*. New York: Garland.

Ueno, Mieko, and Susan M. Garnsey. 2008. An ERP study of the processing of subject and object relative clauses in Japanese. *Language and Cognitive Processes* 23, 646-688.

Valgina, Nina S. 1979. *Russkaja punktuacija: Principy i naznačenie*. Moscow: Prosveščenie.

van Riemsdijk, Henk. 1997. Left dislocation. In Elena Anagnostopoulou, Henk van Riemsdijk, and Frans Zwarts (eds.). *Materials on left dislocation*, 1-12. Amsterdam: John Benjamins.

van Riemsdjik, Henk, and Frans Zwarts. 1997. Left dislocation in Dutch and status of copying rules. In Elena Anagnostopoulou, Henk van Riemsdijk, and Frans Zwarts (eds.). *Materials on left dislocation*, 13-30. Amsterdam: John Benjamins.

Vasić, Nada. 2006. *Pronoun comprehension in agrammatic aphasia: The structure and use of linguistic knowledge.* Utrecht: Utrecht LOT International Dissertation Series.

Vat, Jan. 1997. Left dislocation, connectedness, and reconstruction. In Elena, Anagnostopoulou, Henk van Riemsdijk, and Frans Zwarts (eds.). *Materials on left dislocation*, 67-92. Amsterdam: John Benjamins.

Wagers, Matthew, Ellen Lau, and Colin Phillips. 2009. Agreement attraction in comprehension: Representations and processes. *Journal of Memory and Language* 61, 206-237.

Williams, Edwin. 1978. Across-the-board rule application. *Linguistic Inquiry* 9, 31-43.

Wiltschko, Martina. 1997. Parasitic operators in German left-dislocation. In Elena, Anagnostopoulou, Henk van Riemsdijk, and Frans Zwarts (eds.). *Materials on left dislocation*, 307-340. Amsterdam: John Benjamins.

Xiang, Ming, Boris Harizanov, Maria Polinsky, and Ekaterina Kravtchenko. 2011. Processing morphological ambiguity: An experimental investigation of Russian numerical phrases. *Lingua* 121, 548–560.

Zaenen, Annie. 1997. Contrastive dislocation in Dutch and Icelandic. In Elena Anagnostopoulou, Henk van Riemsdijk, and Frans Zwarts (eds.). *Materials on left dislocation*, 119-150. Amsterdam: John Benjamins.