Tonal Aspects of Languages 2016
24-27 May 2016, Buffalo, New York

Embedded clauses and recursive prosodic phrasing in Akan

Frank Kügler

Department of Linguistics, Potsdam University, Germany
kuegler@uni-potsdam.de

Abstract

This study investigates the interaction of lexical tone and intonation in embedded clauses in the two-tone Kwa language Akan. The claim is that embedded clauses show recursive prosodic phrasing at the level of intonation phrases (ι-phrase). The prosodic boundary of an embedded clause is expressed by means of a pitch register reset. At the boundary, lexical tonal distinctions are maintained in the recursively embedded ι-phrase. The amount of pitch register reset depends on the nature of the following tone, smaller reset in case of a following L tone, and larger reset in case of a following H-tone. I will argue that recursive prosodic phrasing at the level of an ι-phrase is thus achieved by means of a pitch register reset.

Index Terms: tone, intonation, Akan, embedded clause, pitch register, pitch reset, recursive prosodic phrasing

1. Introduction

Any declarative sentence in Akan is typically uttered with a systematic downtrend in pitch, illustrated in Figure 1 with the sentence 'He will go to Kumasi this morning' originally from [3]. This prosodic property is referred to as downstep [1–7]. Languages exhibiting this kind of systematic downward trend in pitch are classified as terraced-level tone languages [1, 4].

In case of complex declaratives in Akan the downward trend in pitch appears to be interrupted. We observe a pitch reset at the boundary of an embedded clause. This paper explores three different types of embedded clauses. Two clauses as verb complements, i.e. a complementizer clause and an adverbial clause, and a left dislocation, which all show a similar interruption of the downward trend. All three clauses are treated in identical fashion by prosodic structure formation, and in phonetics. The pitch reset is analyzed as a prosodic expression of a recursively embedded intonation phrase (ι-phrase).

We base our analysis on the assumptions of current Match Theory concerning the syntax-phonology interface [8], which proposes a general match between syntactic and prosodic constituents. Specifically for this paper, a clause in syntactic constituent structure, i.e. a CP matches by a corresponding prosodic constituent, i.e. an ι-phrase.

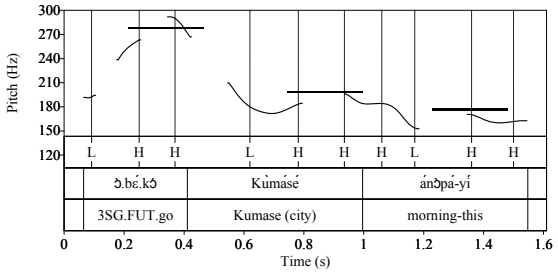

Figure 1: *Tonal terracing at three distinct register levels illustrated by horizontal lines (Figure from [9]).*

1.1. Tone in Akan

Akan belongs to the Kwa branch of the Niger-Congo family and refers to the largest ethnic group in Ghana [10]. Akan consists of several dialects. The data discussed here are based on the Asante Twi dialect, one of the three largest dialects, and we will use Akan as a cover term throughout the paper.

Akan is a two-tone Kwa language [11]. Tone has lexical (1) and grammatical function (2) [2, 12]. Several tonal processes exist in the phonology of Akan (e.g. [2, 3, 12, 13]). The most prominent one appears to be downstep, a lowering of a H-tone after a L-tone. The L-tone trigger does not need to be realized, in which case it is analyzed as floating L-tone that triggers downstep (e.g. [2, 5, 6, 14]). Because of this local tonal lowering, a typical Akan sentence melody is stepping down (cf. Figure 1).

(1) a. pápá 'good' b. pàpà 'fan' c. pàpá 'father' [2]

(2) a. ési tɔ́pɛ̀n b. ési tɔ̀-ɔ́ pɛ̀n
Esi buypen Esi buy.PSTpen
'Esi buys pens.' 'Esi bought a pen.' [12]

1.2. Recursive prosodic phrasing in Akan

Following the assumptions of Match Theory [8], Akan prosodic constituents are isomorphic to syntactic constituents [15]. Recursive prosodic structure exists at the level of the phonological phrase (φ-phrase) assuming maximal and non-maximal φ-phrases in the sense of [16]. A maximal φ-phrase is not dominated by another φ-phrase, whereas a non-maximal φ-phrase is dominated by another φ-phrase.

