Experimental work on prosodically-marked information structure in selected African languages (Afroasiatic and Niger-Congo)

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Abstract

Data from lesser-studied languages help to delineate parameters of typological variation. The paper presents experimental work on prosodic marking of information structure in selected African languages. The languages investigated exemplify the cross-linguistic variety found in prosodic focus marking by either lacking marking of information structure by purely prosodic means, or by lowering pitch under focus. Neither prosodic marking of information structure in general nor expansion of pitch range under focus can thus be considered language universals. The review also gives evidence on how cross-linguistically comparable and highly interesting results are provided by adapting experimental methods and methodological standards.

Index Terms: Focus, deaccentuation, African languages, Niger-Congo, Afroasiatic

1. Introduction

Focused or discourse-new constituents are often marked by prosodic prominence in the languages of the world, acoustically realized by some kind of expansion of the pitch range. This is the case, e.g. in English, where focus prominence is often correlated with a particular kind of pitch accent in autosegmental-metrical approaches (e.g. Pierrehumbert 1980), or by a local expansion of the pitch range as in Mandarin Chinese (Xu 1999; cf. Xu & Xu, 2005 and Liu & Xu, 2007 for English). The salient effect of focus prominence can be further enhanced perceptually by the deaccentuation of discourse-old (given) constituents, acoustically realized by compression of the pitch range. This is found in many languages, such as English and Mandarin Chinese (for an overview see Cruttenden 2006).

However, there is no reason to believe that either pitch-enhancing culminative prominence or deaccentuation are language universals in the prosodic marking of information structure, i.e. that all languages mark discourse-old and -new constituents in this way. Languages can differ with respect to the absence versus presence of prosodic marking of discourse-old/-new constituents or with respect to the acoustic parameters manipulated. For example, some languages only have prosodic marking of focus but no deaccentuation, e.g. Arabic (Hellmuth 2005) and Icelandic (Nolan & Jónsdóttir 2001), cf. Cruttenden (2006).

The available data on prosodic marking of information structure in the languages of the world still represent a mere reflection of the present state-of-the-art in the field rather than statistically significant sample of the variety of prosodic information structure in human language.

A striking example is the African continent. The 2000 or so indigenous African languages (Grimes 1996) are generally understudied, and this is also evident in the area of information structure. As typological research relies on cross-linguistically comparable data, the paper reviews existing studies that report systematic experimental data which allow examining at least some phonetic details of prosodic information structuring.

The current paper is foremost interested in those studies that test if a language can mark information structure purely by prosodic means, as is the case in English and Mandarin Chinese. Many African languages use morphological and/or syntactic means to indicate focus which sometimes go together with changes in prosody as well. However, although the prosody then changes because of focus, this is not considered a case of (pure) prosodic marking of information structure.

2. Case studies

2.1. Hausa (Afro-Asiatic, Chadic; Nigeria)

Hausa is a three-tone language (high, low and falling). Descriptions of Hausa intonation differ as to the prosodic marking of focused in-situ constituents: while Green & Jaggar (2003) report impressionistically that focus is marked prosodically in Hausa (cf. also Leben et al. (1989), Inkelas & Leben (1990) for reported high tone raising on ex-situ focused constituents), Miller & Tench (1980) observe that although intonation is used for the differentiation of sentence types, for boundary marking (e.g. list intonation) and to express emotional states, intonation does not seem to be exploited to mark information structure, neither focus prominence nor deaccentuation.

Hartmann & Zimmermann (2007) confirm the latter in a pilot study on the prosodic marking of in-situ focus which included quantitative and qualitative analysis of production data as well as a perception experiment. In the production study one native speaker of Hausa read a total of 16 Q(uestion)/A(nswer)-pairs (interspersed in 160 recorded sentences altogether which tested other aspects of the language) where the answers differed in the scope of the focus induced by a preceding question, ranging over all-new focus, VP-focus, object-focus and verb-focus. Also the tone pattern of the object varied in order to test for potential interactions between the lexical tone and intonation.

Visual inspection of the pitch contours of the recorded answers showed no striking differences, in particular not on or around the focus constituents. A quantitative analysis of the acoustic parameters pitch, duration, and intensity provided no evidence for prosodic focus marking either. A final perception experiment confirmed the result. In the perception experiment, the (same) Hausa speaker listened to 16 target structures in form of simple Q/A-pairs, which presented a systematic combination of questions and answers from the four focus conditions. The listener had to judge the well-formedness of the combinations. In a second perception experiment the listener was again confronted with Q/A-pairs. This time he had a choice between two answers, one being the

original answer. He had to judge which of the two answers was more appropriate. The results showed a random answer behavior and did thus not give any indication that focus (or information structure) was marked in any way in these sentences.

