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Intonation in Bemba¹

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1. Introduction

This paper presents an initial investigation of Bemba intonation. Bemba is a Niger-Congo language of the Central Narrow Bantu branch that is classified as part of Zone M in Guthrie's (1948, 1967-71) classification. It is spoken in Zambia (mainly in the Northern, Luapula and Copperbelt provinces) and in the Southern Democratic Republic of Congo by approximately 3.3 million speakers (Lewis, Simons & Fennig 2013). Bemba has several dialects, though there are no systematic studies on the exact number and the differences between possible dialects (but see Bickomre & Kula 2013 for a discussion of tonal differences between two dialects). Some information on the possible number of dialects can be found in Ohannessian & Kashoki (1978), Kashoki (1978), Chanda (1996) and Kula (2006). This work is based on the Copperbelt dialect.² Like the majority of languages in this volume, Bemba is a tone language that does not have stress or any kind of accent marking.

The present paper discusses the following robust intonational patterns in Bemba that correlate to different kinds of declarative sentences and questions: final lowering, pitch range expansion and compression, pitch register raising and pitch reset, which will be demonstrated and defined in ensuing discussion. For the notation of intonation we follow basic assumptions within autosegmental-metrical theory as reviewed in [Ladd \(2008\)](#). We employ a number of intonational tones to account for the intonational structure of Bemba. L% and H% are used as the boundary markers of local register effects at the right edges of intonational phrases. It is demonstrated that intonational phrases are the main domain marked in Bemba intonation. We further propose to indicate global effects of pitch range expansion and compression as the anchoring of -H and -L at the left edges of intonational phrases for the specific sentence types in which they occur (polar and constituent questions and right dislocations). Multiple questions and focus constructions also use -H to indicate pitch raising in a more restricted domain within an intonational phrase. A final necessary intonational tone is !H for a downstepped High indicated at the beginning of the domain of downstep. Thus the intonational grammar we will utilize and motivate in the remainder of the paper consists of the set { L% H% -L -H !H }.

The paper is organised as follows: Section 2 presents the general tone patterns and tonal processes of Bemba that are relevant to the current paper; section 3 discusses the intonational structure of declaratives with particular focus on subordinate clauses,

¹ We would like to thank Bob Ladd for comments on an earlier draft of this paper and for discussion Carlos Gussenhoven, Louisa Sadler and audiences at the Linguistic Society of Southern Africa (LSSA) 2015 and the Linguistic Society of Great Britain (LAGB) 2015. We also thank two anonymous reviewers and the editors of this volume whose valuable comments have improved the clarity of the arguments made. We take full responsibility for all the ideas expressed.

² Copperbelt Bemba as used here is not intended to refer to what has been labeled *Town Bemba* which is widely used on the Copperbelt and which evolved as a lingua franca on the mines of the Copperbelt province involving a mixture of languages (see Kashoki 1972, Kabinga 2010). Rather indigenous Bemba speaking peoples migrating from the Northern Province from around the 1920s is what is intended. Needless to say there is inevitable interaction between this Copperbelt Bemba and Town Bemba that we abstract away from here.

- (1) a. bá-ká-lóóndólól-á
 2SM-FUT3-explain-FV
 ‘They will explain’
 b. tù-kà-lòòndòlòl-à
 2PLSM-FUT3-explain-FV
 ‘We will explain’

Unbounded spreading contrasts with bounded spreading which does not spread a H to the end of the verb form. There are two contexts where bounded spreading applies; (i) when the verb is followed by another constituent, such as the adverb in (2a) or (ii) when there is another H following within the verb form as shown in (2b). The final H in (2b) is a grammatical tone that marks the imperative. In Copperbelt Bemba (CB) bounded spreading is ternary. Thus the verb form in (2a) differs from (1a) only in having bounded rather than unbounded spreading when there is a following constituent. In this case the H does not continue to spread even though there are potential target toneless moras. (2b) further shows bounded spreading of the initial H because there is another H following within the verb form. In this case as well, there are possible target toneless moras to which the H does not spread, illustrating that it is ternary.

