

Routes to Prominence in Free Word Order Language Discourse

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Abstract

Perceived prominence in Russian, a free word order language, can be communicated prosodically and/or via word order. Paired production and perception experiments with native speakers show that discourse-prominent constituents are marked acoustically and through a change in word order. These two route to prominence may reinforce each other, as evident from distinctively higher duration and intensity values associated with ex-situ words, as well as their higher visibility in discourse.

1. Introduction

An essential aspect of comprehending language, in written or spoken modalities, is interpreting the status of a linguistic entity relative to the discourse or narrative context. A word or phrase can be introduced as information that is new to the discourse and as relatively important or emphasized, or as given information of lesser significance, and languages may express discourse status by means of prosody, morphology, and the sequencing of constituents within the sentence [1]. This paper investigates the relationship between phrasal prosody and word order in the expression of information structure (IS) in Russian, a free word order language. Results from speech production experiments, and speech and text comprehension experiments are examined to test whether prosody and word order are typically used independently or together in the encoding and decoding of IS in discourse.

Russian is chosen as the test case because first, it allows but does not require surface reordering of sentential constituents for information structural purposes, and second, it exhibits distinctions in prosodic prominence among the constituents of a sentence [2,3].

1.1. IS and Prominence

In languages like English and German, it is generally the case that a word can be assigned prosodic prominence as an expression of its discourse status regardless of its position within the utterance, i.e., *in situ* [4,5]. While the phrase-final position is the default location of the primary prominence in English, the phenomenon of metrical reversal shown in (1-2) illustrates prominence displacement, where the primary prominence shifts leftwards to signal the status of the prominent entity as new or with contrastive focus (examples from [6]).

(1) Joel bought a green CAR.¹

(2) Joel bought a GREEN car.

Apart from prosodic marking, the sequencing of constituents within the utterance or sentence presents an alternative route for encoding IS in so-called free word order languages, eg. in the Italian sentences in (3) below (from [7]), by dislocating the subject noun from its canonical (pre-verbal) position, a speaker or writer deploys the tool of *ex-situ prominence* [7,8] thereby marking the subject as focused and prominent:

(3) E' arrivato MARIO.

arrived Mario

Given that prosody and word order provide two means for encoding IS, it follows that some languages may utilize both mechanisms. This prediction is confirmed for Georgian [8], where the distribution of in- and ex-situ prominence maps onto two different foci types: Ex-situ contrastive or exhaustive focus and in-situ prosodically prominent informational focus. Dual

¹ Here and below prominent words appear in capital letters.

marking of discourse prominence has been reported for the variety of Romani spoken in Komotini, where focus marking is accomplished via a combination of prosodic and morphosyntactic strategies employed in the same utterance [9].

1.2. Encoding IS in a free word order language

For languages that may utilize more than one strategy to mark discourse-prominent information, we may ask how structural and/or prosodic means may apply selectively or concurrently in order to communicate different categories of information in discourse. Here we explore this issue for Russian. The semantically neutral, default word order in Russian is SVO, and as in other free word order languages, a word can appear in its canonical position (in-situ), fronted, or post-posed. The ordering of the constituents in a sentence marks IS and not grammatical function. To illustrate, both (a) and (b) are possible continuations for the sentence in (5), in different discourse conditions. In the context provided in (5), the word *Ivan*, critical to the understanding of who is doing the cooking, may be located in the rightmost position, where it is structurally prominent (as in b), or it may occur pre-verbally as in (a).

(5) Tri druga, Ivan, Petr, i Andrey, nahsli novjij retsept pizzj.

Three friends, Ivan Petr and Andrey, found a new pizza recipe.

- a. IVAN gotovit pizzu.
Ivan-SUBJ cooks pizza-OBJ
- b. Pizzu gotovit Ivan.
pizza-OBJ cooks Ivan-SUBJ

In this study we test the hypothesis that the difference in word order illustrated in (5) is accompanied by a difference in prosodic prominence (assigned to *Ivan* in this example). We explore how prosody and word order function independently and in combination to mark IS in Russian.

