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Cross-linguistic comparison of prosody, syntax and information structure in a production experiment on localising expressions[1]

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Abstract

This article presents a cross-linguistic study of semi-spontaneous data obtained from an experiment conducted uniformly for six languages. It examines how native speakers communicate the changing spatial layouts of toy animals. The analysis of the data focuses on the universal preference for expressing a given constituent before a new one (Chafe 1976, Clark & Haviland 1977 and many others). In terms of grammatical strategies, speakers universally tend to realise the newly introduced or displaced toy animal in a position where it is aligned with a high-level prosodic domain. A constraint to achieve this effect, called ALIGN-FOCUS-R, is formulated as an optimality-theoretic alignment principle (McCarthy & Prince 1993). Language-dependent syntactic and prosodic restrictions may favour or disfavour this tendency. Some languages may reorder their constituents by scrambling, some may use more costly syntactic and prosodic operations, like dislocations, or the insertion of a prosodic boundary. Some use pitch accents, but some do not possess pitch accents in their phonological inventory. A constituent right aligned with a higher-level prosodic domain may be felt prominent (Jackendoff 1972, Truckenbrodt 1995, Büring 2009), but prominence is only a secondary effect of alignment.

1. Introduction

This study is part of a long programme of work on localising expressions and spatial descriptions (see, for instance, Levelt 1984, Ullmer-Ehrich 1982, Ehrich & Koster 1983, Klein 1991 and many others for descriptions of static localisations or path descriptions). We examine semi-spontaneous expressions from native speakers of six languages while localising a new or displaced object (a toy animal) relative to given ones. We qualify the localised toy animal as the 'locatum'. In a relational localisation like (1), the object relative to which the locatum is localised is the 'relatum' (see section 4 for more detail on relational expressions and the difference between these types of expression and the other ones). In (1), the dog is locatum (Loc) and the bird is relatum (Rel). Locata are typically DPs and thus simple expressions; relata are parts of more complex locative expressions (Lx), usually PPs. In SVO

and SOV languages, the word order of localisations is syntactically unmarked if the locatum comes before the locative expression, at least in those cases in which the locatum plays a thematic role hierarchically superior to the role played by the relatum (i.e., the locatum is grammatical subject or direct object of the sentence).

(1) [The dog]$_{Loc}$ is [to the right of [the bird]$_{Rel}$]$_{Lx}$

Information structure induces a tendency to put given referents before new ones (Clark & Haviland 1977), which can amount to a processing disadvantage for spatial relational sentences with unmarked word order. Relational sentences with an asymmetry in the discourse status of locatum and relatum are understood faster and more reliably if the relatum is given and its place is known to the addressee while the locatum is new and its place is unknown to the addressee than when the roles are assigned in the opposite way (Huttenlocher & Strauss 1968, Clark 1972, Harris 1975, Hörnig, Oberauer & Weidenfeld 2005; for an overview, see Hörnig & Weskott 2009). If the roles are correspondingly fixed, it can be advantageous to reverse the word order of the locatum and the locative expression, as in (2), as demonstrated by Hörnig et al. (2005) for German. A previous localisation of the relatum, the bird, renders the bird given and, as a result, the place to the right of the bird becomes easily accessible. This is in agreement with the 'given-new strategy' of Clark & Haviland (1977).

(2) {Discourse context: The bird has been mentioned in a previous localisation.}
[*To the right of* [*the bird*]$_{Rel}$]$_{Lx}$ *is* [*the dog*]$_{Loc}$

A relational localisation can also be used to communicate to the addressee the unknown place of a given locatum relative to a given relatum, for instance, to inform the addressee that the locatum has changed its place (e.g., the dog was behind the bird but is now to the right of the bird). The symmetry in discourse status of locatum and relatum then induces no information-structural pressure to deviate from the unmarked word order in (1). Since the locatum is given, it may be located before the locative expression, in line with unmarked word order. In contrast, if the locatum is new, a conflict arises. For the sake of 'given before new', it should be uttered after the locative expression, but for syntax, it should come first. The preferences discussed so far refer to properties of human communication assumed to be universal (see for instance Clark & Haviland 1977 for 'given before new'). Since individual grammars differ in syntax (e.g., word order possibilities) and phonology (e.g., intonational possibilities), we speculate that the effect of language-independent principles will vary across

languages. The aim of our empirical study is to examine whether this is the case, and the aim of the discussion of the empirical findings is to offer a principled account for these differences.

The following six languages were used for the study: English, Finnish, French, Georgian, German and Mandarin Chinese. These languages differ from each other in several dimensions that prove to be relevant for the investigation. In terms of prosody, the following features are relevant: English and German have lexical stress, that is, every word has exactly one syllable that gets a pitch accent if the word is accented; Finnish always stresses the first syllable of the word (Suomi, Toivanen & Ylitalo 2008); French does not have lexical stress, and for Georgian the literature is not clear about the existence of lexical stress and even less so about its location; Chinese is a tone language, and thus in this language every syllable has its own tonal specification. All of the languages except for Chinese have an intonational prosody, i.e., they may vary the direction of melodic excursions according to pragmatic needs. German, English and Georgian deaccent given postnuclear material, but French and Finnish tend to avoid situations of deaccenting, without completely banning them. Chinese may compress the pitch range of given material, but there is no deaccenting like in the other languages (Xu 1999).

In terms of syntax, all the examined languages have in common that in the unmarked word order the subject precedes the object, whereby the canonical order of English, French, Finnish and Chinese is SVO and the canonical order of Georgian is SOV with considerable freedom in V placement within the predicate (see Apridonidze 1986: 136-143, Skopeteas & Fanselow 2009b). German represents a special case, because the basic order of the syntactic derivation is V-final, but the unmarked order in declarative main clauses is SVO (resulting from V-movement to an earlier position, see Thiersch 1978 and den Besten 1989). All languages at issue display syntactic operations leading to marked word orders in which the object precedes the subject. Crucially, the examined languages differ with respect to the type of syntactic operations that may result in OS orders. All the sample languages have the possibility to extract an argument to a left-peripheral position outside the core clause (instances of Ā-movement). Only a subset of the languages (German, Georgian and Finnish) allow free reordering of the arguments without involving extraction from the clause (a phenomenon known as A-scrambling). These languages are characterised by greater word-order flexibility.

The remainder of this article is organised in the following way: Section 2 introduces the experiment. Section 3 presents some basic classifications of our data. Section 4 proceeds with the classification of a specified subset of the utterances used in the analysis and introduces the

kind of results we are interested in. Section 5 shows a cross-linguistic correlation between word order and information-structural roles. Section 6 is devoted to definiteness and section 7 to the grammatical means that languages have at their disposal to satisfy ALIGN-FOCUS-R. In particular, the interaction between syntax and prosody is given much attention. Section 8 presents a conclusion.

2. Description of the experiment

2.1 Procedure

Nine plastic toy animals, approximately 8cm long, were used as stimuli (plus a toy lion in the German experiment). During the experiment the participants were seated at a table together with the instructor. The task was explained to them orally with carefully prepared instructions. They were instructed to describe the spatial layouts of the animals such that a listener seated behind them could reproduce the spatial dispositions. The instructor (who was also a native speaker) started the session by putting two toys, a crocodile and a gorilla, side by side on the table. The participant described this layout. Then the instructor added a horse as a third animal. This layout of three toys (L1) was described orally by the participants. In a second step, the instructor created L2 by removing the crocodile and adding a tiger (a lion in the German experiment). This procedure was repeated until the participants had described eleven different layouts. Thus, the participants provided a brief oral description of all eleven layouts, one after the other. All layouts were identical for all participants for each language, as shown in Fig. 1. Animals that were currently not on the table were hidden in a bag and thus not visible to participants; hence, the new toy was unfamiliar to the participants in the current setting (an exception was reintroduced animals; see below). For Chinese, an entirely different set of animals was used, but the layouts were identical.