- (2) a. bá-ká-lóòndòlòl-à bwìnò
 2SM-FUT3-explain-FV well
 ‘They will explain well’
 b. bá-ká-lóòndòlòl-é
 2SM-FUT3-explain-SUBJ
 ‘They should explain’

Thus in terms of High tone spreading a H spreads unboundedly until the last TBU if there is no other H tone following within the word (1a). If there is another H tone following within the word, then H tone spreading is bounded and is specifically ternary in Copperbelt Bemba (2b) i.e. it spreads twice after the source creating a ternary domain including the source of H tone spread (HHH..). Bounded spreading also occurs in a word that is not phrase final i.e. if another constituent follows as seen in (2a).

2.2. OCP and Downstep

The preceding example in (2b) illustrates bounded spreading where a H follows within the same word. Consider now a similar case (3a-b) where another H tone follows but where there are fewer intervening moras such that the application of ternary spread would result in adjacent lexical Hs. We assume a standard autosegmental representation where lexical tones are represented on a suprasegmental/tonal tier. In this case ternary spreading is ungrammatical (3b). If the initial lexical H underwent ternary spreading, associating to the following two moras, then the lexical H would be adjacent to the following lexical H on the suprasegmental/tonal tier and therefore consist of an OCP violation. This is avoided by spreading once, rather than not at all, as seen in (3a).

- (3) a. béléèng-á
 read-FV.IMP
 ‘Read!’

b. * bélééng-á

This partial spreading in a ternary spreading context led Bickmore & Kula (2013) to conclude that ternary spreading is achieved by two independent rules namely High Doubling (binary spread) and Secondary High Doubling (SHD). High Doubling spreads a H one mora to the right and SHD spreads it one mora further which then achieves the surface ternary pattern. There are a number of arguments that Bickmore & Kula present in favour of this analysis, which we do not replicate in full here, but one of the central motivations is the application of the OCP. Whereas SHD is subject to the OCP, as the example in (3a) shows, High Doubling is not, so that a H still spreads even though it will create a sequence of lexical Hs. This dispreferred sequence is adjusted by producing the second lexical H at a lower register than the first i.e. downstep (indicated by superscript !). In many languages the trigger of downstep is usually a low tone or a floating low tone preceding a H (see, for example, Clements 1990, Connell 2001, Connell & Ladd 1990, Ladd 1990, Lindau 1986, Steward 1965, among others).⁵ In Bemba there is no evidence of a low tone as the trigger of downstep and we must conclude that in this case downstep is a reflex to remedy an OCP violation. Interestingly, there is no downstep between underlyingly adjacent Hs with downstep only occurring in derived environments. The disparity between violation of the OCP and concomitant downstep in High Doubling, versus OCP violation avoidance in SHD is further illustrated in (4a) vs. (4b).

- (4) a. bá-ká-[!]tú-lúk-á
 2SM-FUT3-1PLOM-plait-FV
 ‘They will plait us (our hair)’
- b. bá-ká-mù-lás-á
 2SM-FUT3-1OM-hit-FV
 ‘They will hit him/her’

In (4a) the subject marker *bá-* and the object marker *-tú-* are lexically H-toned. The H of the subject marker is subject to bounded spreading because of the following lexical H but can only spread once (High Doubling) and does so resulting in downstep of the following lexical H of the object marker. This H itself undergoes unbounded spreading to the end of the verb form. Pitch tracks of downstep examples can be seen in figures 6 and 9 below. By contrast the subject marker H in (4b) spreads once but does not spread further – no Secondary High Doubling – to complete its ternary span, thereby avoiding an OCP violation. There is therefore also no downstep in this case.

