

## Prosody of Scrambling\*

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### 1. Introduction

The interaction between prosody and word order has been of significant cross-linguistic interest in generative linguistics (Valld 1992, Cinque 1993, Selkirk 1995, Zubizarreta 1998, Reinhart 2006, Büring 2007, *i.a.*). In Slavic languages, which exhibit significant freedom of word order (Bailyn 1995 and many others) the effects of prosody on word order permutations, known as scrambling, have received limited attention. Although a number of studies refer to the role of intonation, stress, or focusing on the sentence interpretation, oftentimes these claims are based on the authors' intuition and are not supported by experimental results. Recent advances in experimental methods have prompted emergence of research based on solid empirical data from Slavic languages (see Zybatow & Mehlhorn 2000, Kallestinova 2007, Féry, Paslawska & Fanselow 2007); nevertheless, studies directly addressing correlation of scrambling and prosody in various Slavic languages are scarce.

In this paper we present novel evidence for the role of prosody in Ukrainian - a 'free-word-order' intonational language, exhibiting optional direct object scrambling. The major questions addressed in the study are whether prosody operates as an alternative to scrambling and whether the absence of scrambling in definite and/or partitive contexts is represented by a distinct prosodic contour. Eight female native speakers of Ukrainian (age range 20-52) participated in a sentence-reading experiment. Their speech was submitted to a detailed acoustic analysis, with special attention to the prosody of scrambled and non-scrambled syntactic structures. The results demonstrated that Ukrainian speakers produce several types of prosodic contours depending on the semantic and syntactic properties of involved constituents. Particularly, basic SVO structure has a distinct prosody if it contains a definite/partitive direct object (as compared to an indefinite object), which suggests that object scrambling and prosodic shift are two options available in a free-word order language to mark object semantics.

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## 2. Background Information

Many studies have investigated variations in the syntactic position of arguments and identified aspects that contribute to these variations, i.e., direct object type (pronoun versus DP), semantic/pragmatic context, and prosody. In Slavic languages, interpretational correlates of scrambling are traditionally associated with information structure: basic word order is SVO, but old/known/given objects may also appear in a pre-verbal position, yielding such structures as SOV, OSV, or OVS. New/unknown objects, on the other hand, usually remain in their base post-verbal position (Firbas 1964, Sgall, Hajičová, & Panevová 1986, Yokoyama 1986, among many others). However, scrambling is a very widespread phenomenon cross-linguistically, and in other languages, its semantic/pragmatic properties can be defined in other terms. For instance, in Germanic tradition, direct object scrambling (or shift) is associated with the semantic features of specificity or definiteness (see Diesing 1992, Diesing & Jelenek 1993, i.a.). It appears that there are some overlapping syntax-semantic characteristics of a scrambled object cross-linguistically, defined by Thráinsson (2001:193) as follows: a weak/existential reading is incompatible with Object Shift (or scrambling), *but* objects with a strong/quantificational/specific reading do not necessarily have to shift or scramble. With regard to Slavic languages it has also been shown that: *i*) there is a correlation between definiteness/specificity and scrambling (Dyakonova 2004, Brun 2005, Biskup 2006); and *ii*) an SOV structure has a special status in Russian as one of the most commonly used (Kallestinova 2007, Slioussar 2007, Dyakonova 2009). In view of such considerations, it seems reasonable to focus on the SOV scrambled structure and its use in various semantic/pragmatic contexts.

In this paper, we investigate short object scrambling from SVO to SOV, and consider definiteness and partitivity as semantic features of a direct object defined by the previous context. We define *definiteness* as the speaker's assumption that the hearer shares the speaker's presupposition of the existence of a unique individual in the set denoted by the NP (based on Heim 1991)<sup>1</sup>. By *partitivity* we mean a semantic feature that denotes an individual that is a member of a set introduced by previous discourse (also defined as specific in Enç 1991, or as presupposed in Diesing 1992). The following discussion of these properties is based on data from Ukrainian.