<Insert Fig. 1 here>

In L1 to L5, as well as in L11, the animals were disposed horizontally, whereas in L6 to L10 the alignment was front to back. Each layout was the result of changing the preceding layout by manipulating one toy animal, either by newly adding it to the layout or by displacing it within the layout. Since the manipulated animal was put at a new place in the new layout, this animal was expected to figure as the locatum in the localisation describing the change in the layout. The layouts L1 and L7 resulted from adding a new animal to a layout of two given ones. In L2-L5 and L8-L10, one of three given animals was removed before a new animal was added either at the place of the removed one (L3, L4, L8) or at another place (L2, L5, L9,

L10). In L7 and L9, the added 'new' animal was not part of the immediately preceding layout but it had been part of previous layouts, i.e., it was reintroduced.[2] Finally, in L6 and L11, one of three animals was removed and one of the two remaining given animals was displaced. There were three categories of manipulated animals, which in Fig. 1 are called **NEW/ADDED** (bold capitals), REINTRODUCED/ADDED (capitals), *displaced*/*given* (italics); the other toys in the layouts were given animals at given places that could be used as relata in relational localisations.

2.2 Participants

In each language the sample was a dialectally and sociolectally homogeneous group of native speakers of the target language. All participants were university students; hence, they should not substantially differ in their abilities to perform the experimental task. Here are the details of the six language samples (each speaker produced 11 layout descriptions):

• American English: 16 speakers from North Carolina produced 176 descriptions.
• Georgian: 16 speakers from Tbilisi produced 176 descriptions.
• French: 20 speakers from the Paris region produced 220 descriptions.
• Finnish: 20 speakers from Joensuu, North Karelia, produced 220 descriptions.
• Mandarin Chinese: 20 speakers from Beijing produced 220 descriptions.
• German: 30 speakers from Berlin-Brandenburg produced 330 descriptions.

Altogether, our dataset contains 1342 descriptions of layouts, produced by 122 speakers.

3. Roles and classification

In the comparative study that follows, 1257 descriptions (93.7% of the entire dataset of 1342 descriptions) used in the analysis. In order to study the effects of discourse status on clause structure, we restricted the analysis to the subset of descriptions that fulfilled the requirements in (3).

(3) a. The added or displaced animal plays the role of the locatum; in particular, the manipulated animal does not figure as the relatum of a relational localisation.

b. The localisation contains a single clause with a locatum and a locative expression. In addition, we included a particular class of transitive constructions that lack a locative expression, e.g., 'X replaced Y' or 'Y is

replaced by X', with 'X' designating the added locatum (see sections 4 and 7.1; examples are given in (11a) and in (17) to (19)).

c. The added animal was first mentioned when localised. There was no independent utterance introducing it prior to the localisation.

Requirement (3a) is met in the majority of cases; that is, the manipulated animal was used as the locatum in relational localisations, as illustrated for the added gorilla in English (4a) and for the displaced bear in Finnish (4b).

(4) a. Now directly in front of that bear there is a **gorilla**. (E 20.7)

b. koira otettiin pois ja **karhu** siirrettiin hevose-n ete-en.
dog was.taken away and bear was.moved horse-GEN front-ILL (Fin 26.6)
'A/the dog was taken away and a/the bear was moved to the front of a/the horse'.

We discarded the few counterexamples to (3a), about 2% of the data, in which the speaker selected the manipulated toy as relatum, like the displaced dog in (5a) and the added horse in (5b).

(5) a. zhu1 na2 zou3 le5, hou2 zi5 zai4 **gou3** de5 zuo3 bian5. (Ch 2.11)
pig take away PFV, monkey be dog ASSOC left
'A/the pig was taken away, a/the monkey is to the left of a/the dog'.

b. **cxeni-s** maržvniv dgas gorila. (Geo 8.1)
horse-GEN to-the-right stands gorilla
'A/the gorilla is standing to the right of a/the horse'.

The requirement (3b) that the localisation is realised in a single clause is necessary in order to identify syntactic and prosodic correlates of the discourse status of the locatum. This requirement was not fulfilled in examples such as (6), without any locative expression. This type of example was extremely marginal.

(6) Now the tiger is gone and there is a **bear**. (E 1.3)

Another type of counterexample to (3b), shown in (7), lists the animals in their spatial order. Such descriptions, which were used several times, effectively convey the location of the new

entity, but the spatial information is not specified first in response to the discourse statuses of the localised entities.

(7) long2 bei4 na2 zou3 le5, xian4 zai4 cong2 shang4 dao4
dragon BEI take.away PFV now from above to
xia4 de5 shun4 xu4 shi4 hou2, zhu1, ma3. (Ch 18.9)
bottom DE order be monkey pig horse
'A/the dragon was taken away. Now from top to bottom, the order is a/the monkey, a/the pig, a/the horse'.

Finally, (8) presents a counterexample to requirement (3c). The fact that the gorilla was added is expressed in a separate sentence prior to its localisation in the subsequent sentence. The unmarked word order of the localisation is most probably due to the previous change of the discourse status from new/reintroduced to given; that is, the first mention of the gorilla turned it into a perfect topic for the localisation.

(8) Ein Gorilla kommt hinzu. Der Gorilla sitzt nun vor
a gorilla comes along the gorilla sits now in.front.of
dem Hund ... (Ger 14.7)
the dog
'A gorilla is joining in. The gorilla is now sitting in front of the dog …'

4. Types of description

Three types of localisation are distinguished according to their propositional content: relational, non-relational and replacement localisations. Relational localisations specify the place of the locatum with respect to the location of another entity (given animal at given place) whose location is assumed to be known to the hearer, as in (9).

(9) **yang2** zai4 tu4 zi5 hou4 mian5 (Ch 19.2)
goat be rabbit behind
'A/the goat is behind a/the rabbit'.

Non-relational localisations specify the place of the locatum with respect to the entire spatial configuration, as exemplified in (10). There is no mention of a relatum.

(10) … zai4 zui4 you4 bian5 tian1 jia1 yi2 ge4 **yang2**. (Ch 15.2)
to very right add one CL **goat**
'Add a/the goat to the very right'.

Replacement localisations, as illustrated in (11), specify the place of the locatum as that of the removed animal (layouts 3, 4 and 8). Syntactically, 'replacement' expressions come either as expressions with a locative PP, as in (11a), or as transitive clauses with an agent and a patient argument, as in (11b).

(11) a. maimun-is nacvl-ad ari-s **zebra** (Geo13.4)
monkey-GEN instead-ADV be-PRS.S.3.SG **zebra(NOM)**
'Here is a/the zebra instead/at the place of a/the monkey'.

b. **maimun-i** še-cval-a žroxa-m. (Geo 25.8)
monkey-NOM PV(into).PRF-change-AOR.S.3.SG cow-ERG
'A/the cow replaced a/the monkey'.

The speakers of all languages mostly produced relational localisations (70% of the valid utterances). Non-relational localisations are attested in all languages (6% of the valid utterances), except for Georgian in which this construction is not attested. Replacement localisations (24% of the valid utterances) are particularly frequent in layouts in which an animal is added at the place of the removed one (L2, L3, L8), but they also marginally occur in layouts in which an animal is removed and another animal is added in a different place (L4, L5, L10). Although replacement localisations in this latter instance are unable to convey the place of the added animal, these instances are included in the analysis.

5. Word order and givenness

This section gives an overview of the results in terms of word order according to the discourse status of the locatum. We are only interested in the order of the locatum relative to the relatum as part of the locative expression, and thus, in how 'given before new' obtains in the data. Two alternative word orders are distinguished: either the locatum comes before the locative expression, yielding the unmarked order Loc $\prec$ Lx as in (12a), or the reverse ordering is realised, Lx $\prec$ Loc, as in (12b). This is the marked word order. If a locatum is placed before a locative expression, this does not mean that the Alignment constraint is fulfilled, as it can be the case that the verb, or some other material, separates the locatum from the right edge of the

intonation phrase (called i-phrase below) (see section 7 for more on the syntactic and prosodic options for the fulfilment of ALIGN-FOCUS-R).