2.2. Chichewa (Niger-Congo, Bantu: Malawi)

Chichewa is a comparatively well-described two-tone Bantu language. Kanerva (1990) claimed that focus inserts a phrase boundary after a focused constituent which results in durational and tonal changes. In a small experimental pilot study Downing *et al.* (2004) show that the re-phrasing due to focus has repercussions for the overall downdrift across a sentence. The observations are based on an acoustic analysis of three sets of simple SVOO sentences which systematically differ in the position of the focused constituent, as pronounced by one speaker who is a native speaker linguist.

An example set is provided in (1). Acute accents mark lexical high tones, brackets mark phonological phrase boundaries, bolding marks the focused constituent, || marks pauses and ↑ marks preceding raised pitch.

(1) Chichewa (Downing et al. 2004)
(a) A-ná-menya nyumbá ndí mwalá
s/he-PAST-hit house with rock
'She hit the house with a rock.'
(b) (**A-ná-mény-a nyumbá ndí mwáálá**). Broad focus
(c) (A-ná-mény-a nyuúmbá) (**ndí mwáálá**) ↑. PP focus
(d) (A-ná-mény-a **nyuúmbá**) ↑ || (ndí mwáálá). OBJ focus
(e) (**A-ná-méeny-a**) ↑ (nyuúmbá) (ndí mwáálá). V focus

The study compares the mean pitch maximum (averaged across five repetitions) of each word across the different focus conditions and finds that the mean pitch maximum of high tones is significantly higher when the word is focused than when the same word is not focused. The results are interpreted as "phrasal register raising [that] accompanies focus" in Downing (2008). Also note that the focused induced prosodic boundaries in (1) have consequences for the duration of penultimate vowels (longer durations are expressed by two vowel symbols).

2.3. Wolof (Niger-Congo, Atlantic; Senegal)

In contrast to all of the other languages reported in this paper and in contrast to the majority of African languages, Wolof is a non-tonal language. It has been claimed to lack pitch accents and any intonational marking (Rialland & Robert 2001), including intonational focus marking. These results are based on a study of altogether sixteen native speakers using recorded elicitation sessions as well as corpora consisting of radio and television programs and conversations. Published pitch tracks show a rather flat intonation contour with no fluctuations attributable to factors such as intonational phrasing or emphasis. The authors ascribe the lack of intonation in this language to the complementary focus marking system which is present in the language's morphology.

2.4. Oti-Volta languages (Niger-Congo, Gur; Ghana)

Buli and the related languages Kɔnni and Dagbani are three-tone languages (high, mid, low) that use morphological and syntactic means to indicate the focused constituent of a sentence (Schwarz 2009). In order to test whether focus scope ambiguities (object focus vs VP-focus, subject focus vs sentence focus, quantifier focus vs object focus) can be resolved solely by prosodic means Schwarz (2009) recorded minimal pairs involving new information focus (as opposed to contrastive focus) from one or two speakers per language, following an experimental set up used e.g. in Uhmann (1991) where the focus of an utterance is controlled by a preceding question. Visual inspection of the data shows that although the data gathered contain incidental cases with divergent pitch between foci, no systematic disambiguation between the two foci of different scope occurred in any of the three languages. The study focused on the production of minimal pairs and in the analysis special attention was given only to F0-related prosodic cues.

2.5. Northern Sotho (Niger-Congo, Bantu; South Africa)

Zerbian (2006, 2007) investigates the prosodic marking of postverbal in-situ focus in Northern Sotho - a two-tone Southern Bantu language - in a production and perception study. The production study contained five different syntactic target structures: intransitive verbs followed by an adverb, and transitive and ditransitive structures both with and without adverb. Examples are given in (2). High tones are marked by accent. Lexical high tones are additionally underlined.

(2) Northern Sotho
a. *Ke bi̱ná monya̱nyé-:ng.*
1st dance party-LOC
'I am dancing at the party.' (intransitive verb + adverb)
b. *Ke mé̱má mo-hú̱:mi.*
1st invite CL1-rich
'I invite the rich man.' (transitive verb)
c. *Ke ré̱má morú̱lá mosé̱ga:ré̱.*
1st chop marula tree midday
'I chop the marula tree at midday.' (transitive verb + adverb)
d. *Ke fá̱ mmá̱ hé̱m:pe.*
1st give mother shirt
'I give mother a shirt.' (ditransitive verb)
e. *Ke né̱á malo̱mé lengwá̱ló bo-dú̱ló:-ng.*
1st give uncle letter CL14-live-LOC
'I give uncle a letter at the dwelling place.' (ditransitive verb + adverb)

