

Anaphoric dependencies in real time: Processing of Russian numerical constructions

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Natural language has numerous ways to encode anaphoric dependencies, including filler-gap (movement) constructions, antecedent-anaphor relations, control, variable binding, and coreference. Such relations can be created in the syntax (e.g. movement constructions), in the semantics (e.g. variable binding), or in the discourse (e.g. coreference). Reuland 2011, building on Reinhart 1983 and others, proposes the following hierarchy in the economy of the encoding of anaphoric dependencies.

- (1) syntax < semantics < discourse

The hierarchy translates into processing preferences; the processing of dependencies farther to the left should be easier than the processing of those to the right. A specific prediction is that syntactic dependencies require less processing effort than discourse-derived dependencies (Koorneef 2008). In other words, movement is, perhaps surprisingly, less burdensome for processing than pronominalization. To test this prediction, this paper analyzes two constructions from Russian which have not been previously fully analyzed. They minimally differ on the surface but we show that they involve distinct kinds of anaphoric dependencies. An experimental study confirms that the syntactic dependency requires less effort than the discourse dependency.

In the Russian examples in (2), a nominal can be fronted out of a numerical expression, stranding a modifying numeral. When the stranded numeral is a so-called paucal number (1.5, 2, 3, 4, and the expression ‘both’), the fronted nominal can appear in a form that matches in number with the numeral, (2a), or in a non-matching plural form, (2b).

- (2) a. *A' movement dependency: matching morphology*
Sobor-a v gorodke bylo tri ~~sobor-a~~
cathedral-PAUCAL in town was three.PAUCAL
- b. *pronominal coreference dependency: non-matching morphology*
Sobor-ov v gorodke bylo tri pro
cathedral-PL in town was three.PAUCAL
‘As for cathedrals, there were three in that town.’

We argue that the construction with matching between the fronted element and the numeral (2a) involves A'-movement of the fronted element but (2b) without matching involves co-indexation between the fronted element and a null pronoun, as shown. Evidence comes from island sensitivity, number connectivity, binding reconstruction, parasitic gaps, word order, and resumption with a pronoun or epithet. For example, only the matching form is sensitive to islands (in blue), (3), and only the matching form reconstructs to yield a Binding Principle C violation, (4).

- (3) a. *Ženixa ja pomnju [vremja [kogda u nee bylo tri ženixa]]
suitor.PAUC 1SG remember time when by her was three
- b. Ženixov ja pomnju [vremja [kogda u nee bylo tri pro]]
suitor.PL 1SG remember time when by her was three
‘As for suitors, I remember the time when she had three.’

- (4) a. [Raza kogda Mašu_i xvalili] ona_{k,*i} nasčitala tri {...}
 time.PAUC when Masha.ACC praised she counted three
 ‘She_{k,*i} found three times when Masha_i got praised.’
- b. [Raz kogda Mašu_i xvalili] ona_{k,i} nasčitala tri *pro*
 time.PL when Masha.ACC praised she counted three
 ‘As for times when Masha_i got praised, she_{k,i} counted three.’

In contrast, only the base-generated non-matching form allows an expletive (in red) at the post-numeral position because pronouns but not traces alternate with overt elements, (5).

- (5) a. Želanija u Peti bylo tri (*štuki)
 wish.PAUC by Petya was three piece.PAUC
- b. Želanij u Peti bylo tri (štuki)
 wish.PL by Petya was three piece.PAUC
 ‘Wishes, Petya had three’.

We conclude that the matching form (2a) involves A'-movement, a syntactic dependency, and the non-matching form (2b) involves coreference, a discourse dependency. The contrast replicates the well-known distinction in Romance between topicalization and Hanging Topic Left Dislocation. The minimal pair is an excellent candidate for a processing study.

The hierarchy in (1) predicts that (2a) should be processed more easily than (2b). We test this prediction in a reading time experiment. The results show a strong effect of the number difference ($p=0.0085$), with a statistically significant slowdown in reading time in the region after the numeral in the non-matching case (discourse dependency) compared to the matching case (syntactic dependency). The result supports Reuland's hierarchy in (1) and is particularly striking since matching topics are less frequent than non-matching ones (5 tokens of (2a) vs. 12 tokens of (2b) over 1000 randomly selected sentences from the Russian National Corpus, <http://www.ruscorpora.ru/en/index.html>).

We reject an alternative explanation of the data in which the reading time slow down is due to a simple morphological mismatch, which has been noted by several studies (e.g. Molinaro et al. 2011). First, agreement mismatches in Russian numeral expressions do not otherwise result in reading time slow down (Xiang et al. 2011). Second, native speakers rated the two constructions comparably; in other studies, agreement mismatch has yielded lower acceptability ratings (Fanselow and Frisch 2006).

In conclusion, our analysis of a syntactic minimal pair in Russian forms the basis of a processing study comparing a syntactic dependency to a discourse dependency. Our experimental investigation of the two constructions shows that syntactic dependencies are processed more quickly than discourse dependencies, providing novel support for the hierarchy in (1). From a processing perspective, movement is less burdensome than pronominalization.

References

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