(12) a. **hevonen** tullee tuo-hon gorilla-n oikee-lle puole-lle
horse comes there-ILL gorilla-GEN right-ALL side-ALL
ja kasvo-t sama-an suunta-an (Fin 17.1)
and face-PL same-ILL direction-ILL
'A/the horse is there on the right side of a/the gorilla and is facing the same direction'.

b. ja sitten nyt se-n gorilla-n oikea-lle puole-lle tul-i
and then now it-GEN gorilla-GEN right-ALL side-ALL came
heppa kanssa naama tä-nne-päin (Fin 4.1)
horse also face-PL here-ALL-towards
'And now on the right side of that gorilla, a/the horse also with its face this way'.

The choice of word order between locatum and locative expression turns out to be sensitive to the discourse conditions, as may be gathered from the distribution of the two alternative orders in Table 1. A three-way distinction can be made between the layout conditions (a) added new locatum, (b) added reintroduced locatum and (c) displaced given locatum. It holds true across all six languages that marked word order (Lx ≺ Loc) is most frequent for added new locata; that is, new locata follow the locative expressions more frequently than reintroduced locata. Unmarked word order (Loc ≺ Lx) plainly predominates for displaced given locata. In this latter case there is no information-structural pressure against the unmarked word order.

<Insert Table 1 here>

The top panel of Table 1 shows the proportions of unmarked (Loc ≺ Lx) and marked (Lx ≺ Loc) word orders for layouts in which a new animal is added to the layout (L1-L5, L8 and L10) and the animal is mentioned in the localisation for the first time. Across all languages, marked order is more frequent than unmarked order, 66% versus 34%, in line with the fact that the locatum is new. The only language in which unmarked order predominates even in this condition is English. In French and Chinese, the two word orders are equally distributed.

The medial panel of Table 1 presents the proportions of word orders for layouts in which a reintroduced animal is added to the layout (L7, L9); that is, the animal is neither new nor was it part of the immediately preceding layout: the gorilla reintroduced in L7 had been part of L1-L3, whereas the tiger reintroduced in L9 had been part of L2 (cf. Fig. 1). Across all six languages, marked word order is less frequent in this condition compared to added new locata, 54% versus 66%, yet marked order still predominates. Languages differ, however, in how they respond to this difference in discourse status of the added locatum. A noticeable drop of marked order is observed for English, French and Finnish, with the first two of these languages showing a general predominance of unmarked order. In contrast, German, Georgian and Chinese exhibit no drop in marked word order. In particular, the first two of these languages still show a clear preference for marked order even for reintroduced locata.

The bottom panel of Table 1 presents the proportions of the two word orders for layouts in which a given animal is displaced, and thus given (L6, L11). In this case, the animal was part of the immediately preceding layout(s). Across languages, marked word order is clearly dispreferred in this condition compared to unmarked order, 21% versus 79%. Accordingly, the drop in frequency of marked order from new to given (45% difference) is much stronger than the drop from new to reintroduced (12% difference). Georgian is the only language in which the marked order Lx ≺ Loc is still more frequent even for given locata (56%), although this language exhibits a drop in frequency of the marked word order that is in line with the general pattern (34% difference from new/reintroduced to given).

The proportions presented in Table 1 suggest a major division between given locata (21% 'Lx ≺ Loc') and new or reintroduced locata (66% and 54% 'Lx ≺ Loc', respectively). This finding is challenging, because at first sight the discourse status of displaced locata as well as of reintroduced locata might be collapsed together as 'given', an intuition reflected to some extent in the definiteness of the corresponding DPs (see section 6 below). But this is not the case, since new and reintroduced animals pattern together. One possible explanation for the behaviour of a reintroduced animal as new is that a given locatum that was both part of the immediately preceding layout and underwent a visible change of location is more likely to be selected as the topic of the localisation than a locatum that was part of some distant layout and then reappears in a new location. Moreover, the speakers must not only remember the previous occurrence of an animal of the type in question (e.g., a gorilla) but they must also assume that it is the same token (given token) and not just another token of the same type (new token). In section 7, it is proposed that new and reintroduced animals are referents of focused constituents, and that this is the base for their similar role in word order.

Fig. 2 illustrates the proportions presented in Table 1. The major cross-linguistic difference relates to the proportions of the examined orders: while the general covariance of word order and discourse status of the locatum shows up in all languages, there is a subset of languages in which the unmarked word order Loc ≺ Lx order is the preferred order across the conditions (English, French and Chinese), and a subset of languages in which the marked word order Lx ≺ Loc order is the preferred pattern (German, Finnish and Georgian).

<Insert Fig. 2 here>

To sum up thus far, the order of locatum and locative expression responds to the discourse status of the locatum in all languages: if it is new, it preferably follows the locative expression, but if it is given, it comes first. Converging patterns could be identified across languages, but the use of marked word order substantially differs between two subsets of languages. This difference suggests that structural properties of the languages at issue interact with discourse status. Section 7 proposes a grammatical account of word order variation in terms of syntactic and prosodic properties. But first, some remarks on the use of articles are the subject of section 6.

6. Definiteness

Finnish, Georgian and Mandarin Chinese do not have definite or indefinite articles; however, English, German and French obligatorily use articles with nouns, at least in the singular. In these languages new animals were generally introduced by indefinite articles and given ones by definite articles. Table 2 compares in percentages the use of definite and indefinite articles in the three languages with obligatory articles.

<Insert Table 2 here>

The results for definiteness are the clearest for French: 91% of the new animals are mentioned with an indefinite article. Similarly, 78% of the new animals in English and 74% of the new animals in German are introduced by an indefinite article. The reintroduced animals are recognised as such and are very often used with a definite article, again French being the clearest language with only 27.7% of the reintroduced animals being mentioned with an indefinite article. Unsurprisingly, the given displaced animals are accompanied by a definite article most often, in approximately 90% of the cases in all three languages.

7. Alignment: syntax and prosody

This section introduces an optimality-theoretic constraint requiring alignment of a new or reintroduced locatum, which is assumed to be the focus of the sentence with the right edge of an i-phrase. ALIGN-FOCUS-R is used as a universal constraint that every language tries to fulfil the best it can (see Féry 2010). It is formulated in (13) in terms of McCarthy & Prince's (1993) Generalized Alignment theory, which requires that the edges of different types of constituent fall together. I-phrases are the highest prosodic domains, often corresponding to sentences (see Nespor & Vogel 1986, Selkirk 1984 and many others for prosodic constituents).

(13) ALIGN-FOCUS-R (ALIGN-FOCUS R, I-PHRASE R):
Align a focus with the right boundary of an intonation phrase.

ALIGN-FOCUS-R is first of all a requirement on prosody to fulfil the needs of information structure, but the most direct way to achieve its goal goes through syntactic reordering, by non-canonical word order.

In the data examined in this paper, the role of focus is taken over by the locatum in the critical conditions in which the locatum is a new/reintroduced referent. In these conditions, the locatum seeks to be aligned with the right edge of an i-phrase. The result is often a change relative to the unmarked word order, which is more often fulfilled when the locatum is new than when it is reintroduced, speaking for a gradient effect: a constituent can be more or less focused, and thus more or less subject to ALIGN-FOCUS-R (see Table 1). As a rule of thumb, Lx ≺ Loc fulfils ALIGN-FOCUS-R better than Loc ≺ Lx. But this is not always true, as alignment is not just implementation of word order. It is possible to right align a focused locatum without changing word order. And the reverse is true as well. Non-canonical word orders do not imply that ALIGN-FOCUS-R is fulfilled. Examples of both cases are shown below.

The languages under consideration differ with respect to the syntactic operation that is involved in the derivation of non-canonical word orders. German, Georgian and Finnish are scrambling languages, which means that the locative PP may be scrambled to a position higher than the subject in order to satisfy discourse preferences. By contrast, many of the available constructions in English, French and Chinese involve Ā-movement. In this kind of syntactic operation, the displaced constituent occupies an operator position outside the

thematic layer of the clause. Scrambling languages are examined in section 7.1 and languages with Ā-movement in section 7.2.[3] Apart from these reorderings, some languages use passivisation in order to change the order between an agent and a patient. This operation also satisfies alignment, as shown in section 7.3. A further way to satisfy alignment is through deaccenting of the material following the focused locatum. This is the subject of section 7.4.