### 2.1 Word Order in Ukrainian

In Ukrainian, scrambled direct objects NPs typically have definite / partitive / given / presupposed interpretation, as shown in (1). On the other hand, direct objects in their base position are likely to be interpreted as indefinite / nonspecific / new (assuming default prosody), as exemplified in (2) (see more in Mykhaylyk & Ko 2008).

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<sup>1</sup> Only two types of definiteness are considered: *i*) unique by previous mentioning (e.g., I saw a *black cat* in the street [...] I brought the black cat home), and *ii*) unique in a given setting (e.g., *the desk, the ceiling, the floor, etc.*) (as defined in Ko, Ionin & Wexler 2010).

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- (1) Maria (svij) persten' znajšla  
Marija (self) ring found  
'Maria has found (her) ring'
- (2) Maria znajšla persten'  
Marija found ring  
'Maria has found a ring'

However, an object does not need to scramble to achieve a definite reading. The same constituent, with the same interpretation, may stay *in situ* (as in (3)).

- (3) Maria znajšla (svij) persten'  
Marija found (self) ring  
'Maria has found her ring'

These examples illustrate a well-known puzzle about the optionality of scrambling, which comes down to the observation that scrambled objects are associated with a particular interpretation, but the same interpretation can also be obtained in the basic structure. The most immediate question is then: how to explain this optionality? To answer this question we have to look at the basic structure more precisely, and to find out whether it undergoes any changes in the absence of scrambling.

### **2.2 Prosody of Ukrainian**

The basic line of investigation is suggested by the behavior of pronouns. Pronouns show a very strong tendency to scramble in many languages (including Ukrainian) (see Richards 2006, for e.g.). Thus in (4), the personal pronoun *joho* scrambles leftward and cannot remain postverbal without infelicity. Interestingly, the scrambling requirement can be circumvented, and pronouns “kept in place,” under special conditions. A prosodic recontouring from neutral intonation to verb-stressed intonation will allow the pronoun to remain *in situ* (5).

- (4) Maria joho znajšla  
Marija it.SgMasc found  
'Maria has found it'
- (5) Maria ZNAJŠLA joho  
Marija found it.SgMasc  
'Maria has found it'

This effect appears to be general. As noted above, NPs very typically show definite interpretation in a scrambled position (as in (1)). But when these elements, with the same interpretation, stay *in situ*, they receive a distinct prosody comparable to that of post-verbal pronouns (as shown in (6)).

- (6) Maria            ZNAJŠLA    (svij) persten'  
Marija            found        (self) ring  
'Maria has found her ring'

However, the change in sentence prosody in (6) is not as easily detectable as that in (5) with the pronoun, and the effect becomes even more subtle in other examples. Therefore, an experimental study with a detailed acoustic analysis of these structures is needed in order to provide valid evidence for the effects of prosody on word order.

### 2.3 Theoretical Assumptions

Considering the observations presented above and a large body of literature on the interaction of prosody and word order, we propose that the assigned interpretation of an element may be encoded either through word order (syntactic movement) or through prosodic means.

Assuming Phase Theory (Chomsky 2001), we argue that scrambling occurs as follows: the functional head *v*, bearing an EPP feature and INT, probes its *c*-command domain for its goal (another instance of INT); upon finding one, *v* agrees with it; and the INT-marked item moves to the *v*P edge. If the EPP feature responsible for movement is present, scrambling occurs. If movement doesn't occur, but INT is valued as [definite/partitive], the prosodic rules shape the outcome at the Syntax-Phonology Interface.

### 2.4 Predictions

Based on the assumptions introduced above, the following core predictions were made: Ukrainian speakers will assign a distinctive prosodic contour to SVO sentences if they contain a definite/partitive direct object. Specifically, following Neeleman & Reinhart (1998) and others, we predicted that such SVO structures will have a falling pitch accent on the verb and a destressed object. We then conducted an experimental production study in order to provide valid evidence for the interaction of prosody, direct object semantics and word order.

