

The model of word order variation in Ukrainian declarative sentences

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In this article we present a model word order variation in Ukrainian. The analysis may be applied to also to other Eastern-Slavic languages (Russian and Belarusian), and also several other languages where the configurational (direct) word order is ‘neutral’ for native speakers, but sentences with violations of the direct word order remain comprehensible and grammatical. In our model we distinguish the structural and linear organisations of the sentence. Synonymous phrases with a different word order are analysed as “interpretations” of their structural invariant. We show that word order variation can be naturally described as interpretations of the invariable structural organisation. The movement occurs only in the linear organisation of the sentence. These cases differ from transformations, where both the linear and structural levels of organisation are changed at once (e.g. passive transformation), so the interpretation model represents those aspects of syntactic synonymy and ambiguity which could be systematically described without transformations. The model accounts for the stylistic distribution of Ukrainian declarative sentences with different types of word order, and for the linguistic intuition of native speakers about these sentences. It is also applied to the analysis of limitations on centre embedding for subordinate clauses in Ukrainian.

1. INTRODUCTION. In this article the relation between the linear and the structural organisations of the sentence is analysed within the framework of functional syntax. There is classical understanding of the concept ‘surface structure’, e.g. [McCawley, 1999], [Chomsky, 1957]. In functional linguistics the ‘surface structure’ is an essential component within the ‘semiotic’ model of syntax. It is understood as a level of syntactic representation which reflects the combinatorial properties of the grammatical categories and meanings and allows to establish the formal coherency of the sentence [Sovremennyy, 1989: 608], [Vyxovanets, 1993: 54]. The surface structure in this approach does not involve entities outside ‘syntactics’ – the sphere of meanings that are regularly expressed in a given language and are usually used to establish the ‘sign-to-sign’ relations in speech. This means, that no lexical category could be used for a description of the surface structure, e.g. ‘lexical projections’ or ‘transitivity’ belong to the level of the logical form, but not to the surface structure.

Ambiguous sentences and the declarative sentences with indirect word order are of particular interest for our research. These examples are peripheral for the analysis of the speaker’s linguistic competence, since while uttering the sentence the speaker knows exactly the way of disambiguating the ambiguous structure and the way of ordering words in configurational (the most neutral) manner. On the contrary, the problems of syntactic ambiguity and unconfigurational word order are central in the ‘recipient-based’ approach [Corriveau, 1995], where an adequate parsing model of the surface structure cannot be constructed without providing a solution for these problems.

We claim that word order variation variations in Ukrainian can be formally predicted only within the surface structure of a sentence. But on the other hand, the usage of a particular type of word order is related to phenomena outside the surface structure, and is related to semantics and pragmatics of the sentence (e.g. theme/rheme distinction) [Pumpyanskiy, 1974]. The proposed model accounts only for *formal constructive properties of the word order variations and syntactic ambiguity*. At this stage, the usage of word order types and disambiguating issues are left outside our analysis.

1. STRUCTURAL AND LINEAR ORGANISATION OF THE SENTENCE. Within the surface structure we distinguish two levels of organisation, which roughly correspond to the D-structure and the S-structure in the paradigm of “universal grammar”. The *structural* level represents the system of relations between words without respect to their linear ordering; the *linear* level of organisation consists of the structural organisation plus its projection into the linear sequence of words. Strictly speaking, the traditional understanding of the D-structure and S-structure both represent the linear level of the sentence organisation since the word order is integrated into syntactic representations in these cases. The D-structure resembles the structural level only in the sense that it represents the structural invariant of the synonymous sentences set. The D-structure is formed by the “direct projection” of the structural representation into the neutral word order, without movement of constituents. An abstraction of the D-structure from the linear ordering of words constitutes the structural level of the sentence organisation.

The linear level is formed by different ways of “linearization” of the structural organisation. Linearization maps the invariant of structural organisation into a set of synonymous sentences which differ by their word order, but have the same conceptual meaning. We are building a model that adequately reflects the set of possible word order variations in synonymous sentences.

2.1. WORD ORDER TYPES IN UKRAINIAN DECLARATIVE SENTENCES. Ukrainian, as most of other Slavic languages with rich inflectional morphology, does not require a fixed word order in declarative sentences, and the word order can vary in a relatively wide range, while the sentence remains grammatical. More compact formulation of word order restrictions will use “negative conditions” more than positive. For example, to describe word order restrictions in Ukrainian prepositional phrases, we can say that (1) word order variation can occur only within a clause; (2) a preposition cannot be linearly separated from a constituent of its NP (a noun or an adjective) that carries an appropriate case feature; (3) any constituents of the controlled NP cannot be placed before the preposition. Everything, which is not prohibited by these conditions, is allowed. So, for the following sentence several word orders variations will be acceptable:

Збираюся в далеку дорогу¹ (V prep N Adj)

I.prepare_{pres.sing.p1} [in_{prep/acc} long_{Adj.acc.sing.fem} journey_{Noun.acc.sing.fem}]

(I prepare for a long journey)

Acceptable indirect word order:

Збираюся в дорогу далеку (V prep Adj N)

В далеку дорогу збираюся (prep Adj N V)

В дорогу далеку збираюся (prep N Adj V)

В далеку збираюся дорогу (prep Adj V N)

В дорогу збираюся далеку (prep N V Adj)

The following sentences violate some of these conditions and are ungrammatical:

*В збираюся далеку дорогу (prep V Adj N) – condition (2) is violated

*Далеку в дорогу збираюся (Adj prep N V) – condition (3) is violated

*Дорогу в збираюся далеку (N prep V Adj) – conditions (2) and (3) are violated

¹ Ukrainian uses Cyrillic alphabet. I prefer not to transliterate Ukrainian examples from Cyrillic, and I apologize, if this causes any difficulty to readers of this paper.

The other type of restrictions is related to preserving/changing of the sentence meaning due to competition of morphological features. For example, in the following sentence an indirect linear ordering of this type is acceptable:

Хлопця збирають в далеку дорогу (N_{acc.masc} V_{3p.pl.} prep Adj_{acc.fem} N_{acc.fem})
 boy_{acc.sing.masc} they.prepare_{pres.plur.p3} in/acc long_{acc.sing.fem} journey_{acc.sing.fem}
 (the direct word order of the impersonal sentence) ⇒

В далеку хлопця збирають дорогу (prep Adj_{acc.fem} N_{acc.masc} V_{3p.pl.} N_{acc.fem})

On the other hand, if the gender feature of the direct object and the adjective inside the PP coincide, such indirect word order becomes unacceptable:

Дівчину збирають в далеку дорогу

girl_{N,acc.sing.fem} they.prepare_{V,pres.plur.p3} in/acc long_{A,acc.sing.fem} journey_{N,acc.sing.fem} ⇒
 **В далеку дівчину збирають дорогу* (prep Adj_{acc.fem} N_{acc.fem} V_{3p.pl.} N_{acc.fem})

Formally, in such interpretation an adjective modifies the noun “дівчину” – girl_{acc.sing.fem}, rather than the noun “дорогу” – journey_{acc.sing.fem}. We can say that in such cases linear organisation of the sentence cannot be mapped back to its original structural organisation, and the meaning of the sentence changes, because the moved constituent is put into a different structural position.