In (3), the prosodic phrasing of an SVO sentence with an incorporated subject pronoun is shown. Based on the syntactic structure in (3b) Match Theory predicts the prosodic structure in (3c): the edges of a syntactic phrase, i.e. the VP and the object DP in (3b) correspond to the edges of phonological phrases in (3c). The φ-phrase that matches with the object DP is non-maximal since it is dominated by another φ-phrase, which matches with the VP. The VP-matched φ-phrase is maximal since there is no further φ-phrase, which it is dominated by.

Recursive prosodic phrasing is indicated by a phonological process of regressive [+ATR] vowel harmony across word boundaries (RVH) [15]. This process is shown in (3a) where the [+ATR] feature associated with the object *kube* 'coconut' spreads regressively onto the adjacent vowel of the preceding verb, which underlyingly is associated with a [–ATR] vowel /ɛ/. The assimilated vowel is indicated in bold face.

(3) a. / ɔ̀-tɛ̀ìré kùbé / → [ɔ̀tɛ̀ìré kùbé]
3.SG-show coconut 'S/he shows a coconut.'
b. [VP ɔtɛɪrɛ [DP kube]]
c. (ɔtɛɪrɛ (kube)$\varphi_{\text{non-max}}$)φ_{max} [15:184]

The SVO sentence in (4) shows that RVH is blocked at the edge of a maximal φ-phrase. According to Match Theory [8] and the model of recursive prosodic constituency [16], both the subject DP and the VP match with a maximal φ-phrase each. RVH is blocked between maximal φ-phrases (4a), i.e. the [+ATR] feature of the verb *di* 'eat' does not spread regressively onto the adjacent [–ATR] vowel /ʊ/ of the preceding subject *adamfʊ* 'friend'. The fact that RVH applies between an object DP and a

 http://dx.doi.org/10.21437/TAL.2016-8

preceding verb, but RVH is blocked between a verb and a preceding subject provides evidence for maximal and non-maximal φ-phrases. We will show in this paper that ι-phrases show similar recursive structure. However, instead of RVH, pitch reset signals recursive ι-phrase structure.

(4) a. [àdàm̀fʊ̀ dí kùbé] *(adamf**u** di …)
friend eat coconut 'A friend eats a coconut'
b. [CP [TP [DP adamfʊ] [VP di [DP kube]]]]
c. ((adamfʊ)φmax (di (kube)φnon-max)φmax)ι

1.3. Intonation in Akan

Any language is assumed to have intonation [17]. Thus, post-lexical meanings conveyed by intonation can be expressed in a tone language even though the acoustic correlate of intonation F0 also functions as a correlate of lexical tone. For instance, in some tone languages the intonation pattern distinguishes different sentence types (e.g. [18] for Chichewa and [19] for Cantonese). In particular, local cues such as boundary tones distinguish between declarative or interrogative sentence type [7, 19, 26]. The prosodic expression of focus has also been shown to affect intonation patterns, in particular adjustments of the pitch register [9, 20]. The underlying lexical tone distinctions are maintained. For an overview of Akan intonation see [27].

The present paper will add to the effects of intonation in tone languages showing that a pitch register reset functions as a prosodic cue for embedded syntactic clauses.

1.4. Data of the production study

The sentence material on complementizer clauses discussed in section 2.1 is taken from [7] and was slightly adapted for this study. Other sentence materials were constructed for the purpose of this study. All sentences discussed below were recorded in Accra, Ghana, in 2014. Four native speakers (two females) of the Akan dialect Asante Twi read the sentences. They were in their mid-twenties and were paid a small fee for participation.

2. Complex declaratives

In complex sentences, the general downtrend in pitch shown in Figure 1 is interrupted. At the boundary of an embedded clause, a pitch register reset takes place to indicate the left edge of an embedded clause. The pitch reset is still within the general downtrend in pitch, i.e., the embedded clause does not start as high in pitch as a completely new sentence. We will examine three different types of embedded clause structures. The first two structures represent complement clauses of the verb, i.e. the complementizer clause in section 2.1, and the adverbial clause in section 2.2. The third structure is a left-dislocation, which is discussed in section 2.3.