## 3. Experiment

### 3.1 Method

#### *1. Participants*

8 adult native Ukrainian speakers (females, age 20-52) participated in the experiment. They were tested in the US shortly after their arrival, so that their language environment was primarily Ukrainian.

#### *2. Design and Stimuli*

The experimental task involved reading sentences which represented 8 conditions with different types of contexts, direct objects and syntactic structures. The table in (7) presents the design used in the experiment.

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(7) Experimental design: testing items distribution

direct object word order	<u>Definite</u>	<u>Indefinite</u>	<u>Partitive</u>	<u>Pronominal</u>
SOV	8	8	8	8
SVO	8	8	8	8

The same sentence appeared in 8 conditions, in which we manipulated the preceding context (to define the direct object semantics as Definite, Indefinite, Partitive, or Definite-Pronominal) and the word order structure (to place the direct object before or after the verb: SOV or SVO). In addition, to avoid any possible ambiguities and to make the testing materials as natural as possible, we marked all direct object NPs with a determiner: *cja/ta* ‘this/that’ for definite, *jakas* ‘some’ for indefinites, and *odna* ‘one’ for partitives<sup>2</sup>.

Stimuli used in the experiment are exemplified below in (8-15). Each context had two continuations – testing sentences with either scrambled or non-scrambled direct object. Hence, Condition 1 and Condition 2 differed only by the last sentence in which the definite direct object *tu rybynu* ‘that fish’ preceded the verb (as in (8)) or followed it (as in (9)). It was predicted that these sentences will be pronounced with a distinct prosody.

### Condition 1: Definite DPs & SOV

- (8) Včora xlopci spijmaly velyku rybynu. Roman pišov dodomu, a Ivan vyrišyv, ščo..  
 Yesterday, the boys caught a big fish. Roman went home, and Ivan decided that...  
 (SO<sub>[def]</sub>V) vin tu rybynu zvaryt’.  
**he that fish will.cook.**

### Condition 2: Definite DPs & SVO

- (9) Včora xlopci spijmaly velyku rybynu. Roman pišov dodomu, a Ivan vyrišyv, ščo..  
 Yesterday, the boys caught a big fish. Roman went home, and Ivan decided that...  
 (SVO<sub>[def]</sub>) vin zvaryt’ tu rybynu.  
**he will.cook that fish.**

The next testing pair is shown in (10) and (11). The same context in Condition 3 and Condition 4 does not introduce any object to be discussed in the subsequent sentence. The direct object *jakus’ rybynu* ‘some fish’ appears only in the last testing sentence and, thus, it is indefinite. Recall that the most natural position for an indefinite object is a post-verbal position (as in (11)) (see Section 2). Hence, the sentence in (11) is predicted to have more neutral, unmarked prosody than the sentence in (10) with the same direct object in a pre-verbal position.

<sup>2</sup> Note that all the direct objects have the same morphological form (Singular, Feminine, Accusative), and the same inflection. We also controlled, to the extent possible, for various ‘phonetics-specific’ factors, such as a number of syllables in a scrambled element, stress in the direct object NP, preference for sonorants in testing material, etc.

Condition 3: Indefinite DPs & SOV

- (10) Mama dumaje, ščo zvaryty sjohodni na večerju. Jakščo dity zahočut', to ...  
 Mom is thinking what to cook for dinner today. If children want, ...  
 (SO<sub>[indef]</sub>V) vona jakus' rybynu zvaryt'.  
**she some fish will.cook.**

Condition 4: Indefinite DPs & SVO

- (11) Mama dumaje, ščo zvaryty sjohodni na večerju. Jakščo dity zahočut', to ...  
 Mom is thinking what to cook today for dinner. If children want, ...  
 (SVO<sub>[indef]</sub>) vona zvaryt' jakus' rybynu.  
**she will.cook some fish.**

The following Conditions 5-8 were designed according the same principle: first, the context is introduced to clearly mark semantics of the object, and then this object is used in two testing sentences: scrambled or non-scrambled. In Conditions 5 and 6, the direct object is partitive – a part of a set of five fish (12-13), while in Conditions 7 and 8, the direct object is a pronoun referring to a previously mentioned object (14-15).