7.1 Alignment through scrambling: reordering of p-phrases

Three languages in our sample, namely German, Finnish and Georgian, allow for scrambling of the PP constituent over a higher argument; see the two word orders in (12a) vs. (12b) for Finnish and in (14a) vs. (14b) for Georgian. Sentences involving a scrambled PP over the subject (hence, the locative expression precedes the locatum, and the locatum is final) are very frequent in these three languages. The crucial point is that the alternation between canonical and scrambled sentences in these languages is a fairly free operation selected in discourse to fulfil ALIGN-FOCUS-R (see extensive discussion for Georgian in Skopeteas & Fanselow 2009b and Skopeteas & Féry 2010, albeit in a different theoretical framework).

(14) a. **cxen-i** maimun-is marʒvniv dgas. (Geo 2.1)
horse-NOM monkey-GEN right stands
'A/the horse is standing to the right of a/the monkey'.

b. datv-is marʒvniv **žağl-i** dgas ... (Geo 2.5)
bear-GEN right **dog-NOM** stands
'There is a/the dog standing to the right of a/the bear ...'

German, Georgian and Finnish are thus languages that allow the reordering of the constituents by scrambling. For prosody, this implies that the prosodic phrases (p-phrases) projected by the locatum and the locative expression can be reordered inside of a single i-phrase. Let us examine some additional examples fulfilling ALIGN-FOCUS-R from the perspective of the prosody.

The first example comes from German. In the sentence in (15), the locative expression is in the preverbal position, the subject is postverbal, and each of them forms its own p-phrase (Selkirk 1984, Uhmann 1991, Büring 2001). The order displayed in this sentence allows the new animal to be right aligned in its i-phrase and to fulfil ALIGN-FOCUS-R. The sentence forms a single i-phrase, divided up into two p-phrases. The successive p-phrases are in a downstep relation, which is typical for an i-phrase (Féry 1993). Downstep means that the

highest pitch accent of a p-phrase is lower than the highest pitch accent of the preceding p-phrase.

(15) [[Links vom Pferd]$_p$ [steht jetzt **ein** **Zebra**]$_p$]$_I$ (Ger 28.4)
left of.the horse stands now a zebra
'To-the-left of the horse stands now **a zebra**'.

In German, there is a very strong correlation between word order and direction of excursions as rising or falling tones. If the locatum is before the locative expression, it is realised with a rising tone, but if it is the last constituent of the sentence, it is realised with a falling tone, which is the standard pitch excursion for focused constituents (Büring 1997). This relates to the fact that a declarative sentence ends with a low tone in German, but a medial prosodic phrase often has a high boundary tone. Table 3 compares the correlation between pitch accent of the locatum and discourse status and between the same pitch accents and word order.

<Insert Table 3 here>

Satisfaction of ALIGN-FOCUS-R in Georgian is illustrated with example (16). The new referent is *lomi* 'lion', which is final in its intonation phrase – the remainder of the sentence is in a separate intonation phrase. The entire word *lomi* is uttered on a very low pitch. The first sentence is organised in three prosodic phrases (p-phrases) in a downstep relation to each other, as shown in Fig. 3, a pitch track of (16). The word preceding *lomi*, that is, *dgas* 'stands', has a high boundary tone.

(16) [[cxen-is]$_p$ [marcxena mxare-s dgas]$_p$ [**lom-i**]$_p$]$_I$ [niang-i ağar aris]$_I$ (Geo 6.2)
horse-GEN left.DAT side-DAT stands lion-NOM crocodile-NOM no.more is
'There is a/the lion standing on the left side of a/the horse, a/the crocodile left'.

<Insert Fig. 3 here>

A very strong (though partial) correlation between word order and tone could be established for Georgian. Georgian is the language with the most Lx ≺ Loc word orders in all conditions (see Fig. 2). Not only is the locatum generally after the locative expression, but it is in the absolute final position of the sentence in 118 cases out of the 172 analysed (69%), thus

satisfying ALIGN-FOCUS-R straightforwardly. And it has a special intonation, in which the last constituent has a super-low tone in 109 cases (or 92% of the sentence-final locata). In the few remaining cases, the final locatum has a falling intonation, never a rising one. When the locatum is given (in layouts 6 and 11), it is less often final and has more rarely a super-low tone (3 times in L6 and 7 times in L11). When the locatum is not final (in the remaining 54 cases), it is rising (37 cases) or falling (17 cases). These results are summed up in Table 4. In Georgian, downstep is even more regular than in German, since every p-phrase is downstepped relative to the preceding one. Because the focused word is very often final, it is also the lowest (see also Skopeteas, Féry & Asatiani 2009 and Skopeteas & Féry 2010 for Georgian intonation, but different data). It can be thus assumed that finality and low tone are strong indicators for focus.

<Insert Table 4 here>

Finnish, the last language with scrambling, is illustrated in (17). It was shown in Fig. 2 that this language considerably changes its word order depending on the status of the locatum as new or given. As can be gathered from Fig. 4, the last p-phrase is much lower than the preceding one, which suggests that it is part of the same i-phrase. Downstep is again very regular in this language. In the words of Suomi et al. (2008: 114-5): 'Neutrally uttered complete statements in Finnish generally take a smoothly descending pitch contour; the first syllable is uttered somewhere above (or at) the middle of the speaker's voice range, and the last syllable is uttered on a very low pitch (often, the end of the intonation-group is accompanied by creak).' This is fully confirmed in our data (see also Mixdorff et al. 2002 for Finnish intonation).

(17) [[ja nytte se-n karhu-n ete-en]$_p$ [tul-i se **gorilla**]$_p$]$_I$ (Fin 4.7)
and now it-GENbear-GEN front-ILL come-IMPF-3SG it gorilla
'And now in front of a/the bear came a/the gorilla'

<Insert Fig. 4 here>

The locatum in Finnish is often realised with a falling pattern, namely 146 times out of the 219 sentences analysed.[4] There is consequently 73 rising tones on the locatum DP, but never when the locatum is given (layouts 6 and 11), suggesting an association of a rising contour

with a new constituent, but not with a given one. This correlates with the observation found in the literature that Finnish has rising tones on strongly accented constituents (see Välimaa-Blum 1993). Compare the data in Table 5.

<Insert Table 5 here>

7.2 Alignment through Ā-movement: creation of i-phrases

ALIGN-FOCUS-R is also achieved by Ā-movement. This option is chosen by languages whose syntax does not allow scrambling and p-phrase reordering. As a result, a more drastic change in syntax and prosody is needed if ALIGN-FOCUS-R is to be fulfilled. This happens by Ā-movement and by creating additional i-phrases. As far as alignment is concerned, if the focused constituent (the locatum) is right aligned with an i-phrase, the result is identical to the one observed for scrambling. But both in terms of syntax and prosody, there is a difference between scrambling and dislocating languages. A different set of constraints is violated in each case (see section 7.5).

English, French and Chinese also allow for marked word orders, as attested in our dataset, though less often than the scrambling languages discussed above. In English and French, we find a number of sentences in which the subject appears *in situ*, while the preverbal slot is filled by an expletive; see English in (18a). A similar pattern with the subject *in situ* is exemplified in (18b) from French, with an *il y a* 'there is' expression. In these examples, ALIGN-FOCUS-R is straightforwardly fulfilled.

(18) a. Now directly in front of that bear there is **a gorilla**. (E 20.7)

b. À la gauche de l'ours il y a **un chien.** (Fr 7.5)
'On the left of the bear there is **a dog**'.

The English and Chinese data contain some sentences in which the subject remains *in situ* while the preverbal position is occupied by the locative PP. These constructions are exemplified in (19) for Chinese and English (this construction is not attested in the French data, though it is grammatically possible; see Cornish 2001). Again, ALIGN-FOCUS-R is straightforwardly fulfilled in these sentences.

(19) a. zhu1 de5 xia4 bian5 shi4 **ji1** (Ch 17.7)
pig ASSOC below be **cock**

'Under a/the pig is a/the cock'.

b. Now… next to the gorilla… on the gorilla's right is **a horse**. (E 20.1)

In still another subset of sentences in English and French, the locative PP is left dislocated to a position that precedes the subject, as exemplified in (20a-b). This operation has the result of reducing everything to the right of the locatum to deaccented material in (20a). This prosodic structure is a way to fulfil ALIGN-FOCUS-R. In (20b), *cheval* is the end of the main i-phrase and the verb *est ajouté* 'is added' is uttered as an afterthought, compressed and in a different i-phrase; see section 7.3. Hence, the examples (20)-(22) illustrate three different structural possibilities to form a Lx ≺ Loc order in English, French and Chinese, and to fulfil ALIGN-FOCUS-R.