But any word order within a clause, which does not violate these constraints, is grammatically acceptable. A constituent can be moved to a random position outside its phrase, but as long as it may be related to an appropriate position in the sentence structural organisation (by the means of its morphological features), the sentence remains grammatical.

On the other hand, there is a clear distinction in stylistic distribution of sentences with different types of word order. Some types of indirect word order are clearly stylistically marked, the other are stylistically more or less similar to the sentences with the direct word order.

We will assume that the direct word order encodes the “default”, most neutral way of linear ordering of the sentence structural organisation. Sentences, where all constituents conform to such ordering, will be called *configurational*.

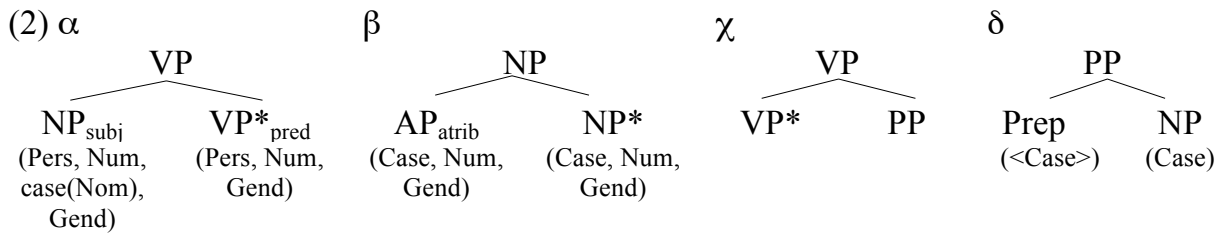
An example of the configurational sentence is presented in (1):

(1)	<i>Світловолосий₁</i>	<i>хлопчик₂</i>	<i>спустився₃</i>	<i>з₄</i>	<i>високої₅</i>	<i>скелі₆</i>
	fair-haired	boy	lowered himself	from	high	rock
	ADJ	N	V	PREP	ADJ	N
	(NOM.SING.MASC)	(NOM.SING.MASC)	(PERF.REFL.PAST.P3.MASC.SING)	(<GEN>)	(GEN.SING.FEM)	(GEN.SING.FEM)

‘The fair-haired boy lowered himself down the high rock’

The configurational word order in sentence (1) is determined by the default sequence of constituents in Ukrainian surface constructions used in it²:

² For representing surface *constructions* (the elementary units of the surface syntactic structure of sentences and phrases) it is convenient to use the format of elementary trees of the Tree Adjoining Grammar (TAG) as discussed in [Joshi and Shabes, 1997], though some alternative ways of representation are possible, e.g. [Kay and Fillmore, 1999].



2.1.1 UNCONFIGURATIONAL WORD ORDER. There are two possible types of violating the configurational word order in Ukrainian. The first type involves permutation of constituents within their phrases (otherwise this process can be viewed as “rotating branches” on a phrase structure tree of the sentence). Such phrases will be referred to as *UNCONFIGURATIONAL*. For example, sentence (1) has the set of synonymous unconfigurational sentences (3), which all are grammatical and comprehensible in Ukrainian:

- (3) (a)[VP [NP Хлопчик₂ ⇔ світловолосий₁] [VP спустився₃ [PP з₄ [NP високої₅ скелі₆]]]].
 (b)[VP [NP Світловолосий₁ хлопчик₂] [VP [PP з₄ [NP високої₅ скелі₆]] ⇔ спустився₃]].
 (c)[VP [NP Хлопчик₂ ⇔ світловолосий₁] [VP [PP з₄ [NP високої₅ скелі₆]] ⇔ спустився₃]].
 (d)[VP [VP Спустився₃ [PP з₄ [NP високої₅ скелі₆]]] ⇔ [NP світловолосий₁ хлопчик₂]].
 (e)[VP [VP [PP з₄ [NP високої₅ скелі₆]] ⇔ спустився₃] ⇔ [NP світловолосий₁ хлопчик₂]].
 (f)[VP [VP Спустився₃ [PP з₄ [NP високої₅ скелі₆]]] ⇔ [NP хлопчик₂ ⇔ світловолосий₁]].
 (g)[VP [VP [PP з₄ [NP високої₅ скелі₆]] ⇔ спустився₃] ⇔ [NP хлопчик₂ ⇔ світловолосий₁]].
 (h)[VP [NP Світловолосий₁ хлопчик₂] [VP спустився₃ [PP зі₄ [NP скелі₆ ⇔ високої₅]]]].
 (i)[VP [NP Хлопчик₂ ⇔ світловолосий₁] [VP спустився₃ [PP зі₄ [NP скелі₆ ⇔ високої₅]]]].
 (j)[VP [NP Світловолосий₁ хлопчик₂] [VP [PP зі₄ [NP скелі₆ ⇔ високої₅]] ⇔ спустився₃]].
 (k)[VP [NP Хлопчик₂ ⇔ світловолосий₁] [VP [PP зі₄ [NP скелі₆ ⇔ високої₅]] ⇔ спустився₃]].
 (l)[VP [VP Спустився₃ [PP зі₄ [NP скелі₆ ⇔ високої₅]]] ⇔ [NP світловолосий₁ хлопчик₂]].
 (m)[VP [VP [PP зі₄ [NP скелі₆ ⇔ високої₅]] ⇔ спустився₃] ⇔ [NP світловолосий₁ хлопчик₂]].
 (n)[VP [VP Спустився₃ [PP зі₄ [NP скелі₆ ⇔ високої₅]]] ⇔ [NP хлопчик₂ ⇔ світловолосий₁]].
 (o)[VP [VP [PP зі₄ [NP скелі₆ ⇔ високої₅]] ⇔ спустився₃] ⇔ [NP хлопчик₂ ⇔ світловолосий₁]].

