Effect of narrow focus on tonal realization in Georgian

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Abstract

This article examines the prosodic correlates of focus in Georgian declarative sentences, based on speech production data. Georgian is an intonation language with flexible word order, and it is sensitive to information structure. It is shown in the paper that focus has an impact on duration but does not systematically change the tonal realization of the constituents. Most prosodic correlates of focus result from the interaction with prosodic phrasing.

Index Terms: prosody, speech production, phrasing, focus.

1. Introduction

There is an agreement in the literature on intonation languages like English and German that there should be a strict one-to-one relationship between focus and prosodic prominence.[1] It is expected that information structure is implemented in prosody, be it through accents, boundaries or other tonal phenomena. This correspondence has been elevated by a number of authors to the level of axioms, as for example [1], [2] and [3]. However, studies on phonetic correlates of information structure in different languages show that not all such prosodic events are directly mapped to concepts such as 'topic' and 'focus', but rather result from the interaction between information structure and syntax on the one hand and the mapping of syntactic phrases to prosodic constituents on the other, see [4], [5] and [6]. Beyond the general value of these observations, it is interesting to understand how prosodic events correlate with other aspects of grammar in particular languages. This paper contributes to this line of research and shows that the prosodic correlates of focus in Georgian are better understood if the discourse effects of syntax are taken into account.

Lexical stress is at most weakly implemented in Georgian phonology. There is no consensus in the literature as to its position in the word. It is neither distinctive, nor culminative (polysyllabic words are reported to have more than one stressed syllables). This typological property is crucial, since it has been observed that intonation languages may lack lexical stress, see [7] on French, and further research will reveal whether Georgian also belongs to this category. Georgian is an intonation language and uses pitch variations to express pragmatic meanings, see [8]. (This does not exclude that other types of languages may also do so, but then to a lesser extent.) Two recent accounts on the intonation of Georgian declarative sentences (see [8] and [9]) differ on the analysis of focus-related tonal events. [8] assumes that focus in Georgian is always expressed by pitch accents, while [9] proposes that prosodic phrasing is essential, and that all tonal movements are best analyzed in terms of their import to the prosodic phrasing. In the latter account focus is not always expressed by a change in tonal implementation, but only in these cases in which prosodic phrasing is changed as well.

The choice of word order in Georgian is sensitive to information structure. In particular, focused constituents most frequently surface at the position that immediately precedes the verb. Alternatively, they may follow the verb, see [10].

The aim of this article is to critically examine the claims made by the previous accounts by using experimental data from speech production. §2 introduces the method of data collection, §3 sums up the results from duration, §4 the results from tonal realization, and §5 the results on phrasing.

2. Method

Native speakers were presented simple Georgian declarative sentences, as illustrated in (1). The informants were instructed to memorize the sentences and to utter them as natural answers to context questions. The questions manipulated the information structure of the answer and were read by the instructor, a native speaker of Georgian: broad focus was elicited through the question 'what happens' and narrow focus through a *wh*- question, e.g., 'who cares for the father?' (subject focus).

nino	*mamas*	*eloliaveba.*	(1)
Nino(NOM)	father(DAT)	cares	
'Nino cares for the father.'			

The data set contained four word orders (SOV, SVO, OSV, OVS) inserted in five contexts (all_F, VP_F, V_F, S_F, O_F), where subscripted F (for *focus*) identifies the constituent asked for in the context question. Since not all word orders were felicitous answers to all context questions, only some of the question/answer pairs were used (13 out of the 4×5=20 cells). We created four items in all 13 conditions. Each speaker was presented each condition in each item twice and hence produced 8 sentences per condition. Eight native speakers (all female, age range: 21-27, average: 23.5) participated to the experiment, which took place in Berlin, December 2007. All speakers had left Georgia only recently (0.6 to 3 years before the recordings).

The aim of this article is to identify the effect of narrow focus on the tonal realization of the arguments. For this purpose, we only examine the preverbal focus in $S[O]_FV$ and $[S]_FVO$ and the postverbal focus in $SV[O]_F$; the same word orders in broad focus are used as a baseline (see [11] for a discussion of all data).

[1] We strictly restrict our investigation to the grammatical correlates of prosody, especially to those arising from information structure.