Conditions 5 & 6: Partitive context and two syntactic structures

Uranci Ivan spijmav bahato ryby. Pjat' rybyn vin dav svojij susidci, i vvečeri...  
 In the morning Ivan caught a lot of fish. Five fish he gave to his neighbor, and in the evening...

- (12) (SO<sub>[part]</sub>V) vona odnu rybynu zvaryla.  
**she one fish cooked**
- (13) (SVO<sub>[part]</sub>) vona zvaryla odnu rybynu.  
**she cooked one fish.**

Condition 7 & 8: Pronouns used in two syntactic structures

Včora Ivan zlovyv velyku rybynu i dav jiji susidci, a siohodni vin pobačyv, ščo...  
 Yesterday, Ivan caught a big fish and gave it to his neighbor, and today he saw, that...

- (14) (SOV) vona jiji varyt'.  
**she it cooks**
- (15) (SVO) vona varyt' jiji.  
**she cooks it**

Conditions 7 & 8 are used as controls only, as the prosody of sentences with a pronoun is very salient: the pronoun is usually destressed, and if it occurs in a post-verbal position, the preceding verb receives a falling pitch accent. The results obtained in these conditions will not be discussed in this paper.

### 3. Procedure

Each participant received 8 counterbalanced testing items and 8 fillers in a randomized order. The participants were given some time to familiarize themselves with the list of sentences, and then they had to read each sentence in its context aloud once. All speech samples were recorded to a personal computer.

### 4. Data Analysis Methodology

Target sentences were excised from the disambiguating contexts, analyzed acoustically and labeled using ToBI labeling conventions, assuming Pierrehumbert's (1980) autosegmental metrical view of prosody (see Igarashi 2002, Yokoyama 2001, and Ode 2001 on the annotation systems for Russian, a closely related language). All labeling was performed manually in simultaneous display of the waveform, wide-band spectrogram and F0 track.

## 3.2 Results

As part of the analysis, pitch contours in various types of structures and contexts were compared. In this paper we focus mostly on definite and indefinite contexts. First, we compare an SVO structure with an indefinite object (Fig. 1) to an SVO structure with a definite object (Fig. 2). It is evident that the prosody of these sentences differs considerably. As shown in Fig. 1, the verb is realized with a rising pitch accent, and the falling nuclear pitch accent is realized on the post-verbal indefinite object; while in Fig.2, the nuclear falling pitch accent is on the verb with the post-verbal definite object being prosodically destressed.