Different order of application of the trees α and χ will generate the sentences where the verb and subject are separated by indirect object, but in these cases the word order still belongs to the same type³:

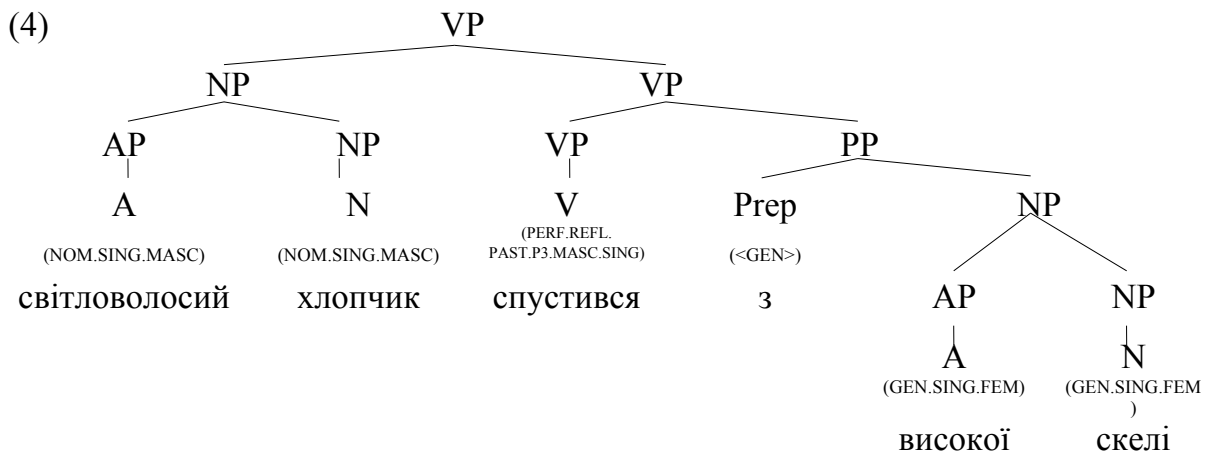
- (p) [VP [VP Спустився ⇔ [NP світловолосий хлопчик]] [PP з високої скелі]]
 (q) [VP [PP з високої скелі] ⇔ [VP [NP світловолосий хлопчик] спустився]], etc.

All these sentences and the sentence (1) have common structural organisation (4):

³ If we analyse the subject of the sentence as a constituent of the VP (another example of such analysis see in Rambow, 1994), we allow the sentences of the configurational word order be analysed in two ways:

[VP N_{subj} Хлопчик [VP V_{pred} спустився [PP зі скелі]]]
 [VP [VP N_{subj} Хлопчик V_{pred} спустився] [PP зі скелі]]

We consider these two representations to be equivalent. Firstly, both representations of this sentence have the same derivation tree in TAG, or the same dependency tree. Secondly, any other solution will make more difficult to explain why all 6 possible permutations of subject verb and direct/indirect object have similar stylistic distribution in Ukrainian, and none of the orderings is “stylistically marked”. (See the analysis further in this article, p.7, chapter 2.2 – SUBJECT/VERB/OBJECT ORDERING AND PROJECTIVITY OF THE SENTENCE).



If the structural organisation (4) is interpreted linearly, the sentence (1) and all the synonymous sentences from the set (3) are predicted through projecting the phrase structure (4) into the linear sequence of words and allowing the rotation of all the tree branches (except the branches of prepositional phrases, formed by the initial tree 2δ: a preposition in a prepositional phrase can never follow the noun phrase in Ukrainian).

2.1.2. UNPROJECTIVE WORD ORDER. The second type of violating the configurational word order involves movement of constituents to a random position outside their phrases. Being in such position, they are either separated from the other constituents of their own phrase, or they themselves separate the constituents of the other phrase. As a result, some phrases in the whole construct become discontinuous. Sentences and phrases with such word order are traditionally called *UNPROJECTIVE*. (This term became standard in Slavic syntax, e.g. see [Gladkyy, 1985], and reflects the fact that the linear ordering of words can be obtained by “projecting” the phrase structure tree into the linear sequence of words. In fact, we even cannot build a constituent system for such sentences without involving the concept of movement. On the dependency tree unprojective sentences have “crossing” dependencies). Morphological redundancy in Ukrainian allows the movement of any constituent to any position within the clause. This movement can be limited only by morphological factors that put the moved constituent into a different position in the structural organisation of the sentence.

Here are some examples of the unprojective word order in Ukrainian. An adjective normally stands in contact position before the noun, which it modifies, and agrees with the noun in case, number and gender. Morphological agreement allows reconstructing the structural organisation of the sentence when the adjective or the noun is moved into any position within their clause outside their own phrase. Such movement is always possible unless another noun, which may appear between the former noun and the adjective, has the same set of categorial values of CASE, NUMBER and GENDER. In this case the structural position of the adjective changes, so the phrase changes its meaning. For instance, in the phrase (5):

- (5) [NP *Картка*₁ [PP *на*₂ [NP *потрібну*₃ *книгу*₄]]]
 card on necessary book
 N(NOM.SING.FEM) PREP(<ACC>) A(ACC.SING.FEM)
 N(ACC.SING.FEM)
 ‘a card for a necessary book’

the noun *Картка*₁ N(NOM.SING.FEM) can be moved into the linear position between the constituents of the inner noun phrase [NP *потрібну*₃ *книгу*₄] NP(ACC.SING.FEM):

- (6) [NP *t_i* [PP *На*₂ [NP *потрібну*₃... [*картка*₁... *книгу*₄]]]

In this case the phrase [NP *потрібно*₃... *книгу*₄] becomes discontinuous. But such movement is possible only if at least one of the morphological category values in phrase (5) is not the same for the two nouns. Otherwise, for example if the noun phrase (5) becomes the component of a larger phrase, which requires the accusative case from its head *Картка*₁ (the noun in the accusative must take the form *картку*₁ N(ACC.SING.FEM)), its movement to the linear position between the constituents of the inner noun phrase [NP *потрібно*₃... *книгу*₄] still forms a grammatical and comprehensible sentence, but with a different structural organisation and meaning:

- (7) [VP [VP *Записати*₀ [NP ***картку***₁]] [PP *на*₂ [NP *потрібно*₃ *книгу*₄]]]
 to write down card on(to) necessary book
 V(INF<ACC>) N(ACC.SING. FEM). PREP<ACC> A(ACC.SING. FEM) N(ACC.SING. FEM)

‘to write down a card to a necessary book’

- (8) [VP [VP *Записати*₀ [PP *на*₁ [NP *потрібно*₂ ***картку***₃]]] [NP *книгу*₄]]]
 to write down on(to) necessary card book
 V(INF<ACC>) PREP<ACC> A(ACC.SING. FEM) N(ACC.SING. FEM) N(ACC.SING. FEM)

‘to write down a book to a necessary card’

In the verb phrase (8) the values of morphological categories of the noun *картку*₃ and the adjective *потрібно*₂ appear to be the same. Because of this the possibility of reconstructing structural organisation [VP *Записати*₀ [NP ***картку***₁]] (meaning: ‘to write down a card’) is blocked. In (6) these values are different and the necessary structural organisation is reconstructed in order to integrate the moved component into the phrase structure.