3. Duration

Narrow focus has a significant effect on duration; see the comparisons in Table 1, which presents the mean duration of the focused constituent (i.e., the object in $S[O]_FV$, the subject in $[S]_FVO$, and the object in $SV[O]_F$) in comparison to the baseline (broad focus). A repeated-measures analysis of variance on the speaker-aggregated data gave a significant main effect of (broad vs. narrow) focus on duration ($F_{1,7}$ = 59.3, p < .001), which reflects the fact that narrow focused constituents are significantly longer than the corresponding constituents in broad focus (O in $S[O]_FV$ vs. $[SOV]_F$: t_7 = 6.1, p < .001; S in $[S]_FVO$ vs. $[SVO]_F$: t_7 = 4.8, p < .002; O in $SV[O]_F$ vs. $[SVO]_F$: t_7 = 4.5, p < .003) (see values in Table 1). This finding reflects the prominence of narrow focused constituents and is in line with previous observations in other languages (see, e.g., [12] and [13] on German). Furthermore, the analysis of variance reveals a significant main effect of word order ($F_{1,7}$ = 45.1, p < .001), which results from the fact that final constituents show a final lengthening effect (O in SVO > O in SOV: t_7 = 6.7, p < .001), where > stands for 'is longer than'. This effect holds independently of focus and has been already observed for several languages (see summary in [14]). Crucially, the two factors do not interact significantly, i.e., there is evidence that word order influences duration but not that it influences the effect of focus on duration.

Table 1. *Average noun duration*

	broad focus		narrow focus	
	msec	*z*-score	msec	*z*-score
O in SOV	279	-.39	314	.19
S in SVO	282	-.35	335	.52
O in SVO	356	-.83	386	1.33
average	306	-.52	345	.68

4. Tonal realization

In the default realization of Georgian utterances, all non-final p-phrases (=prosodic phrases) are realized with rising contours, see [9]. This pattern is illustrated in Figure 1, which shows the F_0 excursion of the SOV sentence in (2) elicited in broad focus: Both subject and object are realized with a rising contour, starting with a low tonal target (L) around the end of the first syllable and reaching a high tonal target (H) at the right edge of the constituent.

nona	*bebos*	*emudareba.*	(2)
Nona(NOM)	grandmother(DAT)	begs	

'Nona begs for the grandmother.'

4.1. Preverbal focus in $S[O]_FV$

Studies of the prosody of intonation languages like German and Greek show that the non-final rising accent of the object is changed into a nuclear falling accent when it is in focus. Bi-syllabic words in Georgian also have a high tone on the last syllable in the default realization, and if Georgian is similar to German and Greek, a falling contour is expected in the narrow focus context, thus a low tone on the last syllable. However, our data did not confirm this expectation: the object, even in focus, was generally accompanied by a rising tonal contour, which we analyze as a high boundary tone.

Empirical evidence comes from the relation between the first H-target (at the boundary between subject and object) and the second L-target (i.e., the F_0-minimum in the middle of the object) in Figure 1. In broad focus, the F_0-minimum was reached on average at the 8th percentile of the second syllable of the object, while in narrow focus on the object, the F_0-minimum was aligned on average with the 11th percentile of the same syllable (this difference is not significant in a paired-sample two-sided *t*-test). In other words, the F_0-minimum was always reached at the beginning of the second syllable, reflecting the fact that the first syllable had a low tonal target and the second syllable a high target (both in broad and narrow focus).