2.1. Complementizer clause

A typical clausal complement in Akan is headed by the complementizer *sɛ* and contains minimally a subject and verb with accompanying tense and aspect marking [21]. Prosodically, the complementizer *sɛ* belongs to the matrix clause. Typically, a pause is realized after *sɛ* which clearly indicates its close relation to the matrix clause, cf. Figure 2. The complementizer itself is realized with a lengthened vowel and a falling tone, cf. Figure 2. After the complementizer and before the embedded clause starts, a pitch reset appears. Pitch reset is annotated by "%reset", which is borrowed from [22].

Consider the complex sentence in (5a). The clausal complement *kukuoba bɔ* 'the small pot breaks' consists of a subject and verb, and is preceded by the complementizer. It has thus clausal status. The prosodic phrasing (5b) proposes a pitch reset before the clausal complement and assumes that it constitutes a recursively embedded ι-phrase.

Compare this complex sentence with a simple declarative sentence made up of ten syllables in (6), which serves as a point of comparison. The matrix clause in (5) contains seven syllables up to and including *sɛ*, which is divided into three parts to represent measures of the falling tone realized on the complementizer. The end of the matrix clause plus *sɛ* is thus at syllable 10 of the simple declarative. This is to compare the F0 contour of the matrix clause up to and including the complementizer with that of a simple declarative.

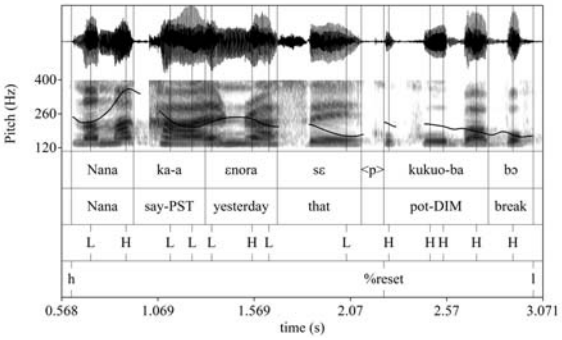

Figure 2: *Waveform, spectrogram and F0 contour of embedded declarative (5).*

(5) a. nànáá kà-à ɛ̀nórà sɛ̀ kúkúó-bá bɔ́.
Nana say-COMPL yesterday that pot-DIM break
'Nana said yesterday that the small pot breaks.' [7:59]
b. [nana ka-a ɛnora sɛ %reset[kukuo-ba bɔ]ι]ι

(6) a. kúkúó-bá pápá nó bɔ́ dáá.
pot-DIM good DEF break everyday
'The good small pot breaks everyday.' [7:57]

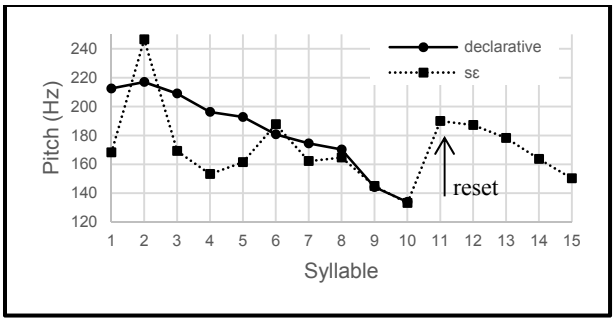

Figure 3: *Averaged F0 contour of four speakers; solid line refers to declarative sentence (6), dotted line to complex sentence (5).*

In Figure 3, a time-normalized intonation contour is displayed. The solid line represents a declarative sentence containing only H-tones and shows the downtrend pattern with final low pitch. The dotted line represents the embedded sentence with the clausal complement. It shows that the final pitch of the matrix clause (5) ends at the low pitch height, which is identical to a simple declarative (6). The clause-final low pitch of a H-tone in a declarative was analysed as tone neutralization in [27]. After the pause (cf. Figure 2), there is a pitch reset at the beginning of the embedded clause, which in (5) contains a phrase-initial lexical H-tone. This initial lexical H-tone is realized lower than an initial H-tone of the matrix clause and lower than an initial

H-tone of the simple declarative (solid line). The conclusion is thus that the pitch register reset signals embedding.