2.3. Melodic high tones

Like other Bantu languages Bemba also has the so-called Melodic Highs (MH; see Odden & Bickmore 2014) which are particular tones/tone patterns associated to specific TAMs. MHs have 3 docking sites in Bemba (Bickmore & Kula 2013): (i) on the final vowel (FV) as in

⁵ Connell (2001) recognizes two types of downstep in the literature. Automatic downstep in cases where Hs are separated by a low tone (HHLHH) and non-automatic downstep where there is no low tone (HH!HH). The latter case is generally assumed to involve a floating low tone. Downstep is not usually seen to affect low tones but see Hyman (1985) for a case in Dschang. The idea of downstep as involving a change in register, where register is understood as a phonetic frame of reference for tone, owes to the work of Clements (1979), Clements and Ford (1979).

examples (2b, 3a); (ii) on the second vowel of the stem (V2); or (iii) on the domain from V2 to the FV. See Kula & Bickmore for a full list of TAMs showing these patterns. The motivation for treating these Hs as MHs is because they cannot be readily explained by the tone spreading rules discussed above, with their occurrence determined by the TAM. They are in this sense grammatical tones. Consider the example in (5) illustrating the V2-FV MH.

- (5) bá-mú-lùk-íílé
 2SM-1OM-plait-PERF
 ‘They have woven for him’

As (5) illustrates, the final three Hs in the verb form cannot be explained by a spreading process from the initial lexical H but are associated with perfective verbs. Note that the application of ternary spread remains the same – only High Doubling applies in this case because there is a following H of the MH V2-FV pattern. MHs will be pointed out where they occur in the following discussion and will also be underscored like lexical Hs as in (5).

2.4. Phrasal tone and prosodic phrasing

At the phrasal level Kula & Bickmore (2015) show that H tone spreading is used as a cue for phonological phrasing with unbounded spreading indicating an immediately following *phonological phrase* (p-phrase) boundary while bounded spreading indicates the absence of such a boundary. Recall from earlier discussion that one of the contexts of bounded spreading was the presence of a following constituent (2a). The more precise description of this condition is that bounded spreading applies in word₁ if a following word₂ is in the same p-phrase as word₁. If the two words are in different p-phrases, then unbounded spreading applies in word₁. If the following word or sequence of following words are all toneless, and are each in independent p-phrases, then the H of word₁ (indirectly) spreads through each of the following words. The examples in (6a-d) illustrate H spreading at the p-phrase level. (6a) indicates a p-phrase boundary between an object-marked verb and its complement, while (6b) shows no such boundary when the object marker is absent. (6c) indicates long-distance H spreading over four words but this spreading is arrested when the verb and first complement phrase together (6d). In this case we see bounded (ternary) H spreading on the verb form.⁶

- (6) a. (bá-ká-mú-lóondólól-á)_{PP} (Bùùpé)_{PP}
 2SM-FUT3-1OM-explain-FV Bupe
 ‘They will introduce him, Bupe’
- b. (bá-ká-lóondólól-à Bùùpé)_{PP}
 2SM-FUT3-explain-FV Bupe
 ‘They will introduce Bupe’
- c. (bá-ká-mú-shíík-íl-á)_{PP} (Chítúúndú)_{PP} (cáàngá)_{PP} (bwíínó)_{PP}
 2SM-FUT3-1OM-bury-APPL-FV Chitundu 1a.bushbaby well
 ‘They will bury the bushbaby for Chitundu well’
- d. (bá-ká-shíík-íl-à Chítùùndù)_{PP} (cààngà)_{PP} (bwììnò)_{PP}
 2SM-FUT3-bury-APPL-FV Chitundu 1a.bushbaby well
 ‘They will bury the bushbaby for Chitundu well’

⁶ There is information structure involved in the interpretation of the complement in (6a-b) with the complement in (6b) being focused. See Kula (to appear) for discussion.

It cannot be assumed in an example such as (6c) that the initial H just spreads unboundedly to the final word. There are a number of data that do not support such an analysis. For example, if a second word (w_2) contains a high tone, a final H in the preceding first word (w_1) still spreads into w_2 but it does not spread any further. This is illustrated in example (7).