The data suggest, that the constraints on unprojective movement in Ukrainian declarative sentences are independent from the structural organisation of the sentence and are influenced by linear ordering of morphological categories in words. Prepositional phrases are an exception also in this case. As it was indicated before, the preposition can never be separated from a following component of its noun phrase (an adjective or a noun) that carries the CASE value required by the preposition. All constituents of the prepositional phrase except the preposition itself may be moved in the clause to any distance but only to the right of the preposition. E.g. in sentences with structural organisation (4) the movement of the noun or the adjective from the prepositional phrase [PP *з високої скелі*] is possible unless this phrase is the last constituent in the sentence. In sentences (1), (3a), (3h) and (3i) the movement of the adjective or the noun is not possible, and it is possible in all other sentences, as in (3b):

- (9) (a) [VP [NP *Світловолосий хлопчик*] [VP [PP *з* [NP *високої* *t_i*]] *спустився*... *скелі*_i...]].

- (b) [VP [NP *Світловолосий хлопчик*] [VP [PP *зі* [NP *t_i* *скелі*]] *спустився*... *високої*_i...]].

Taking into account these restrictions, any kind of possible movement could be predicted by the model. At the first stage, the model interprets any given structural organisation in order to get the set of possible linear organisations with configurational and unconfigurational word order. At the second stage, for any given linear organisation, the model predicts the set of positions for unprojective movement of any constituent. E.g., if in the sentence (1) the unprojective movement of the subject “*хлопчик*₂ N(NOM.SING. MASC)” takes place, the model predicts the positions, opened for the movement (9):

- (10)(a) [VP [NP *Світловолосий t_i*] [VP *спустився*... *хлопчик*_i... [PP *з* [NP *високої скелі*]]]]].

- (b) [VP [NP *Світловолосий t_i*] [VP *спустився* [PP *з* [NP *високої*... *хлопчик*_i... *скелі*]]]]].

- (c) [VP [NP *Світловолосий t_i*] [VP *спустився* [PP *з* [NP *високої скелі*... *хлопчик*_i...]]]]].

The location after preposition *з* is closed for the movement of the subject because the preposition must not be separated from at least one of the other constituents in its phrase, otherwise the sentence becomes ungrammatical.

Linear interpretation of the sentence structural organisation allows to get the set of synonymous Ukrainian sentences with different word order and to distinguish between the configurational, unconfigurational and unprojective word order.

2.2. SUBJECT/VERB/OBJECT ORDERING AND PROJECTIVITY OF THE SENTENCE.

Between sentences with the two types of violating the configurational word order described above there is a difference in distribution. Unconfigurational sentences are used very frequently in all styles in Ukrainian, practically the same way, as sentences with configurational word order. Unprojective sentences are used much less frequently, mainly in poetry and in everyday spontaneous speech. Unconfigurational word order is considered stylistically neutral and has the grammatical function of making the ‘theme/ rheme’ distinction in declarative sentences. Unprojective word order is always marked stylistically or emotionally and expresses the speakers ‘less restricted’ state of voicing thoughts and feelings in modern Ukrainian. Though in old Ukrainian chronicles of the baroque period, unprojective word order was used in the high written style purposefully. A historical work of Samiylo Velychko, written in the end of the 17th century, is an example of this style. The book describes the events of the Ukrainian war for independence of 1648-1656 led by Bohdan Khmelnytsky, the Ukrainian military ruler:

(11)

Ним	зачну	наступуючое t _i	воєнних t _i	Хмельницького	діл i	з	Поляки	поведеніє i
by	I	following	military	of	actions	with	Poles	conduct
this	start	A.ACC.SING.NEUT	A.GEN.PLUR	Khmelnysky	N.GEN.		N.INS.	N.ACC
N.INS.	V.P(1).			N.GEN.SING	PLUR		PLUR	SING.NEUT
SING	SING.							
	FUT.PERF							

‘By this I will start [to relate] the following conduct of military actions against Poles of Khmelnytsky’.

The configurational word order of the sentence (11) should have been as shown in (12), the structural organisation of both sentences is presented in (13):

(12) *Ним зачну наступуючое поведеніє воєнних діл Хмельницького з Поляки.*

(13) [VP [VP [NP *Ним*_{N.INST.SING}]

[VP *зачну*_{V.P(1).SING.FUT.PERF}

[NP_{ACC}[NP *наступуючое*_{A.ACC.SING} *поведеніє*_{N.ACC.SING}

[NP_{GEN}[NP_{GEN}[NP *воєнних*_{A.GEN.PLUR} *діл*_{N.GEN.PLUR}

[NP_{GEN} *Хмельницького*_{N.GEN.SING}]]

[PP *з Поляки*]

]]

]]

Unprojective sentences in modern Ukrainian are stylistically distinct from sentences with the two other types of word order. Native speakers feel stylistic ‘unrestrictedness’ of sentences with the unprojective word order, the ‘peripheral’ character of these sentences, which nevertheless remain grammatical and are widely accepted in ‘unrestricted’ styles of Ukrainian, such as poetry. E.g. in the line taken from the poem of the modern Ukrainian poet Vasyl Stus, presented in (14), the noun phrase *злупа ніч* ‘the late night’ becomes discontinuous because of the unprojective movement of the noun into the position after the verb :

(14) *І злупа* *т_i* *облягає* *ніч* *i* *пекельний* *край* *і* *крик* *пекельний*

and	late	surrounds	night	infernal	land	and	cry	infernal
A.NOM.	V.P(3).SING.	N.NOM.	A.ACC.SING.	N.ACC	N.ACC.	N.ACC.	A.ACC.	
SING.FEM	PRES	SING.FEM	MASC	SING.MASC		SING.MASC	SING.MASC	

‘And the late night surrounds the infernal land and the infernal cry’

However, in the sentences containing a subject, a verb and an object, all 6 possible ways of linear arrangement for these phrases, can be found in Ukrainian texts with equal distribution: none of the ordering is marked “stylistically” or is distinct from any other ordering in any way. We consider the order SVO to be the configurational order, so all other orderings (OVS, SOV, VOS, VSO and OSV) should be unconfigurational, but projective.