A production experiment and an off-line perception experiment were administered to

determine (1) whether the perceived prominence of a word is dependent on its sentential position; (2) whether non-canonical word order by itself is a sufficient tool to mark IS, (3) whether concurrent prosodic marking of ex-situ constituents is necessary to confer greater discourse salience.

Our general hypothesis is that positioning of a word in a designated ex-situ position is an independent cue to prominence, which may be further reinforced with acoustic-prosodic features associated with such position. To test this hypothesis, a miniature corpus comprised of two authentic Russian texts is analyzed for word order and IS properties. Read productions of these texts are analyzed for acoustic evidence of prosodic marking in relation to word order and IS. Perceptual rating studies were performed using written and spoken utterances. Experimental results are analyzed for the relationship between word order, prosodic marking and perceived prominence.

2. Experiment 1: Production task

2.1. Method

To obtain a range of word order and prosodic discourse features, two published narratives were read orally by 8 female speakers of Russian (ages 21-38). The miniature corpus included a short folk tale (text A) and an excerpt from the biography of a Russian poet (text B). With an average sentence length of 5.2 content words (SD =1.77), approximately 30% of the sentences in the chosen narratives deviate from the canonical SVO order.

Following a discourse annotation framework introduced in [10], the miniature corpus was annotated for four kinds of IS categories: 'THEME' (discourse-given), 'RHEME' (discourse-new), 'MEDIATOR' (inferable), and 'CONNECTOR' (function words). Annotations were independently done by one of the authors (TL) and a second native

speaker of Russian. Inter-rater agreement (linearly weighted Kappa) between the annotators, across texts was very strong: $\kappa=0.89$, $SE=0.03$, $\alpha=0.05$.² Words were also marked for Focus, and for sentential position as in-situ or ex-situ (specifically, ‘Fronted’ or ‘Post-posed’, relative to SVO order).

The observed distribution of IS categories in different sentence positions differed by text: while a reliable association held between the features ‘fronted’ (an ex-situ word is positioned sentence-initially) and ‘RHEME’, no such association held between features ‘Fronted’ and ‘THEME’, Pearson $\chi^2=11.26$, $P=0.001$. Such association between the surface order of the constituents and their IS category provides evidence that word order variability in the Russian corpus is used to promote novel information to the clause-initial position.

Acoustic measures were examined as correlates of prosodic prominence, and analyzed for their relationship to the IS and sentential position of a word. The acoustic-prosodic measures of f0 (Hz) and intensity maxima, and vowel duration were taken from the stressed syllable of each IS-coded content word in the corpus for a total of 230 words.³ The relationship between normalized averaged acoustic measures, IS category, and sentential position of a word was then tested in a series of linear, mixed effects multivariate regression analyses.

2.2. Results

Successful predictors of the acoustic measures extracted from the corpus (see Table1) include RHEME, which is

² Maximum possible κ , given observed marginal frequency=0.94.

³ The values of max f0 and max intensity were taken from the center region of the vowel, excluding 20 ms from the left and right edges of the vowel as identified by acoustic criteria, and normalized within-utterance.

associated with higher mean values of intensity and duration, and Focus, associated with significantly higher f0 maxima. All acoustic measures, i.e., max intensity, duration, and max f0 are successfully predicted by the sentential position of the target word, with significantly higher values for words that appear ex-situ and fronted.

Table 1: Predictors of the stressed vowel intensity, duration, and f0, with respect to the carrier word⁴:

(max)intensity	(max)f0	vowel duration
ex-situ, fronted ($t=2.01$, $p<0.05$)	ex-situ, fronted ($t=2.13$, $p=0.03$)	ex-situ ($t=2.01$, $p=0.05$)
RHEME ($t=1.93$, $p=0.055$),	focus(emphatic/ contrastive) ($t=2.68$, $p=0.01$)	RHEME ($t=2.94$, $p<0.01$)
*CONNECTOR ($t=-3.1$, $p<0.01$)	*MEDIATOR ($t=-2.72$, $p=0.01$)	*CONNECTOR ($t=-3.08$, $p<0.01$)

*This factor predicts a lower value for the parameter of interest.