- (7) tù-kà-lás-á Kápèèmbwá
 1PL-FUT3-hit-FV Kapembwa
 ‘We will hit Kapembwa’

In (7) the H on the verb spreads to the final mora in unbounded fashion and then spreads into w_2 which only has the final H as lexical. However the H on the initial syllable of w_2 does not spread further, even in bounded fashion, although there are available targets. This is used to conclude that there is an independent process of inter-word H doubling that doubles a final high tone from w_1 to w_2 .⁷ Such doubling also applies even if it results in an OCP violation in w_2 . This means that in order to achieve the long distance H spreading effects, spreading between words must be interspersed with inter-word H doubling. This process is formalized as following from the constraint *INTER-WORD HL which militates against a HL sequence between two words and therefore forces a final H of w_1 to spread into w_2 (see Kula & Bickmore 2015 for details). The crucial point about this constraint is that it only affects a sequence of TBUs which are in the same *intonational phrase* (i-phrase). If two TBUs are part of words/p-phrases that belong to different i-phrases then inter-word H doubling does not apply. This process is therefore a good diagnostic for p-phrases and i-phrases. Consider the examples illustrating the difference below.

- (8) a. ùmú-límí _{PP} $\text{PP}(\text{tù-ká-pát-á})$
 1-farmer 1PL-FUT3-hate-FV
 ‘the farmer we will hate, (the teacher we will like)’ (contrastive focus)
- b. ùmú-límí _{IP} $\text{IP}(\text{tù-kà-pát-à})$
 1-farmer 1PL-FUT3-hate-FV
 ‘as for the farmer, we will hate (him)’ (left dislocated object topic)

In (8a) the fronted object is a contrastive focus. In this case the initial H of w_1 undergoes unbounded spreading, showing that a p-phrase boundary follows. The final H in w_1 then spreads into w_2 indicating that the two words are part of the same i-phrase. The doubled inter-word H then undergoes unbounded spreading to the end of w_2 . By contrast, in (8b) where the object is a fronted topic we see no spreading between w_1 and w_2 and must conclude that the two identical words in this instance belong to two separate i-phrases. Without inter-word H doubling, w_2 in this case surfaces as all low. We thus see tonal evidence for a distinction between p-phrases and i-phrases in the prosodic phonology of Bemba. This evidence will be used to evaluate whether p-phrases and/or i-phrases are marked in Bemba intonation. We take up this discussion later in section 5.

⁷ There are additional examples illustrating that the spread from w_1 to the initial of w_2 is not creating a ternary domain. Namely in cases of w_1 with a final lexical H, the spread is still only to the initial of w_2 , if there is a H in w_2 , despite following possible targets. The reader is advised to consult Kula & Bickmore (2015) for further details and exemplification.

2.5. Vowel coalescence and tone shift

Vowel coalescence is important in the discussion of the general Bemba tone patterns because it affects surface tones. In Bemba vowel hiatus at morpheme boundaries is resolved in many verbal forms by vowel fusion, where a low vowel (/a/) followed by a high one (/i/ or /u/) results in a long mid vowel (/ee/ or /oo/). If a high vowel precedes the low vowel then the high vowel turns into a glide and the following vowel is compensatorily lengthened (see Kula 2002 for discussion). As the TBU is the mora, there is no tone coalescence for the two moras of a long vowel with a sequence of a low tone followed by a H tone, for example, since rising tone patterns are not permitted. Potential rising sequences are resolved either as level low tone or level H. This depends on the possibility of shifting the H into the next syllable i.e. whether the tone can dissociate from its sponsor and attach to the next mora on the right (see tone shift discussion below) or not.

The numbered examples in this article are given without coalescence to more accurately represent the underlying forms, whereas the transcriptions in the figures indicate all instances of vowel coalescence mirroring the actual realizations.

The class one subject marker -á- which is lexically high toned shows tone shift to a following mora but only if there is no lexical high tone on the target. In (9a) we see vowel fusion between the class one subject marker and the initial vowel of the verb. The resulting long vowel surfaces as all H in this case because shifting from the first to the second mora would result in a rising tone sequence on a long vowel and shifting to the next syllable is not possible since that has a MH. As a result, the MH is downstepped.