2.2. Adverbial clause

For adverbial clauses, [13] claimed an interaction of tone and morpho-syntactic structure. In case of a declarative sentence in progressive aspect that turns into an adverbial clause, leftward H-tone spread occurs throughout the adverbial clause; cf. the tonal change in the verb in (7); the underlying verb form is given in (7a'/b'). Figure 4 illustrates (7a) and shows that the underlying L-H-tone sequence of the verb *cɥícɥɛ* 'to search' is realized as H-H; in addition, the subject pronoun and progressive aspect are realized with a H-tone.

(7) a. mí-í-cɥícɥɛ́ jí kòfí bé-túmì à-dà
1SG-PROG-search while.PRS Kofi FUT-can PFT-sleep
'While I am searching for it, Kofi can sleep.'
a'. /cɥìcɥɛ́/ 'to search'
b. ó-ó-súmá nó àmà dá-éé
3SG-PROG-hide while.PST Ama sleep-COMPL
'While s/he was hiding, Ama fell asleep.'
b'. /sùmá/ 'to hide'
(adapted from [13] p.117, glosses adjusted)

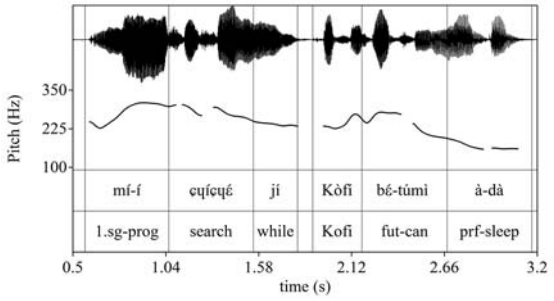

Figure 4: *Waveform and F0-curve of adverbial clause (7a).*

However, [13]'s claim that leftward tone spreading affects the complete adverbial clause seems to be too general. Our data suggest that adverbial clausal structure is indicated by a particular tonal configuration on the verb only. Remaining constituents of the adverbial clause, such as a subject NP in (8) for instance, keep their underlying tonal specification.

(8) a. Declarative sentence
kòfí rè-bìsá nó.
Kofi PROG-ask him
'Kofi is asking him.'
b. Adverbial clause
kòfí rébísá nó ná sɛ̀bɛ̀ àdà
Kofi PROG.ask himwhen Sɛbɛ PRF-sleep
'While Kofi was asking, Sɛbɛ was asleep.'

Consider the data in (8). The declarative (8a) is in progressive aspect, and a full subject NP precedes the verb. Note that in (7), the subject appeared as a pronoun cliticized to the verb. If (8a) turns into an adverbial clause (8b), the underlying L-H-tone sequence on the subject *Kofi* is preserved. Figure 5 illustrates this comparing the time-normalized averaged F0 contour of (8a) and (8b). The solid line represents the declarative, the dashed line the adverbial clause. Both cases show an identical L-H F0 contour on the initial two syllables of the subject. The difference between the two sentences is in syllable 4, which is the initial syllable of the verb stem *bisa* 'ask'. In (8a), it is low while it is high in (8b). The tonal replacement on the verb indicates the adverbial clausal status.

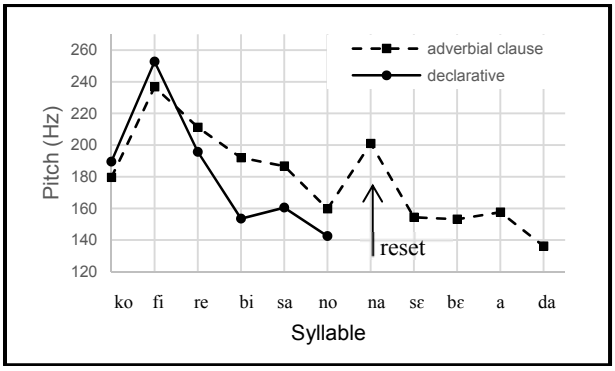

Figure 5: *Averaged F0 contour of four speakers; solid line refers to declarative (8a), dashed line to adverbial clause (8b).*

All four speakers realized a pause between the two clauses. The position of the pause however differed between speakers: One speaker realized the pause after the adverbial clausal marker *na*; the other three speakers realized a pause before *na*. From Figure 5 it becomes obvious that a pitch reset is realized before the adverbial clausal marker *na*. The H-tone associated with *na* is realized higher on average than preceding H-tones, e.g. the second syllable of the verb (sá). Note that the F0 of syllable 6 on the pronoun *no* drops down in (8b) indicating the end of an ι-phrase as is the case for (8a); cf. tonal neutralization [27]. As before, the conclusion is that the pitch register reset signals embedding of an ι-phrase.

