***FASL* 21, xxx-xxx**
Michigan Slavic Publications
2012

Quantifier scope and scrambling in Russian: an experimental study

Anastasia Stoops and Tania Ionin
University of Illinois at Urbana Champaign

The availability of different scope readings for double-quantifier sentences in Russian has been a source of an ongoing debate. The goal of our paper is to use experimental methodology to examine the availability of both surface-scope and inverse-scope readings in SVO and scrambled OVS word orders in Russian.

1 Background: quantifier scope in English and Russian

Double-quantifier English sentences such as (1) and (2) are well-known to be ambiguous between surface-scope and inverse-scope readings. In Montague's type-driven compositional semantics, the different scope readings are obtained through the operation of Quantifier Raising (QR) (May 1977, Heim & Kratzer 1998, Fox 2000). For the surface-scope reading, the subject undergoes covert QR to a position higher than the object, and for the inverse-scope reading, the opposite is the case.

(1) Every girl is stroking a/one kitten.
  a. surface–scope: (every>a/one) *Every girl is stroking a potentially different kitten.*
  b. inverse–scope: (a/one>every) *For a specific kitten, every girl is stroking it.*

(2) A/one girl is stroking every kitten.
  a. surface–scope: (a/one>every) *A specific girl is stroking all the kittens.*

b. inverse–scope: (every>a/one) *For every kitten, a potentially different girl is stroking it.*

Psycholinguistic studies of English sentences such as (1) and (2) find that while both scope readings are available, the surface-scope reading is preferred, both offline (Ioup 1975, Kurtzman & MacDonald 1993, Anderson 2004) and online (Tunstall 1998, Anderson 2004). This led Anderson (2004) to formulate the "Processing Scope Economy" (PSE) principle, according to which surface-scope readings are preferred because they are syntactically simpler (not involving longer-distance QR) and are therefore less costly to process.

The Russian equivalents of (1) and (2) are given in (3a) and (4a). Russian has fairly free word order, and these sentences can also occur in OVS order, with the object scrambled leftward and the subject appearing postverbally (Bailyn 1995, King 1995), as shown in (3b) and (4b).

(3)	a.	Každaja	devočka	gladit	odnogo	kotenka.
		every$_{NOM}$	girl$_{NOM}$	strokes	one$_{ACC}$	kitten$_{ACC}$
	b.	Odnogo	kotenka	gladit	každaja	devočka.
		one$_{ACC}$	kitten$_{ACC}$	strokes	every$_{NOM}$	girl$_{NOM}$
(4)	a.	Odna	devočka	gladit	každogo	kotenka.
		one$_{NOM}$	girl$_{NOM}$	strokes	every$_{ACC}$	kitten$_{ACC}$
	b.	Kazhdogo	kotenka	gladit	odna	devočka.
		every$_{ACC}$	kitten$_{ACC}$	strokes	one$_{NOM}$	girl$_{NOM}$

The availability of both surface-scope and inverse-scope readings to sentences such as (3) and (4) is subject to debate. Ionin (2002) argues that all the sentences in (3) and (4) have frozen scope, with only the surface-scope reading available (i.e., the *one>every* reading in (3b) and (4a) and the *every>one* reading in (3a) and (4b)). Ionin explains this by appealing to information structure (cf. Junghanns and Zybatow 1997), arguing that in (emotively neutral) Russian sentences, the preverbal QP (whether the subject, or the scrambled object) is in Topic position, and the postverbal QP is in focus. According to Ionin's proposal, overt QR above Topic position is impossible, as is reconstruction of the Topic to its base position. Antonyuk (2006) disagrees with the judgments in Ionin (2002) and argues that inverse scope of Russian sentences such as (3) and (4) *is* possible, and is derived by covert QR, exactly as in English.