(20) a. In front of the bear, who is in front of the stallion, **a gorilla** has positioned himself. (E 9.7)

b. À droite du gorille **un cheval** est ajouté. (Fr 1.1)
'On the right of the gorilla **a horse** is added'.

In (21) and (22), additional examples are shown from French and English respectively that illustrate how these languages fulfil ALIGN-FOCUS-R in phrasing.

French does not have pitch accents in the same sense as German and English because of the lack of lexical stress in this language. But it does have high boundary tones, which are perceived as more or less prominent, along with the height of the high tones. Table 6 shows that 91% of the locata have a rising tone when they precede the locative expression, and 74% of them have a falling tone when they follow the locative expression. And, as was observed for German, the correlation between direction of excursion and status of the animal is weak.

<Insert Table 6 here>

The sentence-medial rises have thus a partly different and partly similar function to the German high tones, which can explain why downstep is organised in a different way in the two languages: French also has downstep at the highest level of phrasing, but embedded downstep at lower p-phrases is not as regular as it is in German. This language also differs from the languages with scrambling in that stronger boundaries appear between the prosodic phrases. Pauses between p-phrases are longer than in German (see Féry, Hörnig & Pahaut 2010 for a quantified comparison between French and German prosodic features).

(21) [Le zèbre est enlevé]$_I$ [et à la droite de l´ours]$_I$, [vient se mettre un **chien**]$_I$ (Fr 14.5)
the zebra is taken-away and at the right of the bear comes REFL put a dog
'The zebra is taken away, and a dog locates itself to the right of the bear'.

English presents the least clear pattern in its choice of tones. In the 159 sentences analysed, there are 76 rising patterns, 41 falling ones, 34 rising-falling ones, 2 falling-rising and 6 completely flat contours. English often upsteps the high tone of a new animal, thus cancelling downstep (see Fig. 6).

(22) a. [Take away the dog]$_I$, [and move the **bear**]$_I$, [so that´s in front of the horse]$_I$ (E.16.6)
b. … [and behind the horse]$_I$ [facing the horse´s tail]$_I$ [is the **tiger**]$_I$ (E. 21.9)

The relevance of the distinction between scrambling and Ā-movement for our data is quite straightforward. While scrambling implies that the ordering of the constituents is free and can be determined by the interaction of discourse and/or accentual preferences, Ā-movement is a restrictive syntactic operation that has to be licensed by a contextual trigger (see Neeleman & Koot 2007, Skopeteas & Fanselow 2009a). This distinction is reflected in our data in terms of frequencies. Speakers of scrambling languages (German, Finnish, Georgian) select PP-fronting much more frequently than speakers of languages in which this configuration involves Ā-movement (English, French, Chinese) under the same discourse conditions. The difference is shown in Table 7, which summarises across conditions the word-order results in constructions with a PP constituent: either a locative PP headed by an adposition (relational), as in (9); a PP headed by an adverb (non-relational), as in (10); or an *instead*-phrase (replacement), as in (11a).

<Insert Table 7 here>

In sum, sections 7.1 and 7.2 have shown that all sample languages show a tendency to fulfil alignment of the locatum with the right of an i-phrase. But the individual languages differ with respect to the impact of this constraint on word order. This is because fulfilment of ALIGN-FOCUS-R is obtained through very different operations. On the basis of this finding, we argue that the crucial typological factor is not a distinction between languages with 'rigid' and languages with 'free' word order. The different data patterns reflect the type of syntactic

operations that the languages employ in order to derive non-canonical word orders. In particular, the operation of scrambling is sensitive to givenness asymmetries, which is reflected in the large amount of marked word orders in the scrambling languages of our sample, i.e., German, Finnish and Georgian. Ā-movement involves a higher degree of structural markedness and occurs less frequently under the same discourse conditions, as is reflected in the lower proportion of non-canonical orders in English, French and Chinese.

7.3 Alignment through passivisation

A further subset of elicited utterances involves two referents as agent and patient constituents of a base transitive verb either in the active or the passive voice. The crucial property of these utterances is that they reflect the speaker's choice among four paradigmatic alternatives (two possible orders in two different voices). The choice of voice can be determined by preferences for linear orders in which the patient constituent precedes the agent constituent, as has been shown in several studies (see Mathesius 1975, Tomlin 1995, Skopeteas & Fanselow 2009a). Hence, it offers a further possibility to satisfy alignment that is only applicable to transitive verbs.

Utterances with base transitive verbs occur in replacement expressions in our dataset. The interaction with givenness is illustrated in the examples (23) from English and (24) from Chinese. In the active sentences, (23a) and (24a), the new referent (agent/locatum) precedes the given one (patient/relatum). In their passive counterparts, (23b) and (24b), the order is inverted and the given referent precedes the new one. As a consequence, the locatum is better aligned to the right of an i-phrase. Table 8 summarises the results and shows that passive sentences also occur in French, German and Finnish.

(23) a. Now it seems a **dairy cow** has replaced the gorilla… (E 9.8)

b. The bear was replaced by **a pig**… (E 22.10)

(24) a. xian4 zai4 **ma3** ba3 ji1 huan4 zou3 le5 (Ch 24.8)
now **horse** APPL cock replace PFV
'Now a/the horse has replaced a/the cock'.

b. xian4 zai4 ji1 bei4 yi4 pi3 **ma3** gei3 ti4 huan4 diao4 (Ch 4.8)
now cock BEI one CL **horse** replace
'Now a/the cock is replaced by a/the horse'.

In sentences with transitive verbs, alignment may be also satisfied through scrambling the object in an earlier position in the clause, as illustrated in (25). In this case, the operations at issue are the same with the operations that we observed for PPs in section 7.1. However, these operations occur less frequently with transitive verbs. Table 8 shows that Georgian is the only language in our sample in which such sentences occur.

(25) datv-i šecvala **vepxv-ma** (Geo 25.9)
bear-NOM replaced **tiger-ERG**
'A/the tiger replaced a/the bear'.

Table 8 shows that speakers select either passive or non-canonical word orders (all sentences in this Table were encountered in the conditions of new/reintroduced referent); hence, the possible permutation 'passive and non-canonical order' does not occur at all. This observation supports the view that passive and word order are (in some of their occurrences) alternative strategies that may be selected in order to render the optimal linearisation in a given context, and in this way, to fulfil Alignment. The results in Table 8 reveal a typological distinction between languages that select the passive option (i.e., English, French, German, Finnish and Chinese) and languages that select the word order option (only Georgian in our sample). The fact that English, French and Chinese prefer the passive option with transitive verbs is in line with the observation that a marked word is more costly in these languages, and hence they select an alternative strategy whenever available. From the point of view of prosody, passivisation is similar to scrambling. It involves only reordering of p-phrases projected by constituents, locatum and locative expression or relatum in the data under consideration.

The fact that German and Finnish prefer the passive option with transitive verbs shows that additional factors are involved, i.e., that the choice of passive is not reducible to the non-availability of scrambling. These factors may relate to the potential ambiguity in configurations with two DPs or further phenomena that cannot be addressed here.

<Insert Table 8 here>

7.4. Pitch accent and deaccenting

Finally, ALIGN-FOCUS-R may be fulfilled by still another method that does not necessarily require a change in linearisation. This method only involves pitch accents and deaccenting of

the following given material. In this case, the locatum carries the final (nuclear) pitch accent of an i-phrase, and the following material is deaccented. It is well known that newness and givenness can be expressed in some languages by the relation between the heights of tonal excursions. According to relevant principles in the literature (see Jackendoff 1972, Truckenbrodt 1995 and Büring 2009, among others), it is expected that a new (and focused) constituent has a higher pitch accent than a given one.