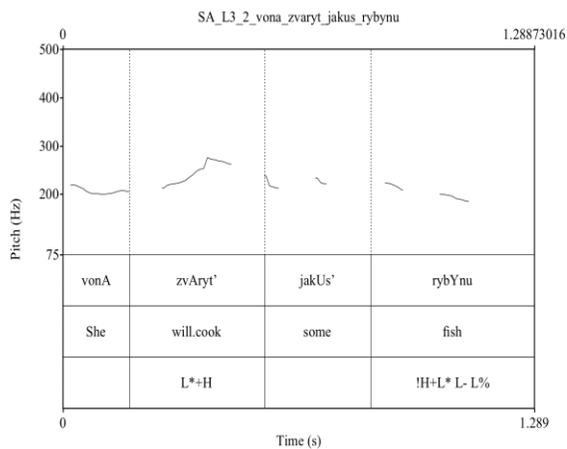


Figure 1. Indefinite object & SVO

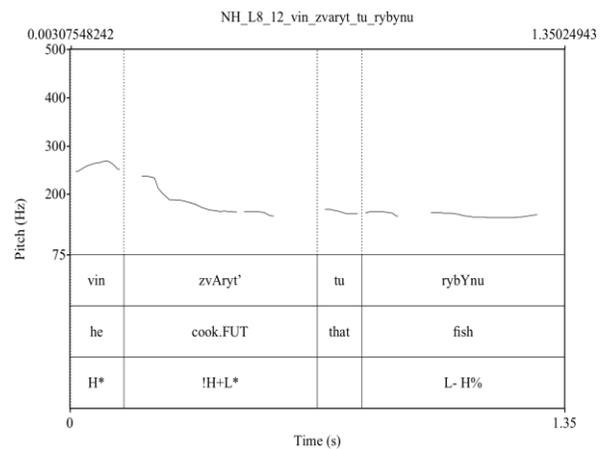


Figure 2. Definite object & SVO

Next, as shown in Fig. 3 and Fig.4, the same definite object occurring in two syntactic structures also receives different realization. Specifically, the definite object in the scrambled position is realized with a rising pitch accent while the same object in the non-scrambled position is prosodically destressed with the falling nuclear pitch accent being assigned to the verb.

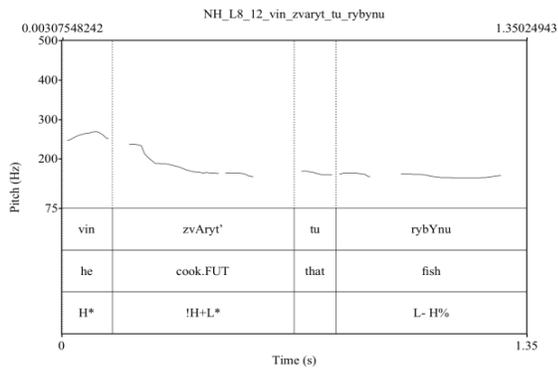


Figure 3. Definite object & SVO

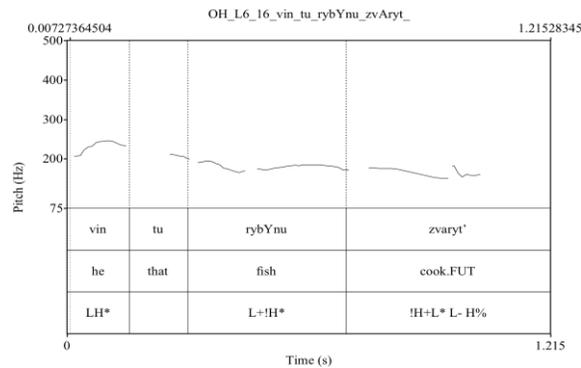


Figure 4. Definite object & SOV

These contour types have been identified for all speech samples, and then analyzed statistically. The group results were analyzed with regard to the object and verb prosody. In the object prosody we focus on the stress assignment. The graph below shows group results for all 8 conditions, but special attention in the following result presentation will be paid only to the first four conditions.