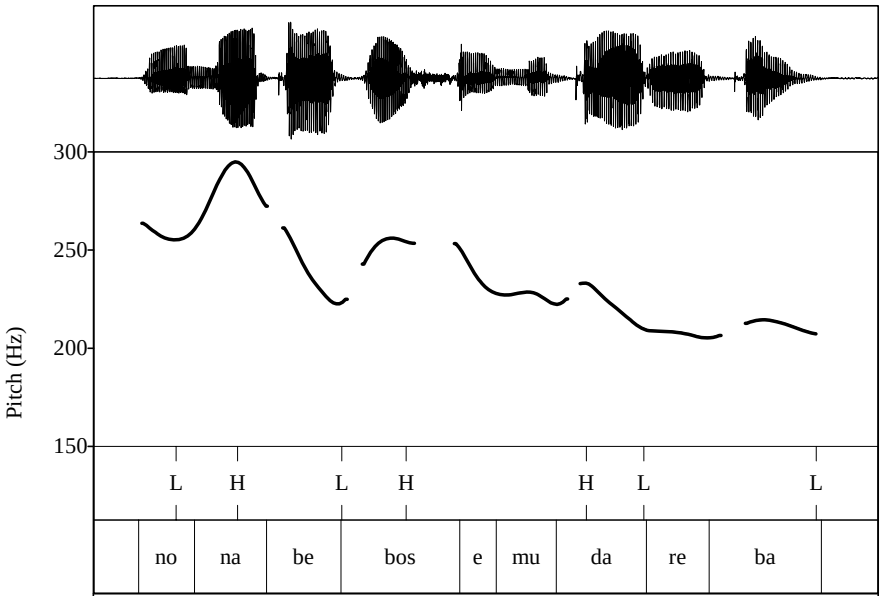

Figure 1: *Rising pattern on non-final p-phrases (item 4, speaker LEL).*

Though the local tonal pattern of the object is identical in broad and narrow focus (low tone in the first syllable and high tone in the second), we find a small but significant difference in the pitch range of the fall (t_7 = 3.2, p < .01). Table 2 presents the average values of the first high target (F_0-maximum) of the utterance, and the average values of the subsequent low target (F_0-minimum). Note that the F_0-maximum is realized within the subject constituent, hence this pitch expansion cannot be accounted for as a pitch effect on the constituent in focus.

Table 2. *Average F_0 of tonal targets in SOV*

	F_0-max (sbj.)		F_0-min (obj.)		range	
	Hz	*z*-score	Hz	*z*-score	Hz	*z*-score
broad	258	.14	188	.07	70	.07
O-focus	266	.54	182	-.37	84	.91

4.2. Preverbal focus in $[S]_F$VO

In the SVO order in broad focus, the initial constituent of the clause appears with two alternative tonal realizations: either with a rising (see Figure 2a) or with a falling contour (see Figure 2b). Following what we know about German or Greek, we might assume that the falling pattern in Figure 2b occurs more frequently when the subject is narrowly focused. In other intonation languages, the change in the direction of a pitch accent on an initial narrowly focused constituent goes together with the deaccenting of postnuclear material, but there is no systematic postnuclear deaccenting in Georgian.

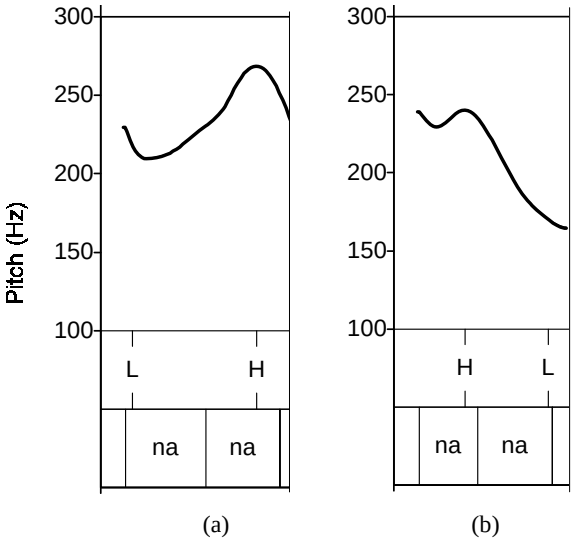

Figure 2: *Rising (LH) vs. falling (HL) contour of the initial constituent* nana 'Nana(NOM)' *in SVO, broad focus (item 3, both produced by speaker NIN).*

Concentrating on the distribution of the patterns in Figure 2, we found 16 out of 64 utterances in $[SVO]_F$ in which the highest F_0 measurement of the initial constituent occurred within the first syllable, i.e., 25%. In $[S]_F$VO, this falling pattern occurred in only 10 out of 64 utterances, i.e., 15.6%. Hence, the obtained difference (not significant in the chi-square test) is not in the predicted direction and contradicts the hypothesis of an early alignment of the H-target (and a subsequent falling pattern) motivated by narrow focus.

4.3. Postverbal focus in SV$[O]_F$

The postverbal realization of focus was often associated with a particular prosodic pattern, documented in [9], and called 'super-low'. The first syllable of the focused constituent was realized with a steep fall that reached a low target in the intonation contour. The second syllable was not further lowered, thus resulting in a low and flat intonational realization of the focused word, see Figure 3. Perceptually, the entire word sounds low. This pattern occurred more frequently when the last constituent was in narrow focus (39 out of 64 tokens, 61%) than in broad focus (28 out of 64 tokens, 44%) (χ^2 = 3.8, p < .05). We assume that the super-low tone is the result of the very strong tendency of high tone downstepping in Georgian, especially on the last constituent of the sentence. Upstep of high tones occurs only rarely. The realization of a super-low tone can be considered as a mean of emphasizing a tone. Since the focused word cannot be made prominent by raising its high tone, the high tone is lowered instead.