Two token sentences of each type combined with narrow focus on each constituent of these sentences plus wide focus yielded 69 target sentences that display different focus structures. Eight native speakers of Northern Sotho participated in the study, engaging in a dialogue set-up in which the question determines the focus structure of the answer. The five speakers who provided the answer target sentences were all speakers of the Sepedi dialect of Northern Sotho. The target sentences were controlled for number of syllables, for tone structure, and for segmental make-up, containing only sonorants as far as possible. Furthermore, they were constructed in such a way that a maximal suprasegmental contrast, both in length and tone, would be observed if focus-induced boundaries in Northern Sotho had indicated differences in information structure. This hypothesis is illustrated in (3).

(3) a. VP and object focus
Ke mé̱má mohú̱:mi).
'I invite [the rich man]$_F$.'
b. Verb focus
Ke mé̱:ma) mohú̱:mi).
'I [invite]$_F$ the rich man.'

In (3a), the verb stem initial high tone spreads onto the immediately right-adjacent vowel under VP- and object focus. If focus induced a phrase boundary, high tone spread (HTS) would be blocked, as shown in (3b). Also, with the language having predictable lengthening of the penultimate syllable of a domain-final syllable, the syllables that undergo penultimate lengthening are expected to differ under different focus structures.

A quantitative analysis of the data was carried out for a sample only, viz. the SVO/SVAdv structures, (2a, b). The reason for the decision in favour of simple SVO/SVAdv structures is that if there is prosodic expression of focus, it will most clearly emerge within short sentences as the register size at disposal for pitch manipulations towards the end of the sentence is wider than in long sentences, due to downdrift. Two acoustic parameters were measured, namely F0 and duration.

For the analysis of pitch the F0 maxima of the vowel were averaged across the four comparable sentences that were subject to analysis. Each speaker was analyzed separately. Visual inspection of the data shows that there is nearly perfect overlap in the F0 contour for all three focus conditions. F0 raises in the verb due to HTS and falls smoothly towards the end of the sentence. Interestingly, in the speech of one participant a slightly higher F0 can be found for the initial syllable of the object when it is in focus. Also, a slightly raised pitch and a lower initial syllable of the object can be found when the verb is in focus, which results in a sharper fall in pitch. The sharper fall after a focused verb could correspond to what has been reported as a focus strategy in Chichewa (Downing *et al*. 2004). In Chichewa the focused element is "made prominent by raising the pitch enough to make the following elements relatively much lower in pitch" (Downing *et al.* (2004: 177). However, what we do not find in Northern Sotho is a pitch range expansion on the focused constituent.

In addition to the lack of evidence for the use of pitch range expansion to indicate focus, it is interesting to note that tonal changes do not emerge as a consequence of different focus conditions either. Against expectation, no speaker shows a fall of F0 on the second syllable of the verb, as predicted if focus inserted a phrase boundary that blocks the application of high tone spread. Also, a third option reported for tone languages, namely the raising of the overall pitch register, could not be observed.

Relative duration of the syllables across the four sentences was also compared. A rather homogenous picture emerged for all speakers, which shows parallel durations across all focus structures. Only two speakers show a slightly lengthened verb final syllable. However, this lengthening is not restricted to one focus condition. Nevertheless, a perception experiment was conducted to test if the observed slight differences have linguistic meaning and also if there are other acoustic cues next to duration and pitch which would indicate the information structure of the utterances.

The perception test set-up provided Q/A-pairs and asked for appropriateness judgements. The stimuli contained both utterances with perceptible suprasegmental differences (which, however, are not related to information structure) and utterances without any obvious differences. The responses were distributed according to chance and thus support the observation that there are no prosodic means employed in order to indicate information structure.

2.6. Akan (Niger-Congo, Kwa; Ghana)

Akan is a two-tone Kwa language with SVO structure. Syntactically two strategies of focus marking exist, either by means of in-situ focus realisation or ex-situ focus fronting (Kobele & Torrence 2006). Kügler & Genzel (submitted) investigate the prosodic realisation of high and low tones in relation to focus and givenness in both syntactic constructions. In a production study 11 speakers of the Asante Twi dialect answered pre-recorded questions. Answers contained a high (amángo) and a low tone (Àddò) target word (4), and were elicited in different contexts. The questions set up either a narrow or contrastive focus on the target word, or the target word in pre-focal or post-focal givenness. In (4) high tones are indicated by acute, low tones by grave accent.