Apart from cases involving vowel coalescence, tone shift in Bemba is also seen in other instances. In infinitives, for example, the VCV shaped noun class prefix (class 15) also has the property of shifting its initial H to the following vowel. The infinitive examples in (9b-c) show different realisations of the shifting initial H depending on whether a toneless verb (9b) or a high-toned verb (9c) is involved.

- (9) a. á-ìb-ìlé léélò → ééb-¹ìlé léélò
 1SM-steal-perf today
 ‘He has stolen today’
- b. ù-kú-sóónték-á
 AUG-CL15-light-FV
 ‘to light’
- c. ú-kú-¹léét-á
 AUG-CL15-bring-FV
 ‘to bring’

In (9b) the initial H of the augment shifts to the following syllable and is then subject to unbounded spreading in this phrase-final verb form which contains no other Hs. In (9c), on the other hand, where the verb is lexically high-toned, tone shift is blocked, and the H surfaces on the augment, from where it spreads rightwards once, resulting in downstep on the following lexical H of the verb. Our annotation in following examples involving tone shift will follow the representations in (9) where the source of a H tone that undergoes tone shift is underscored to indicate the source of the lexical H tone even though in fact the relevant vowel may surface low (as in 9b).

In summary, the main tonal processes we see in Bemba are rightward H spreading which may be bounded (binary/ternary) or unbounded; downstep and OCP violation avoidance in different environments; variable application of tone shift; the presence of MHs which are

subject to the regular tone processes; and long distance spreading at the phrasal level indicating prosodic phrasing. As rising tones are disallowed, there are also a number of processes resolving such sequences depending on the context. These processes are going to be crucial to the interpretation of the tone patterns in the data to be discussed in the following sections, which we now turn to.

3. Declarative sentences

Word order in Bantu is SVO (see e.g. Bearth 2003) and declarative sentences provide either old or all new information as in the examples in (10).⁸ The subject in declarative sentences shows a consistent right edge boundary L%. It remains to be investigated whether this boundary tone replaces the lexical tone or simply causes the final H of the subject noun to be realized at a lower register.⁹ An optional pause after the subject is possible.

- (10) a. àbààná bá-ká-bíl-à ìfyákùfwáálá
 2child 2SM-FUT3-sew-FV 8clothes
 ‘The children will sew clothes’
- b. bànáàyó bá-ká-bílà ìfyákùfwáálá
 2woman 2SM-FUT3-sew-FV 8clothes
 ‘The women will sew clothes’

The other intonational characteristic of significance in declaratives is that (at least) the final three syllables are all lowered. We will treat this as *final lowering* and follow Connell & Ladd (1990) in defining this as a more abrupt lowering effect confined to phrase ends and which affects all tones (high or low) causing them to be lowered. This contrasts with declination, which is more of a phonetic effect. Final lowering can be seen for high-toned words at the right edges of figures 1 and 2. It will be seen in later discussion (e.g. figure 4) that final lowering also affects low-toned words. We cannot precisely define the domain of final lowering, as the target number of syllables varies. In figure 1 at least the last five syllables are affected, in figure 2 about the last three syllables are affected, and in figure 4 at least the final 4 syllables are affected. We treat final lowering as involving a right edge boundary L% following work such as Myers (1996) who argues for possible differences in the phonetic implementation of boundary tones as affecting either only the final TBU or a range of TBUs. In the present case, a single constituent like a subject shows more abrupt L% effects, with only the final syllable affected, while in clause final position (where declination probably also has an effect) a range of TBUs may be affected.