3. Experiment 2: Prominence Rating Task

Analysis of the production data established that the acoustic parameters of f0, intensity, and duration vary in relation to the IS category of a word and focus, and are also associated with its sentential position in the sentence. To determine if some/all of these parameters significantly affect listener’s perception of a word as prominent, i.e., as important in relation to the discourse meaning, structural and acoustic-prosodic cues to prominence were determined on the basis of reading and auditory comprehension tasks performed by linguistically naïve native speakers of Russian (N=49 (reading modality), N=27 (auditory modality)).

3.1. Method

An offline perception task was conducted with 39 clause-size excerpts from the

⁴ Factors ‘speaker’ and ‘word’ (not shown in Table1) were included in the model as random effects.

miniature corpus. A clause (vs. an intonation phrase) was chosen as a unit of presentation as it expresses one relatively complete idea and can be perceived as a whole. Each clause, or target segment, was presented along with the preceding context. The mode of presentation was either written text or audio recording performed by one female speaker of Russian (age=28). Respondents read the entire portion of the text preceding the target segment, read or listened to the target segment and identified discourse-prominent word(s) in the target segment by associating them with one level of the binary variable “+/- prominent”. Following [11], no formal definition of prominence was given. Participants were instructed to mark only those words that ‘were the focus of their attention’ in the utterance, based on the preceding context. Any number of content words could be marked as prominent.

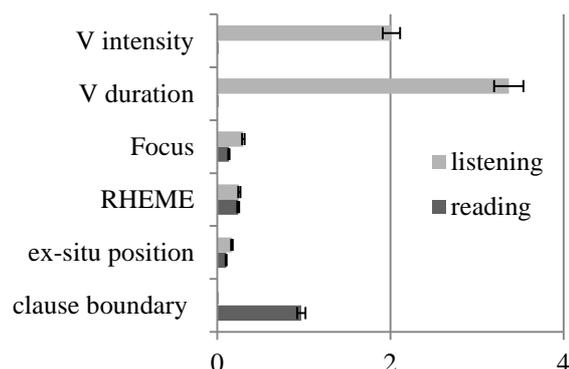
3.2. Results

Consistency of the responses: Responses to the prominence rating task were assessed for inter-rater agreement. The agreement coefficients obtained translate into fair, though highly significant agreement levels: Fleiss’ kappa=0.26 ($p<0.001$) for the written and 0.36 ($p<0.001$) for the auditory modality.

Correlates of perceived prominence: Following [12], each word in the narratives was assigned two discourse salience scores (one per test modality), which were obtained by dividing the total number of times a word was chosen as salient by the total number of participants who responded to the relevant test question. These prominence scores were used as a quasi-continuous measure of perceived prominence, and were submitted to linear regression analyses in which predictors for prominence perception included those listed in Table 1, with the variables ‘*participant*’ and ‘*test item*’ as random effects.

In silent reading of the Russian corpus, words associated with higher prominence scores were those that were located at clausal boundaries ($t=1.97$, $p=0.05$), in ex-situ position ($t=2.08$, $p<0.05$), carrying new information ($t=4.55$, $p<0.001$), and focused contrastively or emphatically ($t=2.61$, $p=0.01$). In the auditory modality, these factors are complemented with two acoustic predictors, duration ($t=2.02$, $p=0.05$) and intensity ($t=2.24$, $p<0.05$). Figure 1 summarizes the findings of the perceived prominence analyses.

Figure 1: Weight of significant predictors of perceived prominence by modality: *Predictor weights (x-axis) as determined by the associated regression coefficient for the significant predictors from the rating task (y-axis).*



4. Discussion

Analysis of perceived prominence in Russian was conducted to determine which factors guide naïve readers’ or listeners’ perception of a word as prominent in a discourse or narrative. A special point of interest was to determine whether variation in word order can be utilized as a means of encoding the information status of a word and its perceived prominence. Results demonstrate that independent of the modality of presentation, words associated with new information or Focus are perceived as more prominent. In a free word order language such as Russian, information status is encoded via two routes, prosodic and syntactic.