The disagreement about judgments is further complicated by the fact that surface-scope readings are preferred even in languages like English, which in principle allow inverse-scope readings. Assuming that Anderson's (2004) PSE principle applies cross-linguistically, it would also dictate a preference for surface-scope readings in Russian. It is not clear, at present, whether native Russian speakers allow inverse-scope readings for sentences like (3) and (4) but disprefer them (because of the PSE); or whether inverse-scope readings are completely disallowed, because of information-structure constraints, per Ionin (2002). The present paper addresses this issue experimentally, investigating the scope readings of Russian double-quantifier sentences in both SVO and OVS orders. Two studies were conducted, which used different methodologies (stories vs. pictures) to establish the relevant readings.

2 Study 1: Story-based contexts

2.1 Participants and stimuli

A total of 23 native speakers of Russian participated in Study 1. They ranged in age from 20 to 69 and the majority of participants (19) were non-linguists and non-language professionals. Most of the participants (14) resided in Russia, seven resided in the US and two in Sweden. Of the nine participants residing outside of Russia, five had lived abroad for less than two years, and four had ten years of US residence.

An internet-based Truth-Value Judgment Task (TVJT) was used, in which the participants were asked to judge the target sentences as true or false in the context of preceding stories. Two factors were varied in constructing the sentences: quantifier configuration (universal subject & indefinite object, as in (5)-(6), vs. indefinite subject & universal object, as in (7)-(8)); and word order (SVO, as in the (a) sentences in (5) through (8) vs. OVS, as in the (b) sentences). Additionally, each sentence type was presented with two story types: test story, as in (6) and (8), vs. control story, as in (5) and (7). As spelled out in the examples below, the control stories made the target sentences true on both the surface-scope and the inverse-scope readings; they were included to ensure that participants paid attention. The test stories made one of the scope readings true and the other false; because of entailment, which reading (surface-scope or inverse-scope) was true and which was false depended on both the quantifier configuration and the word order, as spelled out

below.[1] Four versions of the test instrument were created, to avoid repetition of contexts; each version contained four tokens of each context/sentence pairing (32 test items total), plus 48 fillers.

(5) *control story, universal-subject & indefinite-object*
A lot of adults and children came to a party. There were 3 boys – Sasha, Petya, and Vanya and 4 girls – Lena, Katya, Masha, and Nina. Because there were many adults, not all the kids saw each other. Sasha, Petya, and Vanya all saw Lena, the tallest girl, but did not see the other girls.

a. Každyj mal'čik uvidel odnu devočku.
Every boy_{NOM} saw one $girl_{ACC}$
surface-scope: TRUE, inverse-scope: TRUE

b. Odnu devočku uvidel každyj mal'čik.
One $girl_{ACC}$ saw every boy_{NOM}
surface-scope: TRUE, inverse-scope: TRUE

(6) *test story, universal-subject & indefinite-object*
A lot of adults and children came to a party. There were 3 boys – Sasha, Petya, and Vanya and 4 girls – Lena, Katya, Masha, and Nina. Because there were many adults, not all the kids saw each other. Sasha saw only Lena. Petya saw only Katya. Vanya saw only Masha. None of the boys saw Nina.

a. Každyj mal'čik uvidel odnu devočku.
Every boy_{NOM} saw one $girl_{ACC}$
surface-scope: TRUE, inverse-scope: FALSE

b. Odnu devočku uvidel každyj mal'čik.
One $girl_{ACC}$ saw every boy_{NOM}
surface-scope: FALSE, inverse-scope: TRUE

(7) *control story, indefinite-subject & universal-object*
A lot of adults and children came to a party. There were 4 boys – Sasha, Petya, Vanya, and Oleg and 3 girls – Lena, Katya, and Masha. Because there were many adults, not all the kids saw each other. Sasha ran around more than the rest and saw Lena, Katya, and Masha. The rest of the boys did not see any girls.