Further we present the examples of each of these orderings. All of them look acceptable and stylistically neutral for native speakers of Ukrainian.

(15) a. (SVO) – *А дід запалить корінкову люльку*

And old.man_{N.NOM.SING} will.light_{V.P(3).SING.FUT.PERF} of.root_{A.ACC.SING} pipe_{N.ACC.SING}

‘And the old man will light the pipe made of a tree-root’

b. (VOS) – *Бо тебе і мене б судила не образа, не гнів – любов.*

Because you_{N.ACC.SING} and me_{N.ACC.SING} would judge_{V.P(3).SING} not resentment_{N.NOM.SING}, not anger_{N.NOM.SING} – love_{N.NOM.SING}

‘Because not resentment, not anger, but love would judge you and me’

c. (SOV) – *Поривчий вітер вихолку несе.*

Gusty_{A.NOM.SING.MASC} wind_{N.NOM.SING.MASC} snowstorm_{N.ACC.SING.FEM} brings_{V.P(3).SING.PRES}

‘The gusty wind brings the snowstorm’

d. (VOS) – *Гризуть вудила коні з нетерплячки.*

Gnaw_{V.P(3).PLUR.PRES} rein_{N.ACC.PLUR} horses_{N.NOM.PLUR} from_{PREP} impatience_{N.GEN.SING}

‘The horses gnaw reins in impatience’

e. (VSO) – *Волочить місяць промінь перетертий.*

Drags_{V.P(3).SING.PRES} moon_{N.NOM.SING} ray_{N.ACC.SING} frayed.through_{A.ACC.SING}

‘The moon drags the frayed-through ray’

f. (OSV) – *З підземних нір зацьковану свободу понідруки ти вивела на світ.*

From_{PREP} underground_{A.GEN.PLUR} burrows_{N.GEN.PLUR} persecuted_{A.ACC.SING}
liberty_{N.ACC.SING} by.arms_{ADV} you_{N.NOM.SING} led.out_{V.P(2).SING.PAST.PERF} into_{PREP}
world_{N.ACC.SING}

‘You led out the persecuted liberty by the arms from underground borrows into the world’

We cannot achieve “equal ground” for these sentences, if, for example, we treat a subject as the constituent of a “Sentence”, and an object as a constituent of a VP: in this case the ordering VSO and OSV should be unprojective and stylistically marked, but it is not. So, the simplest solution is to treat a subject and an object as constituents of VP. This solution correctly predicts the equality of the orderings ‘SOV’ and ‘VSO’ (and their inversions – ‘VOS’ and ‘OSV’), but as a consequence we have multiple analysis of the orderings SVO and OVS: e.g., [_{VP}S[_{VP}VO]]; [_{VP}[_{VP}SV]O].

To summarize, there is only one **configurational** word order for any structural organization of a sentence. Deviations from this configurational word order can be obtained in two ways. (1) **Unconfigurational**, but projective sentences are formed by allowed permutation of constituents in phrase structure of the configurational sentence. (2) **Unprojective** sentences are formed, when a randomly selected constituents move to non-typical linear positions, where the movement is still allowed. The set of allowed positions could be predicted for each individual constituent of a sentence with

configurational word order, and for each constituent in all sentences with unconfigurational word order. So first, we generate the configurational sentence out of the structural organization, then we permute constituents and generate the set of unconfigurational sentences, and then for each of the sentences we predict the set of unprojective sentences:

unprojective sentences	
	unconfigurational sentences
	a configurational sentence

The denotational meaning of all sentences with such word order variation remains the same, but unprojective sentences have different stylistic distribution, then other types of sentences.

3. INTELLIGIBILITY OF CENTER EMBEDDED CLAUSES IN THE MODEL. We will apply the framework of our model to investigating the problem of grammaticality/intelligibility of Ukrainian clauses with center embedding.

3.1 CONSTRUCTS WITH CENTER EMBEDDING IN UKRAINIAN. It is known that constructs with central embedding are hard to process [Hawkins, 1999: 252]. On the other hand, Ukrainian constructs expose a great degree of tolerance for centrally embedded structures. Constructs with center embedding in Ukrainian could be easily transformed into constructs with embedding on the right side, due to possible permutation of constituents, and vice versa. In (23) the examples of synonymous phrases with the center embedding (23a) and without it (23b) are presented:

- (23a) $NP[AP[A \text{ відомий } PP[у західних країнах]]] \text{ } N \text{ письменник}]$
 known_{A.NOM.SING} in_{PREP} western_{A.LOC.PLUR} countries_{N.LOC.PLUR} writer_{N.NOM.SING}
 ⇔ (23b) $NP[N \text{ письменник, } \hookrightarrow AP[A \text{ відомий } PP[у західних країнах]]]$
 writer_{N.NOM.SING} known_{A.NOM.SING} in_{PREP} western_{A.LOC.PLUR} countries_{N.LOC.PLUR}
 ‘A writer, known in western countries’

The recursive center embedding is usually possible in Ukrainian. In the examples of the recursive center embedding we will indicate the maximum level of center embedding, as described in [Gladkyy, 1985]. The higher is the maximum level of center embedding, the more cumbersome and the more difficult to process is the construct. In written form much more complicated constructs still remain understandable, but when uttered orally, they may be considered by native speakers totally incomprehensible. The more complicated is the construct, the smaller number of informants will accept it, so in general it is difficult to state a certain number of center embedding levels, allowed in Ukrainian. In any case, these judgements will always remain indistinct. In (24) several examples are presented with the synonymous construct without center embedding example (a) is considered well formed and comprehensible, further examples cause more and more doubt in oral and then in written speech⁴:

- (24) (a) $NP[{}_{6AP}[{}_{5} \text{ отримана } PP[{}_{4} \text{ від } NP[{}_{3} AP[{}_{2} \text{ відомого } PP[{}_{1у} \text{ західних країнах}]_{2}] \text{ письменника}_{3}]_{4}]_{5}]$
 книжка₆] (2)
 received_{A.NOM.SING.FEM} from_{PREP} known_{A.NOM.GEN.MASC} in_{PREP} western_{A.LOC.PLUR.FEM} countries_{N.LOC.PLUR.FEM} writer_{N.GEN.SING.MASC} book_{N.NOM.SING.FEM}

⁴ We indicate the level of embedding in brackets and provide the synonymous sentence without centre embedding (the level of embedding is 0) next to the sentence with the embedding.