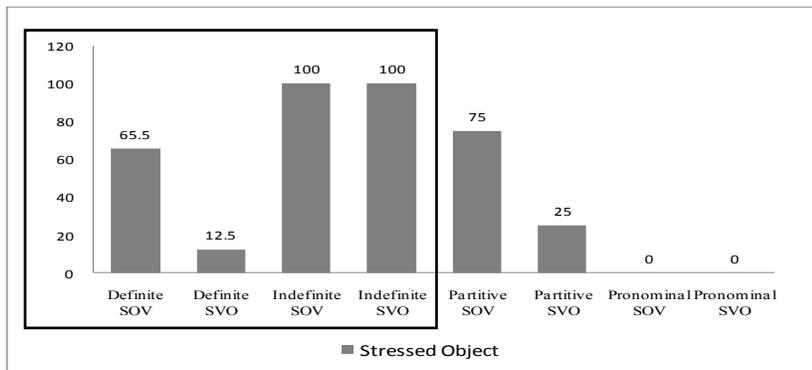


Figure 5. Group results: Percentage of stressed objects per condition

Figure 5 shows that the participants always stress an indefinite (new) direct object regardless of its position in a sentence. However, they rarely stress definite objects in basic SVO structure (12.5%), and thus there is a clear contrast between the Definite SVO Condition and Indefinite SVO Condition. This contrast is confirmed by the statistical analysis ANOVAs conducted with two independent factors (Object Type (Definite & Indefinite) and Word Order (scrambled SOV & non-scrambled SVO)) and a dependent variable: object stress. There is a significant main effect of scrambling ( $F(1;7)=7$ ;  $p=0.033$ ), highly significant effect of definiteness ( $F(1;7)=25$ ;  $p<0.002$ ), and interaction of scrambling and definiteness ( $F(1;7)=7$ ;  $p=0.033$ ). These results show that the stress assignment depends on the object semantics and word order.

A clear contrast between the Definite SVO and Indefinite SVO Conditions is also detected for the verb prosody, particularly for the pitch accent realization. As shown in Figure 6, the verb always receives a falling pitch accent in the Definite Context, but not in the Indefinite Context (100% vs. 25%, respectively), as was predicted.

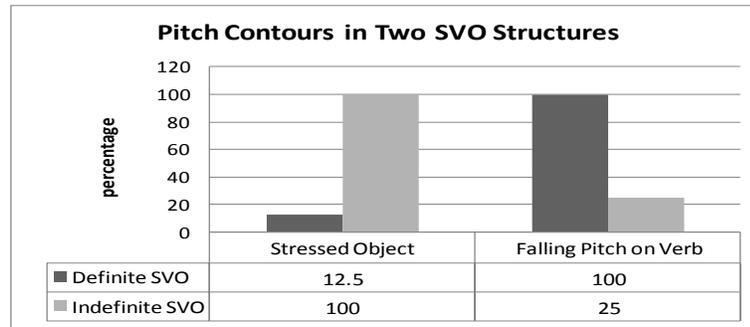


Figure 6. Group results: Definite SVO and Indefinite SVO Conditions

Although the results indicate clear differences between two types of the basic SVO structures, it is important to verify whether the same contrast holds for the other conditions. As shown in Figure 7 below, the definite object also receives a different realization depending on its position in the sentence: after the verb it is usually destressed (12.5%), while in a scrambled position before the verb it is mostly stressed (65.5%).

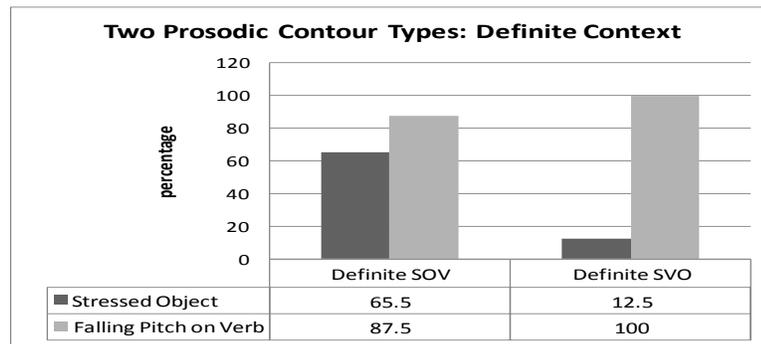


Figure 7. Group results: Two Definite Conditions

The group results for two Indefinite Conditions are of particular interest. As was mentioned earlier (Section 2), the indefinite direct object usually appears in the basic SVO structure, and the scrambled SOV structure is not normally associated with an indefinite interpretation of the object. Thus, in naturally occurring speech, sentences from the Indefinite SOV Condition should be avoided. However, if they are used, we predicted that their prosody should be highly marked.