The following example illustrates this case. The locatum *Kuh* 'cow' is pitch-accented, but the locative expression *an seine Stelle gestellt* 'put at its place' is deaccented (see Fig. 5).[5]

(26) [Der Gorilla wird entfernt]$_I$ [und eine Kuh an seine Stelle gestellt]$_I$ (Ger 39.8)
the gorilla becomes removed and the cow at its place put
'The gorilla is removed and [a cow]$_{LOC}$ is [at its place]$_{LX}$ put'.

<Insert Fig. 5 here>

The next example comes from English, the other language beside German that regularly deaccents postnuclear material. In (27), the locatum *cow*, is right aligned with its i-phrase, although it is followed by the locative expression. The reason is that the PP is completely deaccented, and even creaky, as shown in Fig. 6.

(27) Now [[instead of the gorilla]$_p$]$_I$ [[there is a COW]$_p$ [in front of the bear]$_p$]$_I$ (E 39.8)

<Insert Fig. 6 here>

Not all the languages in our sample may deaccent given material. French (and Chinese) do not have any lexical stress, and thus no pitch accent associated with them. In these languages, ALIGN-FOCUS-R by deaccenting is not available, or rare.

In deaccenting, alignment is fulfilled in a different way, since now it is not the lexical material which is right aligned, but rather the head of a prosodic constituent, as shown in (28). The only grid position at the level of the i-phrase is associated with the lexical stress of the locatum *cow*, rendering this word the most prominent of the entire i-phrase. In the following p-phrase, the locative expression is deaccented at this level.

(x) i-phrase

(x) (x) p-phrase

(28) […] [[there is a COW]$_p$ [in front of the bear]$_p$]$_I$

7.5. Align

Four different ways to fulfil ALIGN-FOCUS-R have been reviewed above. An OT approach allows us to express the fact that every language tries to right align a focus with an i-phrase but that they reach this aim by different means, a case of conspiracy (Kenstowicz & Kisseberth 1979). An important result of this paper is that success differs greatly from language to language and depends on the methods used for satisfying a markedness constraint such as ALIGN-FOCUS-R. Depending on which constraints are at play and how they are ranked, the alignment requirement may be more or less costly to obtain. In this section, which optimality-theoretic constraints are violated in each case are outlined. We restrain from giving a full OT account for each case for reasons of space.

First, languages allowing scrambling reorder p-phrases in such a way that the one containing the focused word (the new or reintroduced locatum) appears at the end of an i-phrase. This does not always happen, because other effects may interfere. In other words, fulfilment of ALIGN-FOCUS-R (29a) is just a preference. Languages with scrambling reorder their constituents for a number of reasons, focus being just one of them. It has been shown that animacy, definiteness, pronominalisation, weight, or length of constituents also act on the order of constituents (Lenerz 1977, Müller 1999). As a result, there is no need for a special constraint for moving a focused constituent, and also no need for a special syntactic position targeting focus. The constraint against scrambling is STAY; see (29b) from Grimshaw (1997). In languages with scrambling, this constraint is ranked lower than ALIGN-FOCUS-R, and it is violated when ALIGN-FOCUS-R is fulfilled.

In a second set of languages, exemplified with French and English in our sample, STAY is high-ranking, which means that scrambling and reordering of p-phrases is not an option. However, another way to fulfil ALIGN-FOCUS-R was shown to involve the creation of additional i-phrases. Again, the restructuring of sentences in several i-phrases is not restricted to focus, but languages may create additional i-phrases for all sorts of reasons: topicalisation is one of them. Notice that languages with scrambling generally also have the option to divide sentences into more than one i-phrase. This may result in cleft sentences, for example. However, the results of this paper show that minimal solutions are preferred, and the reordering of p-phrases happens before the creation of i-phrases. In the languages of this

second set, when ALIGN-FOCUS-R is fulfilled, MAX I-PHRASE (29c) is violated. Again, there is no need for a special constraint stating explicitly that focus has to be realised in a separate i-phrase. The creation of an i-phrase is the consequence of the overall organisation of the grammar.

In a particular subset of sentences that involve an agent and a patient constituent, languages may use passivisation in the same discourse conditions as those triggering the reordering of the locatum and the locative PP. In our view, passivisation is a further possibility in order to change the linearisation for the sake of ALIGN-FOCUS-R. It implies a change of grammatical functions, since now the patient is the subject of the sentence. The constraint penalising such a change comes from Aissen (1999), who proposed a harmonic combination of a grammatical function hierarchy with a theta-role hierarchy: high theta-roles thrive to realise high grammatical functions. For the sake of the present argument, the constraint in (29d) SU/AGENT > SU/PATIENT is sufficient. This constraint reflects the markedness asymmetry between active and passive clauses: An active clause with the agent as a subject is optimal if it does not violate a higher constraint. Again, this constraint is independent from focus. It should be noted that information-structural factors only account for a subset of the passives in discourse.[6]

The last way of fulfilling ALIGN-FOCUS-R implies that the focused constituent carries the last pitch accent in an i-phrase. This goes with deaccenting of the following postnuclear material and renders the focus prominent. There is no need for a special constraint assigning a focus a pitch accent. The presence of pitch accents is independent of focus (see Gussenhoven 1983 and Cinque 1993, for instance, who propose a syntactic account of pitch accent assignment). What is special is that some constituents are deaccented, and for this, a constraint like the one formulated in (29e) is needed (see Féry & Samek-Lodovici 2006 for this constraint). This option is only available in languages in which pitch accents are associated with lexical stress.

(29) OT Constraints

a. ALIGN-FOCUS-R: Align a focus with the right boundary of an intonation phrase.

b. STAY: do not move constituents.

c. MAX I-PHRASE: do not create i-phrases.

d. SU/AGENT > SU/PATIENT: an agent is a subject.

e. DESTRESS-GIVEN: given material is not accented.

8. Conclusion

With the help of an experiment eliciting pseudo-spontaneous speech in six languages (Chinese, English, Finnish, French, Georgian and German), we examined the role of syntax and prosody for the expression of information structure in a typological perspective. The task consisted in localising toy animals relative to each other. In each layout, one of the animals was new or displaced, and in two cases, the animal was reintroduced. Altogether, 1256 utterances were used in the syntactic and prosodic analysis.

The well known tendency for a given constituent to be uttered before a new constituent delivers the non-canonical marked word order (locative expression before locatum, Lx ≺ Loc). In a subset of the studied languages (German, Georgian and Finnish), non-canonical orders were dominant in the critical context. At the other extreme, in French and English, non-canonical orders were always non-preferred, even though they occurred more frequently in the critical condition. The Chinese results were intermediate between the two classes of language. This difference relates to the fact that the syntactic operations involved in the derivation of non-canonical word orders differ in the two language types: the non-canonical word orders in German, Georgian and Finnish are the result of scrambling, while the non-canonical word orders in English, French and Chinese are the results of movement to designated positions in the left periphery. In other words, some languages were much more responsive than others in their propensity for a non-canonical word order for the sake of information structure. This difference was attributed to the restricting role played by syntax and prosody in the languages considered.

In grammatical terms, we proposed that ALIGN-FOCUS-R is active (and high-ranking) in all languages. This optimality-theoretic constraint requires the focus (locatum) to be right-aligned in its intonation phrase (i-phrase). In the scrambling languages, this constraint can be fulfilled by scrambling p-phrases relative to a canonical word order, but in dislocating languages, the creation of additional i-phrases relative to the unmarked word order is involved, and higher-ranked constraints are violated.

It was also shown that ‘given before new’ and ALIGN-FOCUS-R cannot be reduced to each other, because ALIGN-FOCUS-R can be fulfilled even if the locatum is placed before the locative expression. In the same way ‘given before new’ is sometimes obtained when ALIGN-FOCUS-R is not.

In terms of prosody, alignment of the new constituent with the right edge of a constituent can be fulfilled in two ways. First, the constituent can be perfectly aligned if it is the last one in its prosodic domain. This happens where the syntax provides the right configuration, either

by default, or by reordering. In the case of dislocation, a new i-phrase may be created, which allows the new constituent to be right aligned. Second, a nuclear pitch accent may be assigned to the new constituent and deaccenting applies to the following material. This is a way of marking the edge of an i-phrase, as the pitch accent is then the last one in its domain.