---

[1] For reasons of space, only the English translation of the story contexts is given here. The stories were in Russian in the actual test.

a. Odin mal'čik uvidel každuju devočku.
One boy$_{NOM}$ saw every girl$_{ACC}$
surface-scope: TRUE, inverse-scope: TRUE

b. Každuju devočku uvidel odin mal'čik.
Every girl$_{ACC}$ saw one boy$_{NOM}$
surface-scope: TRUE, inverse-scope: TRUE

(8) *test story, indefinite-subject & universal-object*
A lot of adults and children came to a party. There were 4 boys – Sasha, Petya, Vanya, and Oleg and 3 girls – Lena, Katya, and Masha. Because there were many adults, not all the kids saw each other. Sasha saw only Lena. Petya saw only Katya. Vanya saw only Masha. Oleg did not see any girls.

a. Odin mal'čik uvidel každuju devočku.
One boy$_{NOM}$ saw every girl$_{ACC}$
surface-scope: FALSE, inverse-scope: TRUE

b. Každuju devočku uvidel odin mal'čik.
Every girl$_{ACC}$ saw one boy$_{NOM}$
surface-scope: TRUE, inverse-scope: FALSE

2.2 Results and discussion

The results from the control conditions, where both surface- and inverse-scope readings were true, are summarized in Table 1. The participants responded 'true' in these contexts at least 88% of the time, indicating that they were paying attention.

Table 1. Results for the control stories ((5) and (7))

sentence type	word order	truth-value	responses (N=23)
Every boy saw one girl.	SVO (5a)	TRUE	**88% true**, 12% false
	OVS (5b)	TRUE	**96% true**, 4% false
One boy saw every girl.	SVO (7a)	TRUE	**97% true**, 3% false
	OVS (7b)	TRUE	**88% true**, 12% false

The results from the test stories are summarized in Table 2. For SVO orders, participants overwhelmingly (at least 90% of the time) gave the

response consistent with the surface-scope reading, regardless of whether it makes the sentence true (for (6a)) or false (for (8a)). For OVS orders, participants also preferred the surface-scope reading both when it made the sentence true ((8b), 73% 'true' responses) and when it made the sentence false ((6b), 68% 'true' responses); however, the preference was not as pronounced as in the SVO sentences, and inverse-scope readings were allowed about 30% of the time.

Table 2. Results for the test stories ((6) and (8))

sentence type	word order	truth-value on surface-scope reading	truth-value on inverse-scope reading	responses (N=23)
Every boy saw one girl.	SVO (6a)	TRUE	FALSE	**90% true**, 10% false
	OVS (6b)	FALSE	TRUE	32% true, **68% false**
One boy saw every girl.	SVO (8a)	FALSE	TRUE	5% true, **95% false**
	OVS (8b)	TRUE	FALSE	**73% true**, 27% false

The results on the test stories were subjected to a repeated-measures ANOVA, with word order and quantifier configuration as the two independent variables and the proportion of responses corresponding to the surface-scope reading as the dependent variable. The results revealed a significant effect of word order ($F_1(1,22) = 19.027$, $p<.0001$; $F_2(1,15) = 18.956$, $p<.001$). No significant effect of quantifier configuration and no interaction between word order and quantifier configuration were observed. This confirms that the surface-scope reading was significantly more likely with SVO word order regardless of the quantifier configuration.

These findings suggest that neither Ionin (2002) nor Antonyuk (2006) is completely right: while SVO sentences with two quantifiers do appear to have frozen surface scope, consistent with Ionin (2002), scrambled OVS sentences are more likely to allow inverse-scope

readings, although the surface-scope reading is still preferred. A possible explanation is that, consistent with Ionin (2002), the subject in an SVO sentence is in Topic position, and the object cannot undergo covert QR to a higher position than Topic. However, a scrambled object QP in an OVS sentence *can* reconstruct to its base position in the scope of the subject.

It is important to note, however, that there might be a potential confound in the test materials that could have affected the pattern of results. All the stories inadvertently set up the subject as the topic: e.g., in (5) through (8), the stories are always about the boys, and not about the girls, with SVO order used throughout the stories. This may explain the word order effect in the results. Study 2 controlled for this potential confound by using pictures rather than stories to set up the context, as described below.