2.3. Left-dislocation

In Akan, a topic is syntactically expressed by means of constituent fronting (e.g. [23, 24]). Either a fronted constituent appears with a morphological topic marker *deɛ*, which follows the fronted element (9a) or without a topic marker (9b); the topicalized constituent is morphologically resumed by an obligatory pronoun *ɔ* cliticized to the verb of the matrix clause.

All speakers realized a pause after the topicalized constituent, cf. Figure 6. After the topicalized constituent, pitch reset occurs. This becomes obvious in Figure 7 where the matrix clause, which follows the fronted constituent, is signalled by pitch reset as an embedded clause. The solid line in Figure 7 presents a declarative of similar length without constituent fronting (9c) for comparison. Both (9a) and (9b) end in a low tone (syllable 4 in Figure 7), and the initial tone of matrix clause is low as well. The initial lexical L-tone of the matrix clause is realized higher than the topic phrase-final L-tones, thus indicating pitch reset. Prosodic phrasing of ι-phrases is shown below the examples in (9).

(9) a. kòfí déɛ̀ ɔ-à-bá hà.
Kofi TOP 3SG.SBJ-PFT-come here
'As for Kofi, he has come here.'
a'. (kòfí déɛ̀ %reset(ɔ-à-bá hà)ι)ι
b. wɔ̀fà àdò, ɔ-à-bá hà.
uncle Ado 3SG.SBJ-PFT-come here
'Uncle Ado, he has come here.'
b'. (wɔ̀fà àdò %reset(ɔ-à-bá hà)ι)ι
c. wòfà kòfí rè-bè-dídí.
uncle Kofi PROG-FUT-eat
'Uncle Kofi is about to eat.'
c'. (wòfà kòfí rè-bè-dídí)ι

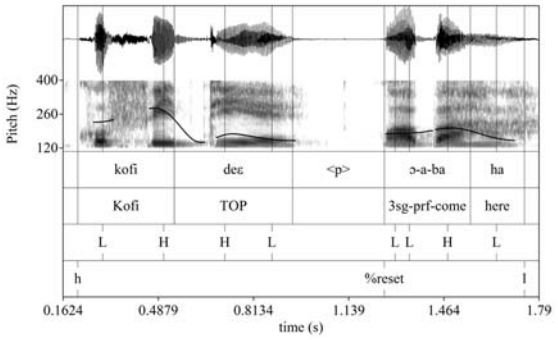

Figure 6: *Waveform, spectrogram, and F0 contour of left-dislocation (9a).*

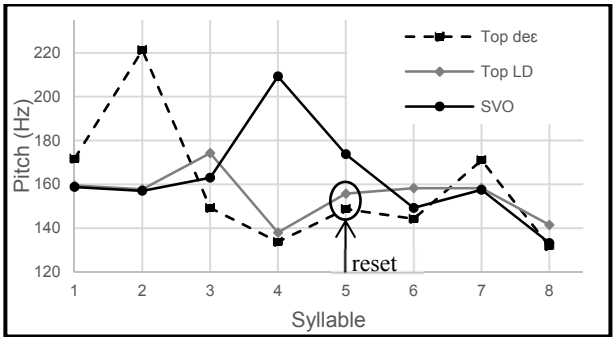

Figure 7: *Averaged F0 means of four speakers for left-dislocated structures and corresponding simple declarative (solid black line); dashed black line represents left-dislocated phrase with a morphological topic marker deɛ; solid grey line represents a left-dislocated phrase that ends in a L-tone.*

3. Analysis of phrasing

The data on structurally different embedded clauses, i.e. complementizer clauses, adverbial clauses and left-dislocations, have shown that the phonetics component that assigns pitch to these structures treats these identically. A pitch reset occurs at the left edge of an embedded clause, more precisely at the left edge of an embedded ι-phrase. In (10), a rough syntactic representation of the data discussed in this paper is shown. Given the assumptions of Match Theory, a syntactic clause matches with an ι-phrase (cf. MATCHCLAUSE in [8]). Hence, the CPs in (10) are matched with recursively embedded ι-phrases in (11). These different input structures are treated in identical fashion by prosodic structure formation. In complex syntactic structures in Akan, a pitch reset occurs at the left edge of an embedded ι-phrase. Since the embedded ι-phrase is dominated by another ι-phrase, the pitch reset occurs at the left edge of a non-maximal ι-phrase (11).