In sum, prosodic alignment is first of all a prosodic constraint that relates information structure to the edge of a prosodic domain. But syntax provides some of the tools to fulfil this constraint. Thus, prosody and syntax are working together in satisfying information-structural needs.

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Abbreviations

ALL	allative
APPL	applicative
ASSOC	associative
BEI	gloss for Chinese *bei4* (passive auxiliary)
CL	noun classifier
ERG	ergative
GEN	genitive
ILL	illative
i-phrase	intonation phrase
NOM	nominative
PFV	perfective
PL	plural
p-phrase	prosodic phrase

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Notes

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[2] In the German experiment, only the gorilla in L7 was reintroduced; the tiger in L9 was new since the lion was part of L2 instead of the tiger.

[3] The distinction adopted here differs from a binary distinction between languages with 'free word order' in which different orderings are allowed and languages with 'rigid word order' in which the order is syntactically fixed (see Mathesius 1975: 156ff., Tomlin 1995: 538, Prat-Sala 1997: 99, Van Valin 1999). In the view advocated in our article, all languages have the structural possibility of deriving marked word orders (and they do so as our findings in Table 1 show), albeit through different syntactic operations.

[4] In the literature on Finnish intonation, it is often stated that accented syllables are only realised by rising tones. The following fall is then attributed to an extra low boundary tone (see for instance Välina-Blum 1984). This is not disconfirmed by our data.

[5] See also the examples in (20) in which only the verb follows the right-aligned locatum. In such a case, the verb is integrated into the same p-phrase as the locatum, and it is this latter word which is the head of the p-phrase.

[6] Beyond information structure, passivisation can be used in order to suppress the expression of the agent and is associated with semantic effects in several language, e.g., it may interact with the lexical aspect.

L1	Crocodile	Gorilla	**HORSE**			
L2	Gorilla	Horse	**TIGER***			
L3	Gorilla	Horse	**BEAR**			
L4	**ZEBRA**	Horse	Bear			
L5		Horse	Bear	**DOG**		
L6	Horse	L7	Horse		L8	Horse
	Bear		Bear			Bear
			GORILLA			**COW**
L9	TIGER	L10	**PIG**			
	Horse		Tiger			
	Bear		Horse			
L11		*Tiger*	Horse			

Figure 1 Layouts used in the experiment (* in the German experiment, a lion was added instead of the tiger)