3 Study 2: Picture-based contexts

3.1 Participants and stimuli

A total of 17 native speakers of Russian participated in Study 2 (several bilingual Russian/Kazah speakers were excluded), ranging in age from 27 to 65. The majority of participants (15) were non-linguists and non-language professionals. The majority of participants (14) resided in the US, with 28 as the average age of US arrival (range of 10 to 50); the remaining three resided in Russia.

An internet-based TVJT was used, in which the participants were asked to judge the target sentences as true or false in the context of preceding pictures. The sentences in (3) and (4), repeated below, were used. As in Study 1, two factors were varied in constructing the target sentences: quantifier configuration (universal subject & indefinite object, as in (3), vs. indefinite subject & universal object. as in (4)); and word order (SVO, as in (3a) and (4a) vs. OVS, as in (3b) and (4b)). Additionally, each test sentence was presented in the context of three different picture types, represented in Figures 1 through 3. The subject-oriented picture (Figure 1) makes the sentences in (3) unambiguously false, and those in (4) – unambiguously true. The object-oriented picture (Figure 2) makes the sentences in (3) unambiguously true, and those in (4) – unambiguously false. Both of these picture types were controls, designed to ensure that the test format worked and participants were paying attention. The distributive picture (Figure 3) made the sentences

in (3a) and (4b) true on the surface-scope reading and false on the inverse-scope reading, and made the sentences in (3b) and (4a) false on the surface-scope reading and true on the inverse-scope reading. These truth-values are spelled out in Tables 3 through 5 in the next section.

(3)	a.	Každaja	devočka	gladit	odnogo	kotenka
		every$_{NOM}$	girl$_{NOM}$	strokes	one$_{ACC}$	kitten$_{ACC}$
	b.	Odnogo	kotenka	gladit	každaja	devočka
		one$_{ACC}$	kitten$_{ACC}$	strokes	every$_{NOM}$	girl$_{NOM}$
(4)	a.	Odna	devočka	gladit	každogo	kotenka.
		one$_{NOM}$	girl$_{NOM}$	strokes	every$_{ACC}$	kitten$_{ACC}$
	b.	Kazhdogo	kotenka	gladit	odna	devočka
		every$_{ACC}$	kitten$_{ACC}$	strokes	one$_{NOM}$	girl$_{NOM}$