- \Leftrightarrow (a') $NP[N]$ книга,
 $\downarrow\uparrow$
 $AP[отримана від NP[N]$ письменника,
 $\downarrow\uparrow$
 $AP[відомого у західних країнах]]]$ (0)
book_{N.NOM.SING.FEM} received_{A.NOM.SING.FEM} from_{PREP} writer_{N.GEN.SING.MASC}
known_{A.NOM.GEN.MASC} in_{PREP} western_{A.LOC.PLUR.FEM} countries_{N.LOC.PLUR.FEM}
'A book, which was received from the writer, who is known in western countries'
- (b) $NP[9AP[8]$ характеризований
 $PP[7\theta NP[6AP[5]$ отриманій
 $PP[4від NP[3 AP[2відомого$
 $PP[1у західних країнах]2]$
 $письменника3]4]5]$
 $книзі6]7]$
 $персонаж8]9]$ (3)
characterized_{A.NOM.SING.MASC} in_{PREP} received_{A.LOC.SING.FEM} from_{PREP} known_{A.NOM.GEN.MASC}
in_{PREP} western_{A.LOC.PLUR.FEM} countries_{N.LOC.PLUR.FEM} writer_{N.GEN.SING.MASC}
book_{N.LOC.SING.FEM} personage_{N.NOM.SING.MASC}
- \Leftrightarrow (b') $NP[N]$ персонаж,
 $\downarrow\uparrow$
 $AP[характеризований PP[6 NP[N]$ книзі,
 $\downarrow\uparrow$
 $AP[отриманій від NP[N]$ письменника,
 $\downarrow\uparrow$
 $AP[відомого у західних країнах]$ (0)
personage_{N.NOM.SING.MASC} characterized_{A.NOM.SING.MASC} in_{PREP} book_{N.LOC.SING.FEM}
received_{A.LOC.SING.FEM} from_{PREP} writer_{N.GEN.SING.MASC} known_{A.NOM.GEN.MASC} in_{PREP}
western_{A.LOC.PLUR.FEM} countries_{N.LOC.PLUR.FEM}
- 'A personage, who is characterized in a book, which was received from the writer, who is known in western countries'
- (c) $NP[12AP[11]$ пов'язана
 $PP[103 NP[9AP[8]$ характеризованим
 $PP[7\theta NP[6AP[5]$ отриманій
 $PP[4від NP[3 AP[2відомого$
 $PP[1у західних країнах]2]$
 $письменника3]4]5]$
 $книзі6]7]$
 $персонажем8]9]10]11]$
 $проблематика12]$ (4)
related_{A.NOM.SING.FEM} to_{PREP} characterized_{A.INS.SING.MASC} in_{PREP} received_{A.LOC.SING.FEM}
from_{PREP} known_{A.NOM.GEN.MASC} in_{PREP} western_{A.LOC.PLUR.FEM} countries_{N.LOC.PLUR.FEM}
writer_{N.GEN.SING.MASC} book_{N.LOC.SING.FEM} personage_{N.INS.SING.MASC} problems_{N.NOM.SING.FEM}

⇒ (с') $NP[N]$ *проблематика,*

↓↑

$AP[$ пов'язана з $NP[N]$ *персонажем,*

↓↑

$AP[$ характеризованим в $NP[N]$ *книзі,*

↓↑

$AP[$ отриманій від $NP[N]$ *письменника,*

↓↑

$AP[$ відомого у західних країнах]]]]]]]] (0)

problems_{N.NOM.SING.FEM} related_{A.NOM.SING.FEM} to_{PREP} personage_{N.INS.SING.MASC}
 characterized_{A.INS.SING.MASC} in_{PREP} book_{N.LOC.SING.FEM} received_{A.LOC.SING.FEM} from_{PREP}
 writer_{N.GEN.SING.MASC} known_{A.NOM.GEN.MASC} in_{PREP} western_{A.LOC.PLUR.FEM}
 countries_{N.LOC.PLUR.FEM}

'Problems, that are related to a personage, who is characterized in a book, which was received from the writer, who is known in western countries'

⇒ (d) $NP[15AP[14$ *представлена*

$PP[13Y$ $NP[12AP[11$ *пов'язаній*

$PP[103NP[9AP[8$ *характеризованим*

$PP[76$ $NP[6AP[5$ *отриманій*

$PP[4$ *від* $NP[3$ $AP[2$ *відомого*

$PP[1Y$ *західних країнах]*₁₂]

*письменника*₃]₄]₅]

*книзі*₆]₇]

*персонажем*₈]₉]₁₀]₁₁]

*проблематиці*₁₂]₁₃]₁₄]

*концепція*₁₅] (5)

represented_{A.NOM.SING.FEM} in_{PREP} related_{A.LOC.SING.FEM} to_{PREP} characterized_{A.INS.SING.MASC}
 in_{PREP} received_{A.LOC.SING.FEM} from_{PREP} known_{A.NOM.GEN.MASC} in_{PREP} western_{A.LOC.PLUR.FEM}
 countries_{N.LOC.PLUR.FEM} writer_{N.GEN.SING.MASC} book_{N.LOC.SING.FEM} personage_{N.INS.SING.MASC}
 problems_{N.LOC.SING.FEM} conception_{N.NOM.SING.FEM}

(d') $NP[N]$ *концепція,*

↓↑

$AP[$ представлена у $NP[N]$ *проблематиці,*

↓↑

$AP[$ пов'язаній з $NP[N]$ *персонажем,*

↓↑

$AP[$ характеризованим в $NP[N]$ *книзі,*

↓↑

$AP[$ отриманій від $NP[N]$ *письменника,*

↓↑

$AP[$ відомого у західних країнах]]]]]]]]]]

(0)

conception_{N.NOM.SING.FEM} represented_{A.NOM.SING.FEM} in_{PREP} problems_{N.LOC.SING.FEM}
 related_{A.LOC.SING.FEM} to_{PREP} personage_{N.INS.SING.MASC} characterized_{A.INS.SING.MASC} in_{PREP}
 book_{N.LOC.SING.FEM} received_{A.LOC.SING.FEM} from_{PREP} writer_{N.GEN.SING.MASC}
 known_{A.NOM.GEN.MASC} in_{PREP} western_{A.LOC.PLUR.FEM} countries_{N.LOC.PLUR.FEM}

‘A conception, which is represented in problems, that are related to a personage, who is characterized in a book, which was received from the writer, who is known in western countries’

The sentence (24c), which has the maximum level of embedding “4” still could be acceptable in written form, but (24d) with level “5” already could hardly be comprehensible even in a written text in Ukrainian. From the examples presented above it could be concluded that the constructions with recursive center embedding with maximum levels of embedding from “1” to “3” are grammatical and comprehensible in Ukrainian, and even the higher level of center embedding – “4” – is possible under certain circumstances.