(4) a. Àgyeman bóàà Àddò ánɔpà yi.
Agyeman help.past Addo morning this
'Agyeman helped Addo this morning.'
b. Anúm tɔ̀ɔ amángo ánɔpà yi.
Anum buy.past mango morning this
'Anum bought a mango this morning.'

The lexical tones were measured in semitones at the midpoint of each tone bearing vowel. Overall, a gradual decrease in pitch height goes along with increasing prosodic prominence of in-situ focus. For the high tone target word the height of the pitch peak differs as a function of information structure. The peak is realized lower if narrowly or contrastively focused. On average the lowering of contrastive focus amounts to 1.6 st which corresponds roughly to 20 Hz. For the low tone target word Àddò the same gradual decrease in pitch height with increasing prosodic prominence occurs. Overall, pitch on the focused renditions of the target word is lower than in the broad focus condition. On average the lowering of contrastive focus amounts to 1.1 st which corresponds roughly to 10 Hz.

To obtain a detailed picture of durational figures the amount of durational change of the word and the individual syllables of the target word between broad focus and narrow and contrastive focus conditions was calculated. In narrow focus, the high tone target word is 6.4 % shortened while 10.3 % in contrastive focus. In both focal conditions the tone bearing syllable does not contribute substantially to the word shortening effect. The low tone target word is somewhat less shortened, only about 2.6 % in narrow focus and 6.6 % in contrastive focus.

The pitch lowering in focus is thus accompanied by a durational reduction. Further, the duration data suggest that no phrase break appears after the focused constituent. A phrase break would have been marked by lengthening as it is the case in the Chichewa and Northern Sotho data above.

2.7. Summary

The studies reviewed show a lack of prosodic marking of information structure in many languages independent of the language family (Afroasiatic versus Niger-Congo), geographical distribution (west versus south) or the word prosodic system (tonal versus non-tonal). In most languages there is no evidence for either prosodic focus marking or deaccentuation. Only in Chichewa has re-phrasing been reported as a cue to focus which goes together with durational changes and raising of pitch on the focused constituent. However, the study does not provide enough detail to allow a more fine-grained assessment as to the alignment or implementation of the higher pitch. Akan is unique not only among the African languages but cross-linguistically in that it lowers the pitch register accompanied by segmental shortening to mark contrastive focus. This finding contradicts the idea of the effort code (Gussenhoven 2004) which predicts a deviation from a neutral voice only in one direction, i.e. an expansion of

pitch register or tonal raising. From the study on Akan, however, Kügler & Genzel (submitted) conclude that a deviation from the neutral register *per se* matters to express prominence.

3. Conclusion

All the languages reviewed in this article make use of morphological and/or syntactic means for information structuring. Thus, information structure is encoded linguistically in these languages. However, these languages confirm that neither prosodic focus marking through pitch range expansion, nor deaccentuation are language universals. We find that focus marking and deaccentuation can both be absent in a language, thus lacking a prosodic encoding of information structure altogether, as seems to be the case in Wolof, Buli, Hausa, and Northern Sotho.

When we do find prosodic marking of focus the encoding might differ from what has been reported for better-studied languages. The prosodic effect of focus has been analyzed as re-phrasing by Downing *et al.* (2004). The acoustic realization, however, can also be interpreted as familiar pitch range expansion which makes the focused constituent salient. In Akan, on the other hand, we find the exact opposite: pitch register compression under focus. The highly-controlled study also showed that givenness is not marked consistently.

The question has been raised in the call for papers for this workshop if focus involves deaccenting and/or dephrasing. If no language can be found that has deaccentuation without focus marking, then the typological implication could also be to the contrary, namely that deaccentuation implies prosodic focus marking. The data from African languages reviewed in this paper cannot provide an answer. However, the results from Akan seem to support previous observations that focus marking can be separate from givenness-marking. Given the nearly 2000 African languages that wait to be explored further, we can expect more interesting results.

What also came apparent in the review of the available literature is the methodological backlog in the field. The review has selected the most experimentally-oriented studies. Most of them have been carried out in the past five years and still show considerable methodological weaknesses (such as the small number of speakers, the lack of systematically controlled stimuli with respect to segmental and suprasegmental make-up, statistic evaluation and significance tests), cf. Xu (2006). The study on Akan is the most recent study on focus marking in an African language and has overcome the weaknesses of previous studies in the field (Kügler & Genzel submitted). Nevertheless, all of these investigations are necessary pilot studies whose results will determine the direction of further investigation.

The backlog might of course well be due to the absence of the phenomenon in these languages. Not all languages have such a rich intonational system as English. After all, overt morphological case-marking is not systematically investigated in English beyond pronouns and genitive-s because English does not have rich overt morphological case-marking as e.g. German or Finnish.

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