Figure 1. Subject-oriented picture

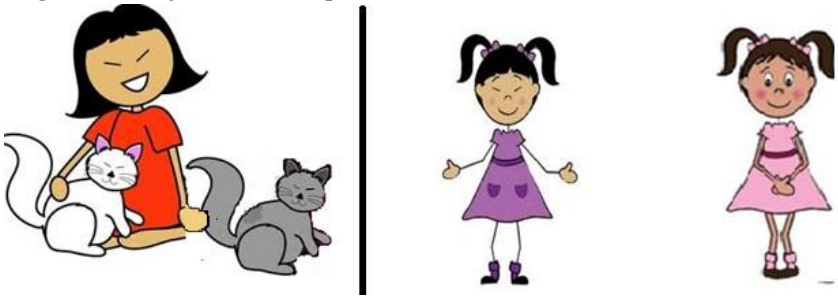


Figure 2. Object-oriented picture

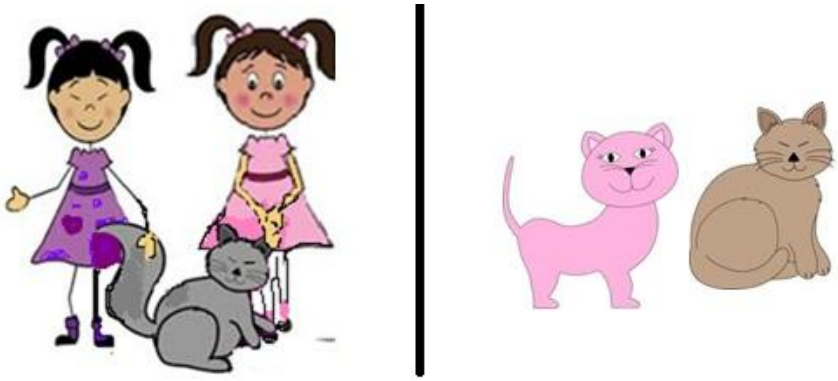
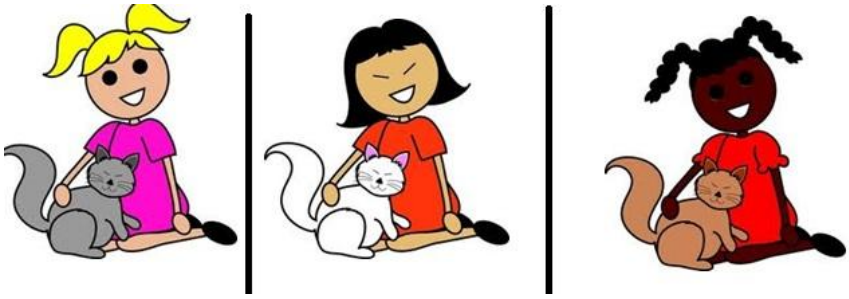


Figure 3. Distributive picture



Two versions of the test were created, to avoid repetition; each version contained 4 tokens of each picture/sentence pairing (3 picture types x 4 sentence types x 4 tokens = 48 test items total), plus 24 fillers.

3.2 Results and discussion

The results for the subject- and object-oriented pictures are given in Tables 3 and 4, respectively. They illustrate that the participants were paying attention. For unambiguously false sentences, the rate of 'false' responses was near ceiling. For unambiguously true sentences, the rate of 'true' responses was still quite high, but not at ceiling; in particular, it was unexpectedly low (78%) for the sentence type in (3a) in the context of the object-oriented picture. One possible explanation is that participants strongly wanted (3a) to have a distributive interpretation (each girl stroking her own kitten), and did not realize that the picture of both girls stroking the same kitten also makes the sentence true.

Table 3. Results for the subject-oriented picture (Figure 1)

sentence type	word order	truth-value	responses (N=17)
Every girl strokes one kitten.	SVO (3a)	FALSE	6% true, **94% false**
	OVS (3b)	FALSE	1% true, **99% false**
One girl strokes every kitten.	SVO (4a)	TRUE	**82% true**, 18% false
	OVS (4b)	TRUE	**84% true**, 16% false

Table 4. Results for the object-oriented picture (Figure 2)

sentence type	word order	truth-value	responses (N=17)
Every girl strokes one kitten.	SVO (3a)	TRUE	**78% true**, 22% false
	OVS (3b)	TRUE	**93% true**, 7% false
One girl strokes every kitten.	SVO (4a)	FALSE	4% true, **96% false**
	OVS (4b)	FALSE	3% true, **97% false**

The results for the distributive picture type (Figure 3, the test context) are reported in Table 5. They show that both surface-scope and inverse-scope readings were accessed, but with differences across conditions.

Table 5. Results for the distributive picture (Figure 3)

sentence type	word order	truth-value on surface-scope reading	truth-value on inverse-scope reading	responses (N=17)
Every girl strokes one kitten.	SVO (3a)	TRUE	FALSE	**85% true**, 15% false
	OVS (3b)	FALSE	TRUE	**74% true**, 26% false
One girl strokes every kitten.	SVO (4a)	FALSE	TRUE	**50% true, 50% false**
	OVS (4b)	TRUE	FALSE	**72% true**, 28% false