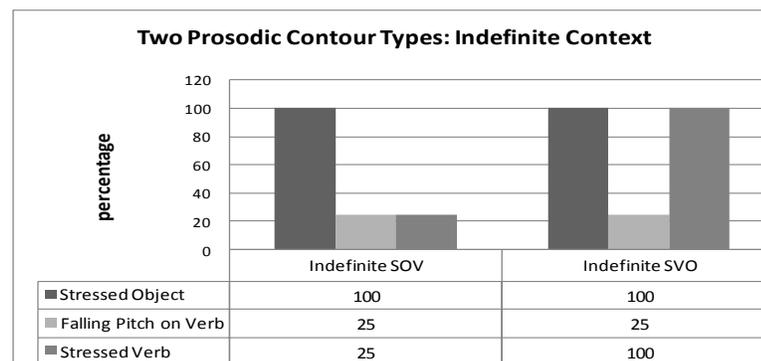
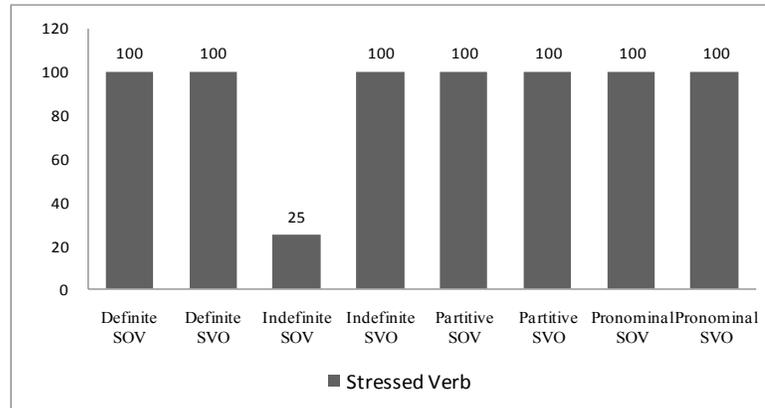


Figure 8. Group results: Prosody in two Indefinite Conditions

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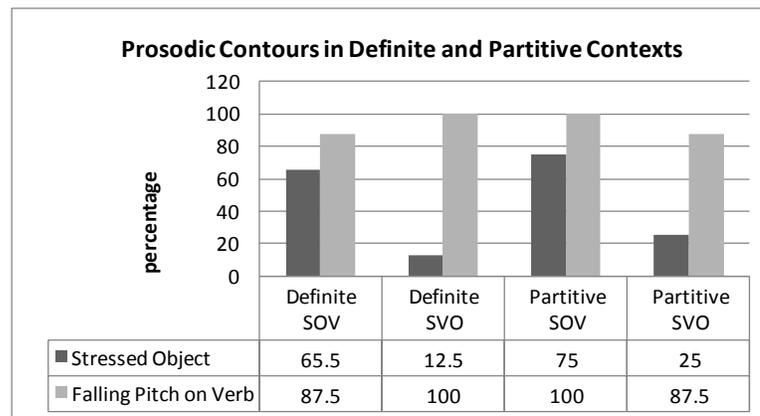
Figure 8 shows that while indefinite objects are always destressed regardless of their position in the sentence, the verb prosody in two conditions is different: the ‘infelicitous’ SOV structure rarely has a stressed verb (25%), and when the verb is stressed, it always receives a falling pitch accent.

Furthermore, if we consider stress assignment for all available data, the result is quite striking. The verb is invariantly stressed across all conditions, except the Indefinite Scrambled Condition. This is exactly as predicted: the indefinite object should not be scrambled, but if it is, such a sentence clearly stands out with regard to its prosody.



*Figure 9.* Group Results: Percentage of the stressed verb per condition

Finally, analysis of the group results for other conditions is also revealing, as it extends investigation of prosody-scrambling correlation to partitive contexts. It appears that partitive objects behave very similarly to definite objects.