(10) a. Complementizer clause
[$_{CP}$ matrix clause [$_{CP}$ complementizer clause]]
b. Adverbial clause
[$_{CP}$ [$_{CP}$ adverbial clause] [$_{CP}$ matrix clause]]
c. Left-dislocation (topic)
[$_{CP}$ topic [$_{CP}$ matrix clause]] (cf. [21])

(11) a. (nànákà-à ènórà sè $_{\%reset}$(kúkúóbá bɔ́)$_{\iota non\text{-}max}$)$_{\iota max}$
b. ((míícɥícɥé jí)$_{\iota non\text{-}max}$ $_{\%reset}$(kòfi bétúmì àdà)$_{\iota non\text{-}max}$)$_{\iota max}$
c. (kòfi déè $_{\%reset}$(ɔ̀àbá hà)$_{\iota non\text{-}max}$)$_{\iota max}$

The recursive maximal and non-maximal interpretation of ι-phrases is parallel to the distinction of maximal and non-maximal φ-phrases [15] discussed in section 1.2. Akan thus exhibits recursive prosodic phrasing at the level of the φ-phrase as well as at the level of the ι-phrase.

Of course, other theories of the syntax-phonology interface such as Align theory [28] or Wrap theory [29] may treat the facts discussed here in a similar fashion. What remains to be shown is whether Match theory, as discussed in this paper, captures the facts in a more coherent way than other theories. The theoretical comparison will be for future research.

4. Conclusions

The data of this study have shown that a pitch reset occurs at the left edge of an ι-phrase. If a syntactic clause (CP) is matched by an ι-phrase according to [8], it is at the left edge of the embedded CP where the pitch reset occurs. The assumption on recursive prosodic constituency [16] allows us to refine the occurrence of a pitch reset, i.e. at the left edge of a non-maximal ι-phrase. The fact that the complementizer *sɛ* phrases with the matrix clause, while the adverbial clause marker *na* in (8) phrases with the embedded clause needs further consideration in how to represent the syntax-phonology match.

The amount of pitch reset depends on the tonal structure. Reset was larger in the complementizer clause because an initial H-tone occurred in the embedded phrase, while it was smaller in the left-dislocated structure because an initial L-tone occurred in the embedded clause. Thus, lexical tone distinctions are maintained, and pitch reset is superimposed on the lexical tones.

5. Acknowledgements

Financial support for this research came from a German Research Association (DFG) grant, SFB 632 "Information structure", project D5; Special thanks to Susanne Genzel, Reginald Duah, Kofi Dorvlo, Rike Schlüter, and Lisa Bausdisch.

The speech data appear in IPA transcription, glossing is based on Leipzig Glossing Rules [25]. The following abbreviations are used in glosses: COMPL=completive; DEF= definite; DIM=diminuitive; FUT=future; PFT=perfective; PRS=present; PST=past; PROG=progressive; SG=singular; SUBJ=subject; TOP=topic.