The results in the test context were subjected to a repeated-measures ANOVA, with word order and quantifier configuration as the two independent variables, and rate of responses corresponding to the surface-scope reading as the dependent variable. The results revealed a significant effect of word order ($F_1(1, 16) = 9.77$, $p<.01$; $F_2 (1, 7)=15.65$, $p<.001$) and a significant interaction between quantifier configuration and word order ($F_1(1,16)=11.90$, $p<.01$; $F_2(1,7)=61.45$, $p<.001$). Follow-up analyses revealed the source of the interaction to be as follows. When the surface-scope reading is true for SVO order and false for OVS order (in the "Every girl strokes one kitten" configuration in (3)), surface-scope responses occur significantly more frequently in the SVO order (85% vs. 26%). This result indicates that inverse scope is readily accessible in OVS order. In contrast, when the surface-scope reading is false for SVO order and true for OVS order (in the "One girl strokes every kitten" configuration in (4)), the rate of surface-scope responses in

the SVO condition (50%) and the OVS condition (72%) do not differ on the by-subjects analysis and differ only marginally on the by-items analysis. This indicates that inverse scope is less readily allowed in SVO order. Overall, participants tended to give the response of 'true' as long as at least one scope reading was true; but, in the configuration where the surface-scope reading was false and the inverse-scope reading was true on the SVO order, the rate of 'true' responses was much lower than in all the other conditions.

4 English version of Study 2

In order to compare scope readings in Russian and in English, an English-language version of Study 2 was conducted, in which the indefinite determiner (*a* vs. *one*) was varied instead of word order (since English does not allow scrambling).

4.1 Participants and stimuli

Twenty-nine native speakers of English, residing in the U.S., participated in the English-language study. The same pictures were used as in the Russian version of Study 2 (see Figures 1 through 3). The four target sentence types (4 tokens per sentence type) are exemplified in (9).

(9) a. Every girl is stroking a kitten.
b. Every girl is stroking one kitten.
c. A girl is stroking every kitten.
d. One girl is stroking every kitten.

4.2 Results and discussion

Table 6 presents the English-study results in the context of the distributive picture (Figure 3). For reasons of space, we do not present the results in the context of the two control pictures; as in the case of the Russian study, responses in the context of the control pictures were near ceiling.

The English results in Table 6 are very similar to those of the Russian study in Table 5. When the context makes the sentence true on surface-scope reading (9a-b), the rate of 'true' responses is near ceiling. When the context makes the sentence false on the surface-scope and true on the inverse-scope readings (9c-d), the responses are split almost evenly between 'true' and 'false'. This suggests that the inverse-scope

reading is in principle available, and that participants are experiencing a competition between two strategies: giving a response of 'true' as long as at least one reading of the sentence makes it true; and giving a response consistent with the surface-scope reading (which in this case is 'false'). The same competition was observed for the SVO order in the Russian version of the study; interestingly, however, for OVS order in Russian, the preference for going with the 'true' response overrode the preference of going for the surface-scope reading.

Table 6. Results for the English version of Study 2, in the context of the distributive picture (Figure 3)

sentence type	truth-value on surface-scope reading	truth-value on inverse-scope reading	results (N=29)
Every girl is stroking a kitten (9a)	TRUE	FALSE	**94% true**, 6% false
Every girl is stroking one kitten (9b)	TRUE	FALSE	**84% true,** 16% false
A girl is stroking every kitten (9c)	FALSE	TRUE	**63% true,** 37% false
One girl is stroking every kitten (9d)	FALSE	TRUE	**57% true,** 43% false

5 General discussion of studies 1 and 2

The results from Study 1 and Study 2 on Russian are, on the surface, contradictory. In Study 1, participants had a very strong preference for the surface-scope reading, especially for SVO sentences, but also for OVS sentences. In Study 2, participants quite readily allowed the inverse-scope reading, although still less so for SVO than for OVS sentences. (This pattern held at the individual level, with 8 of 17 participants allowing inverse scope for both SVO and OVS word orders).

In fact, performance on SVO order in Russian in Study 2 was nearly identical to performance in the English version of the study.