*Figure 10.* Group results: Definite and Partitive Conditions

Figure 10 demonstrates that the partitive objects are mostly stressed in scrambled position (75%), but mostly unstressed in base position (25%). Furthermore, ANOVAs confirm that there is no statistically significant difference between definite and partitive contexts for object prosody ( $F(1,7)=9.33, p=0.018$ ). These findings suggest important similarities between prosodic and syntactic properties of definite and partitive objects in Ukrainian.

#### 4. Discussion

The results show clear contrasts between different types of structures: 1) indefinite objects in an SVO structure vs. definite and partitive objects in an SVO structure; and 2) indefinite object in an SOV structure vs. indefinite object in an SVO structure. Specifically, target SVO sentences with indefinite object NPs are produced with neutral prosody on which the verb is realized with a rising pitch accent (L\*+H), and the strongest falling pitch accent is realized on the object (consistent with the Nuclear Stress Rule (see Cinque 1993)). In contrast, the same SVO structures with definite or partitive object NPs have the strongest falling pitch accent realized on the verb (H+L\*), while the object is prosodically destressed.

Based on these findings and the theoretical proposal regarding optional scrambling (spelled out in 2.4), it can be suggested that when all preconditions for the syntactic movement are met, the outcome can be either a scrambled structure or a prosodically recontoured structure. We further propose the following Recontouring Rule: if the INT feature has been valued as definite/partitive, but movement has not applied, *don't stress the object and apply falling pitch to the verb*.

Our data also confirms that in the grammar of native Ukrainian speakers, the scrambled structure is normally associated with definiteness, and indefinite direct objects do not usually scramble. Therefore, when participants in our experiment encountered scrambled structures in indefinite contexts, they were forced to “repair” them by means of prosody. As a result, sentences in the Indefinite Scrambled Condition were realized with the most marked prosody: with a weakly pronounced verb, which was mostly destressed or had a falling pitch accent.

Importantly, our findings concerning partitive objects complement previous research on semantic/pragmatic effects of word order (see literature on information structure in Section 2) and on the prosodic effects associated with givenness (see Schwarzschild 1999 and others). In our experiment, definite objects are also given, known, or old (depending on the assumed theoretic approach) in that they are introduced in the discourse and then repeated in a target sentence or replaced by a personal pronoun. In this regard, our data can be perceived as evidence for the givenness effects in scrambling and for the object destressing associated with them. This seems to be correct, since the definition of givenness corresponds to definiteness by previous mentioning, i.e., for an element to be given, it must be entailed by previous discourse and must have a salient antecedent (based on Schwarzschild 1999). There are, however, some limitations in this theory. First, it predicts that any given object should be destressed (presumably in any position in the sentence if free-word order languages are considered), but this prediction could not be confirmed by our data: definite-given objects were destressed in their base position, but mostly stressed in the scrambled position. And second, the definition of givenness provided above does not specify what ‘a salient antecedent’ of a given element is. Is it ‘one and only one’ or unique antecedent, as we have in the case of personal pronouns or definite NPs? Is it salient to the speaker only or both to the speaker and the hearer? As our data show, not only definite objects, but also partitive objects are

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destressed in the post-verbal position. Can we consider a partitive object to be an element with a ‘salient’ antecedent in previous discourse? Even if it is so, it is salient to the speaker only, as the hearer might not know which one of several objects the speaker refers to. Since we are not in a position to provide answers to these questions, we assume that the chosen terminology allows us to provide an adequate analysis of the phenomena: both definite and partitive objects exhibit similar prosodic properties. We remain open to further discussions on this matter.

### **5. Conclusion**

In this paper, we have provided experimental evidence that scrambled direct objects and non-scrambled destressed direct objects are associated with the same interpretation. These findings imply that there is no true optionality in scrambling in the sense that object movement and prosodic recontouring are the two licit ways of expressing definite/partitive object semantics.

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*Prosody of Scrambling*

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