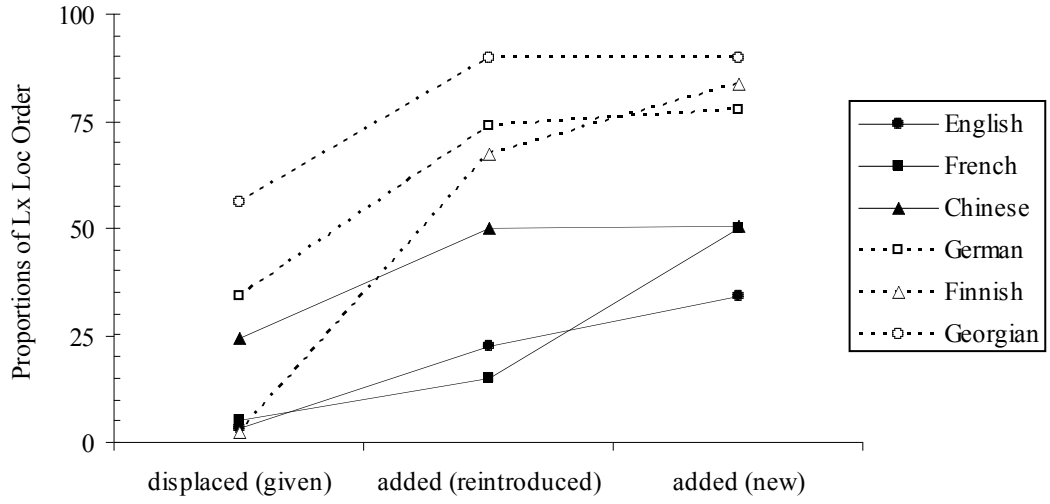

Figure 2 Proportions of orders with Lx preceding Loc

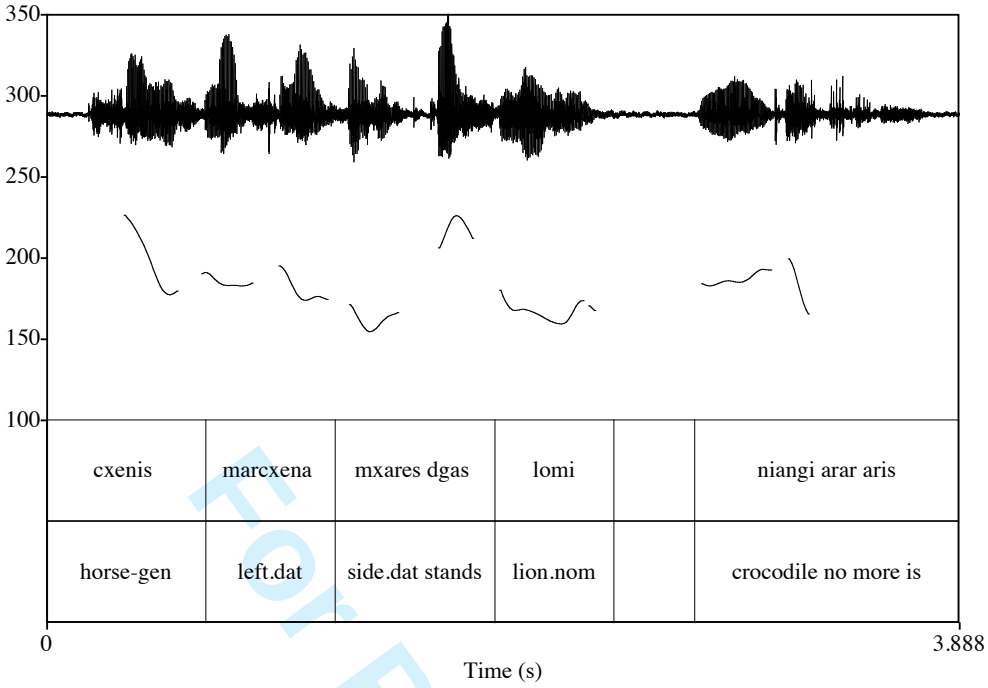

Figure 3 Super-low tone in Georgian

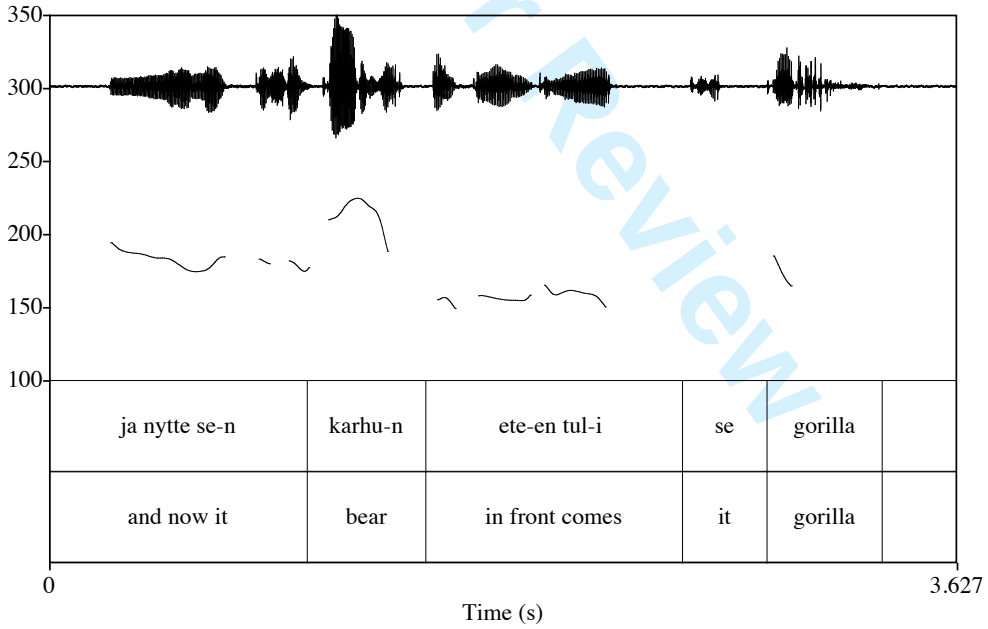

Figure 4 Initial fall followed by register lowering in Finnish

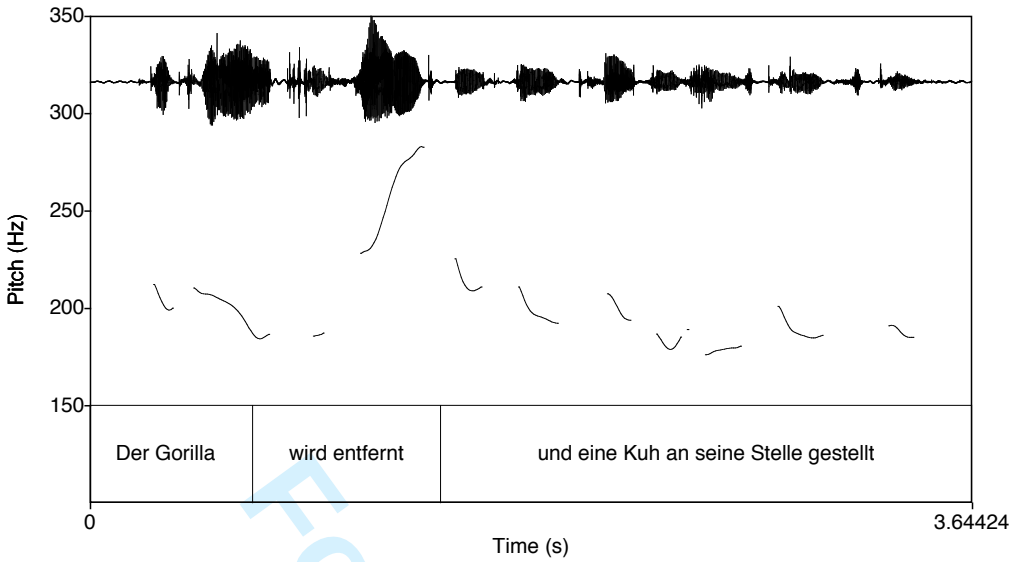

Figure 5 Deaccenting of postnuclear material in German

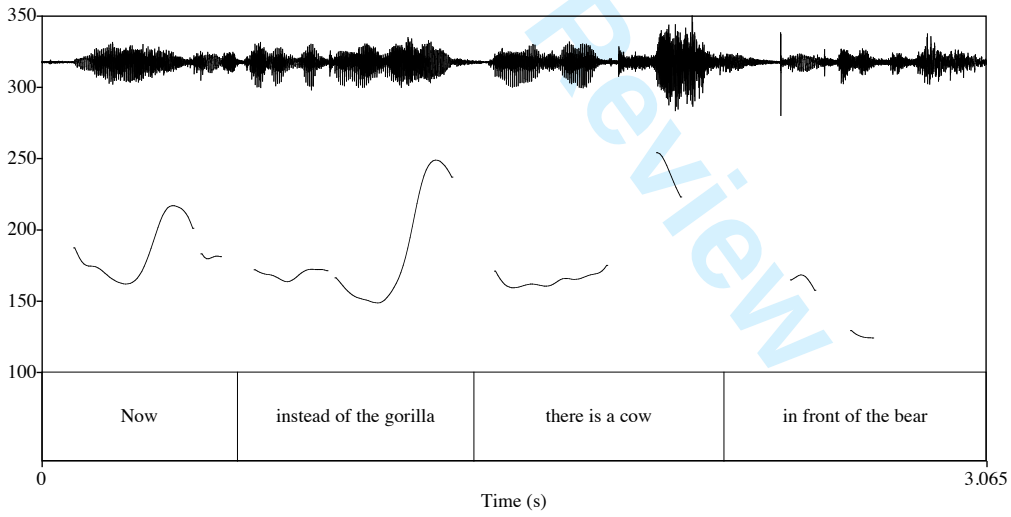

Figure 6 Deaccenting of postnuclear material in English

Table 1. Frequencies of unmarked (Loc ≺ Lx) and marked (Lx ≺ Loc) word order

	English		French		German		Finnish		Georgian		Chinese		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Added (new)	*99*	100	*138*	100	*199*	100	*140*	100	*108*	100	*115*	100	*799*	100
Loc ≺ Lx	*65*	66	*69*	50	*45*	23	*23*	16	*11*	10	*57*	50	*270*	34
Lx ≺ Loc	*34*	34	*69*	50	*154*	77	*117*	84	*97*	90	*58*	50	*529*	66
Added (reintroduced)	*31*	100	*39*	100	*57*	100	*40*	100	*29*	100	*38*	100	*234*	100
Loc ≺ Lx	*24*	77	*33*	85	*15*	26	*13*	33	*3*	10	*19*	50	*107*	46
Lx ≺ Loc	*7*	23	*6*	15	*42*	74	*27*	68	*26*	90	*19*	50	*127*	54
Displaced (given)	*30*	100	*37*	100	*56*	100	*40*	100	*32*	100	*29*	100	*224*	100
Loc ≺ Lx	*29*	97	*35*	95	*37*	66	*39*	98	*14*	44	*22*	76	*176*	79
Lx ≺ Loc	*1*	3	*2*	5	*19*	34	*1*	3	*18*	56	*7*	24	*48*	21

Table 2. Indefinite articles in the new, reintroduced and displaced (given) locata

	English		German		French	
	n	%	*n*	%	*n*	%
New animal	*88*	78	*127*	74	*128*	91
Reintroduced	*29*	59	*12*	45	*11*	28
Displaced (given)	*3*	9	*5*	10	*3*	8

Table 3. Tonal contours in German

	New		Given		Lx-Loc		Loc-Lx	
	n	%	*n*	%	*n*	%	*n*	%
Falling contour	*133*	67	*19*	26	*136*	74	*14*	16
Rising contour	*66*	33	*54*	74	*48*	26	*74*	84
Total	*199*	100	*73*	100	*184*	100	*88*	100

Table 4. Tonal contours in Georgian

	Final locata		Non-final locata	
	n	%	*n*	%
Super-low tone	*109*	92	–	–
Falling contour	*9*	8	*17*	31
Rising contour	–	–	*37*	69
Total	*118*	100	*54*	100

Table 5. Tonal contours in Finnish

	New locatum		Given locatum	
	n	%	*n*	%
Falling contour	*106*	59	*40*	100
Rising contour	*73*	41	–	–
Total	*179*	100	*40*	100

Table 6. Tonal contours in French

	New		Given		Lx-Loc		Loc-Lx	
	n	%	*n*	%	*n*	%	*n*	%
Falling contour	*65*	41	*7*	18	*60*	74	*12*	9
Rising contour	*114*	59	*31*	82	*21*	26	*124*	91
Total	*179*	100	*38*	100	*81*	100	*136*	100

Table 7. Fronting PP constituents (S = subject; PP = prepositional phrase)

	English		French		German		Finnish		Georgian		Chinese		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
S ≺ PP	*117*	89	*133*	73	*97*	34	*75*	35	*28*	18	*72*	59	*522*	48
PP ≺ S	*14*	11	*50*	27	*187*	66	*141*	65	*131*	82	*51*	41	*574*	52
Total	*131*	100	*183*	100	*284*	100	*216*	100	*159*	100	*123*	100	*1096*	100

Table 8. Fronting NP-constituents (Act. = active; Pass. = passive; S = subject, O = object)

	English		French		German		Finnish		Georgian		Chinese		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Act., S-first	*1*	3	*1*	3	*1*	4	–	–	–	–	*26*	84	*29*	23
Act., O-first	–	–	–	–	–	–	–	–	*10*	100	–	–	*10*	8
Pass., S-first	*28*	97	*30*	97	*22*	96	*4*	100	–	–	*5*	16	*89*	70
Total	*29*	100	*31*	100	*23*	100	*4*	100	*10*	100	*31*	100	*128*	100