Two differences between the two studies must be considered: a difference of populations and a difference of test design. The participants in Study 1 were mostly Russian speakers in Russia and even for those speakers tested abroad, most had left Russia relatively recently; in contrast, the participants in Study 2 were primarily Russian speakers in the U.S. It is possible that the observed higher preference for the inverse-scope readings could be attributed to the influence of English in Study 2. This seems unlikely, however: the three Study 2 participants tested in Russia showed the same pattern as the 14 tested in the U.S. However, to rule out an effect of English for certain, more participants in Russia need to be tested for the Study 2.

The second possible source of differences is the test design. The pictures in Study 2, unlike the stories in Study 1, did not set up either the subject or the object as the topic. It is possible that participants were assigning different information-structure configurations to the sentences in the two studies: in Study 1, participants interpreted the subject in SVO sentences as the Topic, but in Study 2, they did not assign a topic-focus configuration to the sentences at all. Given that the sentences in both studies were presented visually rather than auditorily, we have no control over the prosodic contour that participants imposed on the sentence: they may, for example, have assigned a contrastive interpretation to the sentence. A possible direction for future research would be to present the sentences auditorily; another direction would be to conduct a follow-up study in which the object is set up as the topic, and to see if this would influence performance on the OVS sentences.

6 Conclusion and future directions

The Study 2 results are consistent with Antonyuk's (2006) proposal that Russian, like English, allows inverse scope readings. However, the differences between Study 1 and Study 2 for Russian suggest that surface scope is strongly preferred when the preverbal element is clearly the topic, thus providing partial support for Ionin's (2002) proposal. Furthermore, the difference between SVO and OVS orders, in both studies, suggests that the preverbal subject is more likely to be interpreted as a topic than the scrambled object. As discussed above,

more research is needed to determine the effect of information structure as well as prosody on Russian scope.

More research is needed to determine whether inverse-scope readings are just as available in Russian as in English, only dispreferred for processing reasons (cf. Anderson 2004); or whether the availability of inverse scope in Russian depends on a particular information-structural configuration. A related question to explore is whether inverse scope in English at all is related to information structure.

References

Anderson, C. 2004. The structure and real-time comprehension of quantifier scope ambiguity. Doctoral dissertaion, Northwestern.

Antonyuk, S. 2006. The scope of quantifier phrases in Russian: A QR analysis. Linguistics in the Big Apple. <http://web.gc.cuny.edu/dept/lingu/liba/CSN2006.html>

Bailyn, J. 1995. A configurational approach to Russian 'free' word order. Doctoral dissertation, Cornell University.

Fox, D. 2000. *Economy and semantic interpretation.* Boston: MIT Press.

Heim, I. and A. Kratzer. 1998. *Semantics in generative grammar*. Malden, MA: Blackwell.

Ionin, T. 2002. The one girl who was kissed by every boy: Scope, scrambling and discourse function in Russian. In *Proceedings of ConSole X,* ed. M. van Koppen. Student Organization of Linguistics in Europe.

Ioup, G. 1975. Some universals for quantifier scope. In *Syntax and Semantics 4,* ed. J. P. Kimball. New York: Academic Press.

Junghanns, U. and G. Zybatow. 1997. Syntax and information structure of Russian clauses. *Proceedings of the Annual Workshop on Formal Approaches to Slavic Linguistics: The Cornell Meeting,* 289-319.

King, T.H. 1995. *Configuring Topic and Focus in Russian.* Stanford, CA: CSLI Publications.

Kurtzman, H. S., and M.C. MacDonald. 1993. Resolution of quantifier scope ambiguities. *Cognition 48*: 243-279.

May, R. 1985. *Logical form: Its structure and derivation*. Boston: MIT Press.

Tunstall, S. 1998. The interpretation of quantifiers: Semantics and processing. Doctoral dissertation, University of Massachusets.

agusico2@illinois.edu, tionin@illinois.edu