In the auditory modality, listeners treat the acoustic-prosodic realization of a word as a cue to its discourse status. This is evident from the finding that greater duration and intensity of the stressed vowel reliably trigger perception of a word as prominent. About 30% of the utterances in the mini corpus of published narratives used in this work deviate from canonical word order. Results of the prominence rating task show that apart from the acoustic effects of prosody, an ex-situ position of a word also contributes to its perception as prominent. Analysis of the syntactic and acoustic-prosodic characteristics of perceived prominence reveals that different cues to prominence may apply concurrently: When the word is situated non-canonically, it is more likely to have a higher prominence score and, in the auditory modality, to perceptually stand out by virtue of having greater duration and intensity. The distinctive acoustic realization of a non-canonically positioned content word may not only cue its relatively high informational load and discourse prominence, but may also (redundantly) signal that the word is left- or right- dislocated. This is evident from the finding that most of the prominence predictors are selectively associated with clause-initial and clause-final sentential positions which may be reserved for words carrying higher informational load. This result is consistent with the previous findings that Russian exhibits focus fronting and right-edge dislocation for IS purposes [3,13].

5. Conclusion

This study contributes to the understanding of discourse-prominence in a free word order language. While results of the production and perception experiments performed by linguistically naïve native speakers of Russian reveal that perceptually salient acoustic-prosodic realization of discourse-prominent information holds

under free word order, further studies are necessary to determine whether cross-application of prominence cues is characteristic of all vs. select categories of discourse-prominent information and whether its effect is additive, i.e., leading to a word being associated with a yet greater degree of perceived prominence.

References

- [1] Morgan, J. L., Meier, R. P., & Newport, E. L. (1987). Structural packaging in the input to language learning: Contributions of prosodic and morphological marking of phrases to the acquisition of language. *Cognitive Psychology*, 19, 498–550.
- [2] Sekerina, I. (2003). Scrambling processing: Dependencies, complexity, and constraints. In S. Karimi (ed.), *Word order and scrambling UK*: Blackwell, 301–324.
- [3] Slioussar, N. (2011a). Processing of a free word order language: The Role of Syntax and Context. *Journal of Psycholinguistic Research*, 40:291–306.
- [4] Ladd, R. D. (2008). *Intonational Phonology*. Cambridge University Press.
- [5] Katz, J., Selkirk, E. (2011). Contrastive focus vs. discourse-new: Evidence from phonetic prominence in English. *Language*, 87, 771–816.
- [6] Calhoun, S. (2010). The Centrality of Metrical Structure in Signaling Information Structure: A Probabilistic Perspective, *Language*, 86(1), 1–42.
- [7] Donati, C. & N. Nespors (2003). From Focus to Syntax. *Lingua*, 113–11, 1119–42.
- [8] Skopeteas, S. & Fanselow, G. (2010). Focus in Georgian and the expression of contrast. *Lingua*, 120, 1370–1391.
- [9] Arvaniti, A. & Adamou, E. (2011). Focus expression in Romani. In *Proceedings of the 28th West Coast conference on Formal Linguistics*, Somerville, MA: Cascadilla Proceedings Project.
- [10] Calhoun, S., M. Nissim, M. Steedman, and J.M. Brenier. (2005). A framework for annotating information structure in discourse: Pie in the Sky. *Proceedings of the workshop, ACL*, 45–52.
- [11] Cole, J., Mo, Y., & Hasegawa-Johnson, M. (2011). Signal-based and expectation-based factors in the perception of prosodic prominence. *Laboratory Phonology*, v.1, 2011, p. 425–452.
- [12] Mo, Y., Cole, J., & Lee, E. (2008). Native listeners? Prominence and boundary perception. *Speech Prosody 2008*.
- [13] Neeleman, A., Titov, E. (2009). Focus, contrast, and stress in Russian. *Linguistic Inquiry* 40, 514–524.