3.2. CENTER EMBEDDING OF THE SUBORDINATE CLAUSES. The surprising fact, that the recursive center embedding becomes completely incomprehensible with subordinate clauses in the subject phrase, presents difficulty for the syntactic theory and requires some explanation. Starting from the level “2” of center embedding sentences with subordinate subject clauses cease to be understandable. E.g., in the sentence (25) the level of center embedding is “1”, so it is the acceptable sentence in Ukrainian, but the sentence (26) is not: its level of center embedding is “2”. Sentences with higher levels of center embedding are unacceptable either:

(25) [_{VP} [_{NP:subj} Дівчина, [_S яку пісня чарувала], _{V:pred} раділа].
 girl_{N.NOM.SING.FEM} whom_{PRON.ACC.SING.FEM} song_{N.NOM.SING.FEM}
 fascinated_{V.SING.FEM.PAST.IMPERF} rejoiced_{V.SING.FEM.PAST.IMPERF}
 ‘A girl, who was fascinated by the song, was rejoicing’

(26) * [_{VP} [_{NP:subj} Дівчина,
[_S яку [_{NP:subj} пісня,
[_{PredP} яку пташка вела]],
_{V:pred} чарувала]],
_{V:pred} раділа].

girl_{N.NOM.SING.FEM} whom_{PRON.ACC.SING.FEM} song_{N.NOM.SING.FEM} which_{PRON.ACC.SING.FEM}
bird_{N.NOM.SING.FEM} sang_{V.SING.FEM.PAST.IMPERF} fascinated_{V.SING.FEM.PAST.IMPERF}
rejoiced_{V.SING.FEM.PAST.IMPERF}

‘A girl, who was fascinated by the song sung by the bird, was rejoicing’

– this proposition in Ukrainian could be expressed by the means of subordinate clauses without center embedding, e.g. with right embedding of the object subordinate clauses, as (27), or at least with the level of center embedding “1”, as (28).

(27) [_SПташка вела [_{OP:obj} пісню, [_Sяка чарувала [_{OP:obj} дівчину, [_Sяка раділа]]]]]
 bird_{N.NOM.SING.FEM} sang_{V.SING.FEM.PAST.IMPERF} song_{N.NOM.SING.FEM}
 which_{PRON.NOM.SING.FEM} fascinated_{V.SING.FEM.PAST.IMPERF} girl_{N.ACC.SING.FEM}
 who_{PRON.NOM.SING.FEM} rejoiced_{V.SING.FEM.PAST.IMPERF}
 ‘A bird sang a song which fascinated a girl who was rejoicing’

(28) [_S [_{NP:subj} Дівчина, [_S яку чарувала [_{OP:obj} пісня, [_S яку вела пташка]]]], _V раділа]

girl_{N.NOM.SING.FEM} whom_{PRON.ACC.SING.FEM} fascinated_{V.SING.FEM.PAST.IMPERF}
 song_{N.NOM.SING.FEM} which_{PRON.ACC.SING.FEM} sang_{V.SING.FEM.PAST.IMPERF}
 bird_{N.NOM.SING.FEM} rejoiced_{V.SING.FEM.PAST.IMPERF}
 ‘A girl, who was fascinated by the song, which the bird sang, was rejoicing’

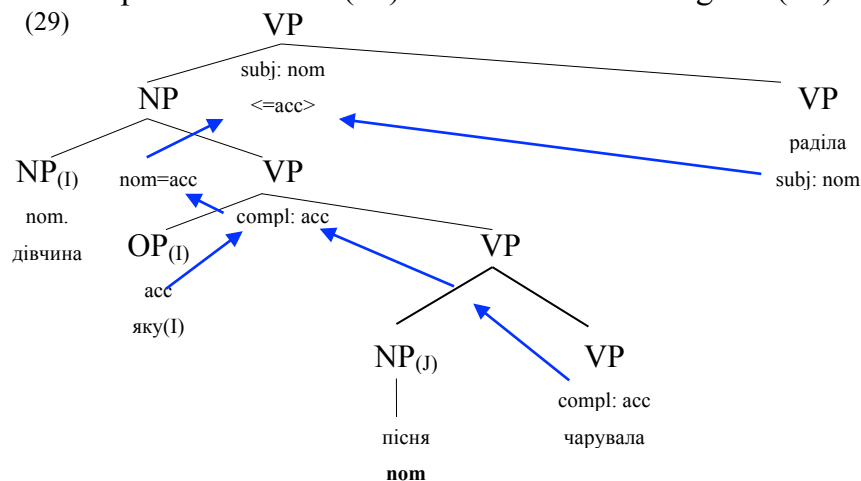
A similar phenomena could be found in English, where the sentences of the form (26) are not comprehensible either: **The cat the dog the man saw chased cried* or **The rat the cat the dog chased bit ate the cheese* [Abney, Johnson, 1991: 233]. I

consider not complete the observation made by the authors of this article that parsing such sentences is *difficult*: actually, parsing such sentences is *impossible* and if the sentence has the level of center embedding of the subordinate clauses greater than “1”, it becomes completely incomprehensible.

Steven Abney and Mark Johnson in [1991: 244-246] explained this fact stating that the problem with parsing such constructs is related to memory requirement and the parsing strategy. I think the limitations of memory must be illustrated with some other examples, but not with subordinate subject clauses with recursive center embedding. Otherwise it is difficult to account for the fact why, for instance, centrally embedded adjectives and prepositional phrases change the acceptability of sentences gradually to levels “3”, “4” and “5”, and subordinate subject clauses with recursive center embedding change the intelligibility abruptly at the level “2”.