6. References

[1] W. E. Welmers, "Tonemics, morphotonemics, and tonal morphemes," *General Linguistics*, 4, 1–9, 1959.
[2] F. Dolphyne, *The Akan (Twi-Fante) language: Its sound systems and tonal structure*. Accra: Ghana Universities Press, 1988.
[3] P. Schachter and V. Fromkin, "Phonology of Akan," in *Working Papers in Phonetics 9*, Dept. Ling., UCLA, 1968, 1–268.
[4] G. N. Clements, "The description of terraced-level tone languages," *Language*, 55, 3, 536–558, 1979.
[5] J. M. Stewart, "Dschang and Ebrié as Akan-type total downstep languages," in *The phonology of tone*, H. van der Hulst and K. L. Snider, Eds, Berlin: De Gruyter, 1993, 185–244.
[6] S. Genzel and F. Kügler, "Phonetic Realization of Automatic (Downdrift) and Non-automatic Downstep in Akan," in *Proc. 17th ICPhS, Hong Kong*, 2011, 735–738.
[7] S. Genzel, "Lexical and post-lexical tones in Akan," PhD Thesis, Department Linguistik, Universität Potsdam, Potsdam, 2013.
[8] E. O. Selkirk, "The Syntax-Phonology Interface," in *The Handbook of Phonological Theory*, J. A. Goldsmith et al., Eds. 2nd ed, Chichester: Wiley-Blackwell, 2011, 435–484.
[9] F. Kügler and S. Genzel, "On the Prosodic Expression of Pragmatic Prominence: The Case of Pitch Register Lowering in Akan," *Language and Speech*, 55, 3, 331–359, 2012.
[10] K. Nkansa-Kyerematen, *The Akans of Ghana: Their customs, history and institutions*. Accra: Sebewie Publishers, 2004.

[11] F. Dolphyne and M. E. Kropp Dakubu, “The Volta-Comoe Languages,” in *The Languages of Ghana*, M. E. Kropp Dakubu, Ed, London: Kegan Paul, 1988, 50–90.
[12] M. Paster, “The verbal morphology and phonology of Asante Twi,” *Studies in African Linguistics*, 39, 1, 77–120, 2010.
[13] E. N. Abakah, “Tone rules in Akan,” *JWAL*, 32, 109–134, 2005.
[14] E. N. Abakah, “A closer look at downstep in Akan,” *Afrika und Übersee*, 83, 253–275, 2000.
[15] F. Kügler, “Phonological phrasing and ATR vowel harmony in Akan,” *Phonology*, 32, 1, 177–204, 2015.
[16] J. Itô and A. Mester, “Recursive prosodic phrasing in Japanese,” in *Prosody Matters*, T. Borowsky et al., Eds, London: Equinox Press, 2012, 280–303.
[17] D. L. Bolinger, “Intonation as a universal,” in *Proc. 7th ICL*, Oslo, 1962, 833–848.
[18] S. Myers, “Boundary tones and the phonetic implementation of tone in Chichewa,” *Studies in African Linguistics*, 25, 1, 29–60, 1996.
[19] J. K.-Y. Ma, V. Ciocca, and T. L. Whitehill, “The perception of intonation questions and statements in Cantonese,” *JASA*, 129, 2, 1012–1023, 2011.
[20] Y. Xu, “Effects of tone and focus on the formation and alignment of f0 contours,” *JPhon*, 27, 1, 55–105, 1999.
[21] L. Boadi, *Three major syntactic structures in Akan*. Accra: Black Mask Ltd, 2005.
[22] S.-h. Peng et al., “Towards a Pan-Mandarin System for Prosodic Transcription,” in *Prosodic Typology*, S.-A. Jun, Ed, Oxford: Oxford University Press, 2005, 230–270.
[23] L. Boadi, “Focus-marking in Akan,” *Linguistics*, 140, 5–57, 1974.
[24] K. K. Saah, “Studies in Akan Syntax, Acquisition, and Sentence Processing,” PhD Thesis, University of Ottawa, Ottawa, 1994.
[25] B. Bickel, B. Comrie, and M. Haspelmath, *The Leipzig Glossing Rules.* Available (December 2015): http://www.eva.mpg.de/lingua/resources/glossing-rules.php.
[26] S. Genzel and F. Kügler, “Prosodic question marking in Akan - what do listeners hear?” Submitted to *JIPA*.
[27] F. Kügler, “Tone and intonation in Akan,” to appear in *Intonation in African Tone Languages*, L. Downing and A. Rialland, Eds, Berlin: Mouton de Gruyter, 2017.
[28] E. O. Selkirk, “The interaction of constraints on prosodic phrasing,” in *Prosody: Theory and Experiment*, M. Horne, Ed, Dordrecht: Kluwer, 2000, 231–261.
[29] H. Truckenbrodt, “On the relation between syntactic phrases and phonological phrases,” Linguistic Inquiry, 30, 219-255, 1999.