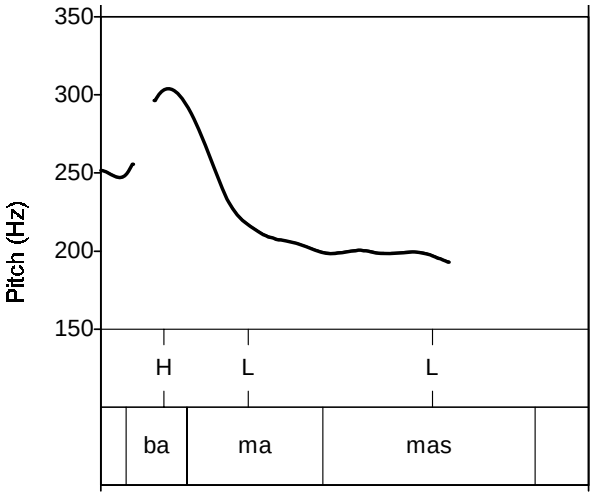

Figure 3: *'Super-low' pattern in final focus* (SV$[O]_F$) *(item 1, speaker LEL); the figure presents the last syllable of the verb* eloliaveba 'cares' *and the object* mamas 'father(DAT)' (see lexical material in (1)).

5. Prosodic phrasing

The effects of narrow focus on the tonal realization are weak: S$[O]_F$V shows the same tonal pattern with $[SOV]_F$ accompanied by a small pitch range expansion (Section 4.1). $[S]_F$VO involves a (unexpected) increase of the rising LH pattern in comparison to the broad focus. In SV$[O]_F$, the occurrence of a 'super-low' tonal pattern is more frequently attested than in broad focus. In [9], it was shown that the essential effect of focus in Georgian lies in prosodic phrasing. And we claim here that the properties of prosodic phrasing account for the correlates of focus identified in the previous sections. Prosodic phrasing is determined by constituent structure. As a result, non-verb-final orders are derived by syntactic movement. In line with the syntactic fact that non-verb-final orders in this language involve syntactic movement (see [10]), we found an asymmetry in the phrasing preferences for the SOV and SVO orders in broad focus: while the canonical order is preferably phrased as $(SOV)_P$ or $(S)_P(OV)_P$, the derived order is phrased as $(SV)_P(O)_P$.

The effect of focus on prosodic phrasing is a preference for phrasing focused constituents separately. The interaction of focus and word order is illustrated in Figure 4, which

displays the average pitch contour of the verb and the object in the SVO order in three discourse conditions. In broad focus, the average measurements showed a raising of the value at the right edge of the verb, which can be interpreted as a high boundary tone. This is the result of the preference for $(SV)_P(O)_P$. In in $SV[O]_F$, the raising of the average contour at the right edge of the verb is even larger . In $[S]_F VO$, this pattern is not available, implying that the given part of the sentence (VO) forms a single p-phrase.

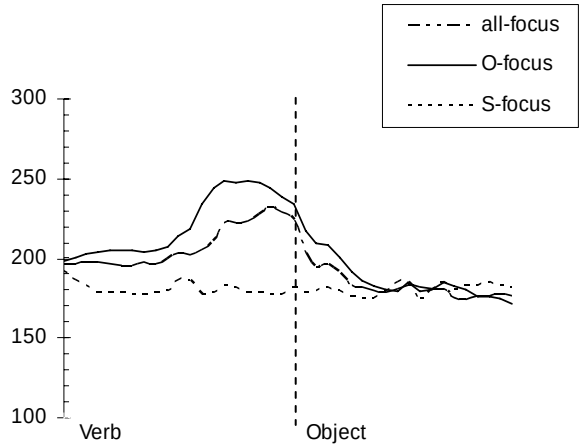

Figure 4: *Averages of F_0 measurements in the SVO order (measurements of ten equal intervals per syllable).*

The focus effects on phrasing explain the unexpected finding for $[S]_F VO$ in section 4.2. Assuming that the LH contour creates a prosodic boundary at the right edge of the constituent, the preference for focus to form a separate p-phrase accounts for the frequency of the LH pattern observed in the subject of the $[S]_F VO$ configuration. The results of section 4.1 are slightly different. The sequence SOV is realized as $(SOV)_P$ or $(S)_P (OV)_P$. When the object is focused, the latter phrasing option is realized more often, i.e., a high boundary precedes the posverbal focused phrase. This results in an effect on the alignment of the H-target in the subject constituent that is similar with the observations in the SVO order: the highest F_0 measurement of the initial constituent occurred within the first syllable in 22 out of 64 utterances, i.e., 34%, in $[SOV]_F$ and in 28 out of 64 utterances, i.e. 44%, in $S[O]_F V$ (the chi-square test does not reveal a significant result). The average length of prosodic breaks between S and O is in line with this observation: 14.4 msecs in $[SOV]_F$ and 23.8 msecs in $S[O]_F V$. The higher pitch of the H-target of the focused object in Table 2 relates to this difference in phrasing.