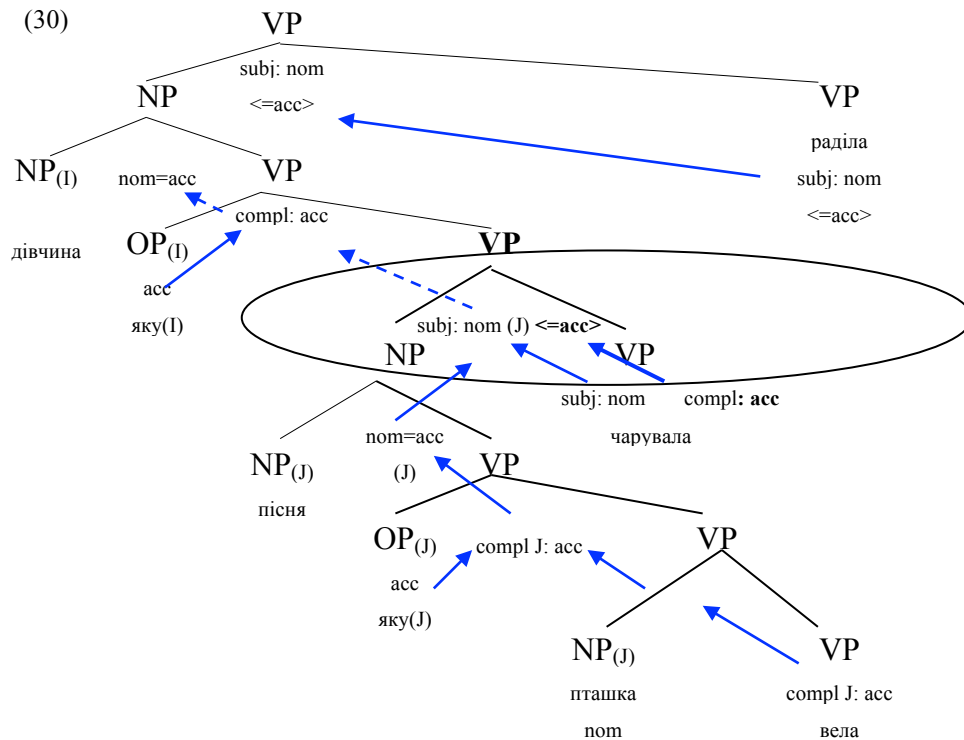
I suggest the following explanation to this phenomenon. Center embedding becomes incomprehensible in embedded relative clauses due to the same reason, why certain movement of constituents is unacceptable in unprojective sentences: there is a “competition” for the morphological features in the nodes of phrase structure. Our discussion will be an argument in favor of treating sentences with the level of embedding (2) of relative clauses as ungrammatical, not just “grammatical but unacceptable” (see [Levis, 1996]).

The phrase structure and the relevant head/complement morphological features in the acceptable sentence (25) are shown on the diagram (29):



Here the pronoun *яку* – ‘whom_{acc.sing.fem}’ (the object of the embedded clause) is co-referential with the subject of the main clause: *дівчина* – ‘girl_{nom.sing.fem}’. It is shown, that the verb in the main clause *радїла* – ‘rejoiced_{past.sing.fem}’ requires subject in nominative, but the representation also keeps track of the fact, that subject nominative is co-referential with accusative pronoun in the subordinate clause. This “co-referential” accusative remains on the background of the derivation, and does not need to be checked, but in fact, it can be checked, as will be shown in the next example. We assume that morphological features within a sub-tree are checked at the parent node of the sub-tree.

We will try to show that similar way of checking morphological features is blocked, if the second relative clause is embedded into the first relative clause. The diagram (30) illustrates the phrase structure of the unacceptable sentence (26).



We suggest, that in this sentence the derivation crashes, when complement features of the verb *чарувала* – ‘fascinated_{v.sing.fem.past.imperf}’ in the first embedded clause are incorrectly checked by the head features of the second relative pronoun *яку_J* – ‘which_{acc.sing.fem}’ instead of the first relative pronoun *яку_I* – ‘whom_{acc.sing.fem}’. As a result, the case features of the first relative pronoun _(I) remain unchecked. The feature “accusative case” comes into derivation from the co-reference of nominative subject in the first subordinate clause and accusative complement in the second clause (see the circled node in the diagram 30; the bold arrow indicates wrong feature checking).

The analysis above correctly predicts why a different way of ordering constituents in the sentence 26 does not influence the acceptability of the sentence:

*[_{VP} Раділа ⇔ [дівчина, яку пісня, яку пташка вела чарувала].

rejoiced_{v.past.sing.fem} girl_{N.nom.sing.fem} whom_{Pron.acc.sing.fem} song_{N.nom.sing.fem} which_{Pron.acc.sing.fem}
bird_{N.nom.sing.fem} sang_{v.past.sing.fem} fascinated_{v.past.sing.fem}

*[_{VP} Раділа ⇔ [дівчина, яку пісня, яку [вела ⇔ пташка] чарувала].

rejoiced_{v.past.sing.fem} girl_{N.nom.sing.fem} whom_{Pron.acc.sing.fem} song_{N.nom.sing.fem} which_{Pron.acc.sing.fem}
sang_{v.past.sing.fem} bird_{N.nom.sing.fem} fascinated_{v.past.sing.fem}

In this example the level of centre-embedding is 1, but the sentence remains unacceptable: the position of the crash in the derivation is below the main clause, so permutation of constituents in the main clause does not prevent the crash in the derivation.

It can be concluded, that centre-embedded constructions normally allow the level of embedding that is consistent with the hypothesis of V.Ingve: the size of the human short-term memory is 7±2 items (we assume that one level of centre embedding takes 2 clusters). This hypothesis correctly predicts that the maximum “understandable” level of center embedding is 4. We showed, that the “classic” example of unacceptable centre embedding of relative clauses (of the level 2) can be explained by feature conflicts, in the same way, as we explained restrictions on movement in sentences with unprojective word order.

4. CONCLUSION. The proposed model of word order variation accounts for the set of possible synonymous sentences with different word order in Ukrainian and some other Slavic languages. It also accounts for restrictions on changing the order of constituents inside clauses.

The general idea is that different linear organisations of synonymous sentences are predicted by the valid ways of mapping the unique structural organisation. The structural organisation remains the same for all possible linear orderings of words. The movement or permutation in the linear organisation of the sentence does not involve changes in the structural organisation and this allows keeping both levels of the sentence organisation (linear and structural) simpler, then it is done in alternative analyses of this problem.

Our model also takes into account the facts of stylistic distribution of Ukrainian declarative sentences, and links this distribution to the feature of their projectivity. To the great extent, the model accounts for linguistic intuition of native speakers about “marked” and “neutral” word order in Ukrainian.

5. REMARKS ON THE FUTURE RESEARCH. After the present research was completed, I came across a number of facts from the field of phonetics, which showed a new way of using the proposed model of the word order variation. It appears, that making the word order unconfigurational or unprojective changes the prosodic structure of the sentence: as a rule, new phrase boundaries are created around moved constituents and the structure of intonation centres can also change. The link between the word order variation and the prosodic structure of the sentence is a robust indication on the changes that happen in communicative structure of discourse with a certain type of word order changes. This phonetic evidence can be used to bring into light cognitive facts about sentence understanding and generation, which are, in general, much more concealed.

We have available the data with transcriptions of recorded Russian sentences, where an experienced phonetician has manually annotated phrase boundaries and the position of phrasal stress. The analysis of these data can show, how exactly the word order variation is related to the prosodic structure of the sentence and the way in which the sentences are processed in human cognition.

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