6. Conclusion

This paper has examined changes in the tonal pattern of Georgian sentences with a narrow focus on the subject or on the object in comparison to the same sentences with broad focus. A default tonal pattern was identified in the broad focus realization in which preverbal subject and object both had a rising contour (LH), and in which downstep of a sequence of high tones was predominant. In broad focused SOV sentences, the object and the verb were phrased together. The subject either formed a separate phrase or was integrated to the same phrase with the object and the verb. In $S[O]_F V$, default phrasing could be preserved, but there was a preference for the [OV] portion of the sentence to be phrased separately from the subject. In $[S]_F VO$ sentences, when the initial subject was narrowly focused, it was more often realized with a rising contour (speaking for a high prosodic boundary) than when it was part of a broad focus pattern. Finally, in $SV[O]_F$, the final narrowly focused constituents were often realized with a 'super-low' tone, conveying an inverted prominence, a strategy also found in broad focus (though less often). When it was realized tonally at all, focus was not accompanied by an extra high tone, as in most intonation languages, but rather with an extra low tone. This pattern was the only genuine tonal correlate of focus that cannot be traced back to effects on prosodic phrasing, and we analyzed this low tone as a kind of inverted prominence. Because of a strong tendency for downstep, a high tone cannot trigger upstep. A 'super-low' arises instead which conveys prominence. The final focus was also occasionally separated from the preceding verb by a clear high boundary tone on the final syllable of the verb, showing a tendency of the focused constituent to be phrased individually.

In sum, Georgian shows different tonal properties from English, German, Greek and other intonation languages. More research is needed to understand how it implements focus, for instance in longer sentences, or in different syntactic contexts. The issue of the lexical accent has to be resolved, since it is not clear at this stage whether Georgian really has lexical accents, or whether tones are just correlates of phrasing, like they are in some Indian languages or in West Greenlandic, for instance. In that case, Georgian would be a 'phrase language' rather than an 'intonation language'.

7. References

[1] Chomsky, N., "Deep structure, surface structure, and semantic interpretation", in Steinberg, D. and L. Jakobovits [Eds], Semantics, 183-216, Cambridge University Press, 1971.

[2] Jackendoff, R., Semantic Interpretation in Generative Grammar. MIT Press, 1972.

[3] Truckenbrodt, H., Phonological Phrases: Their Relation to Syntax, Focus and Prominence. Ph.D dissertation, MIT, 1995.

[4] Nespor, M. and Vogel, I., Prosodic phonology. Foris, 1986.

[5] Selkirk, E.O., Phonology and Syntax: The Relation between Sound and Structure. MIT Press, 1984.

[6] Féry C. and Samek-Lodovici, V., "Focus projection and prosodic prominence in nested foci", Language, 82(1):131-150, 2006.

[7] Vaissière, J., "Language-independent prosodic features", in Cutler, A. and D.R. Ladd [Eds], Prosody: Models and Measurements, 53-66, Springer, 1983.

[8] Vicenik, C. and Jun, S.-A. "An Autosegmental-Metrical Analysis of Georgian Intonation". Ms. UCLA, 2008.

[9] Skopeteas, S., Féry, C., and Asatiani, R., "Word order and intonation in Georgian". Lingua 119, 102-127, 2009.

[10] Skopeteas, S. and Fanselow, G., "Focus in Georgian and the expression of contrast". Lingua, (in press), 2009.

[11] Skopeteas, S. and Féry, C. (2010). Prosodic Structure of Georgian: Syntax, information structure and prosodic realization. Ms., Univ. of Potsdam.

[12] Baumann, S., Grice, M., and Steindamm, S., "Prosodic Marking of Focus Domains - Categorical or Gradient?", in Hoffmann, R. and H. Mixdorff [Eds], Proceedings of Speech Prosody, 301–304, Dresden, Germany, TUDpress, 2006.

[13] Féry, C. and Kügler F. "Pitch accent scaling on given, new and focused constituents in German". Journal of Phonetics 36:680-703, 2008.

[14] Kügler, F. and Genzel, S., "Sentence length, position, and information structure on segmental duration in German". Ms., Univ. of Potsdam, 2009.