There are 5 tiers in each figure showing; (i) the sentence broken up into syllables with surface tones indicated; (ii) lexical Hs; (iii) intonational tones; (iv) significant intonational

⁸ All data are generated by the first named author, a native speaker of CB, for the purpose of this research and are therefore not naturally occurring data, although an effort was made to depict everyday scenarios so that the sentences used are not particularly marked. At least three examples (with at least three repetitions each) were analysed for each of the sentence types investigated and reported here. Pitch tracks for each of the examples were compared to arrive at the final analysis with only select figures shown for illustrative purposes. Pitch tracks and annotations were conducted in Praat (Boersma & Weenink 2014).

⁹ We thank Carolos Gussenhoven for raising this point. At least subjects with final low tone will have to be investigated to ascertain the effect of the intonational tone. If the boundary L% alters the register of lexical tone then we expect a final low-tone to be produced at a lower register. We leave a full investigation to future work but preliminary results did not show a lowered register suggesting that the lexical tone succumbs to the boundary tone. See Hyman and Monaka (2008) for some hypotheses on the interaction of lexical and intonational tone.

effects if present; and (v) the gloss. Note that the lexical tones in tier (ii) are aligned with the phonetic signal (and thus the pitch curve), and therefore might not be fully aligned with the corresponding surface tones transcribed on the syllabic tier (i). Furthermore, it should be kept in mind that lexical H tones in tier (ii) may correspond to surface low tones in tier (i) in cases where they have shifted as discussed in section 2.

Figures 1 and 2 below illustrate examples (10a) & (10b), respectively.

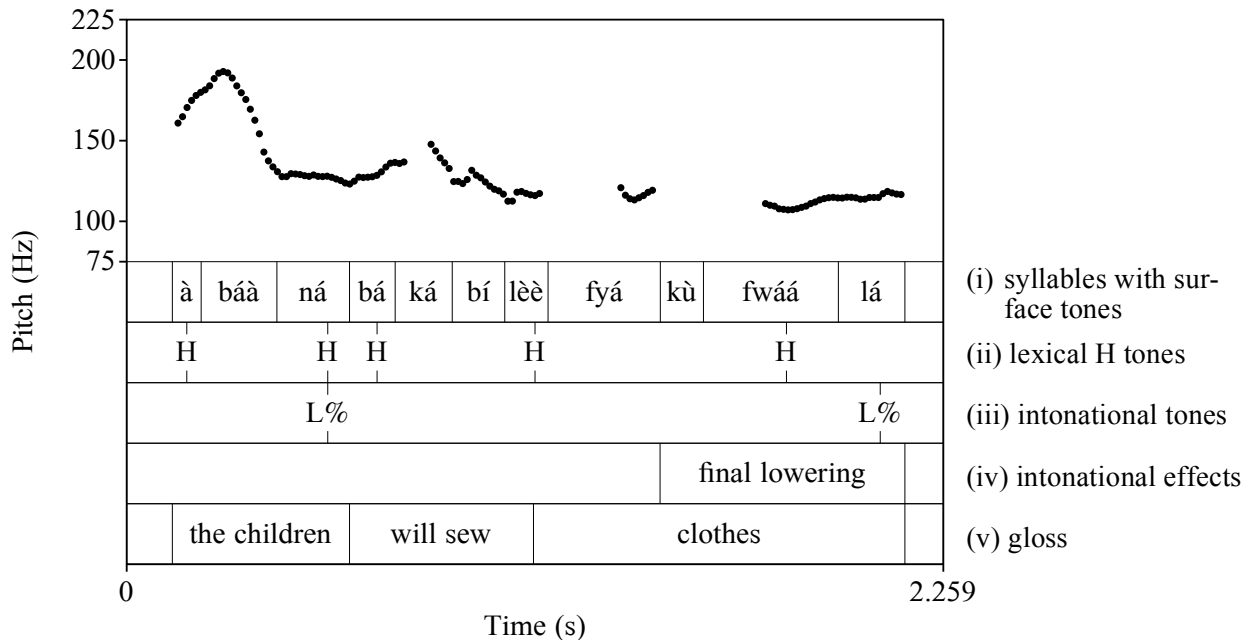


Figure 1. Boundary L% for subject and final lowering in a declarative (10a)

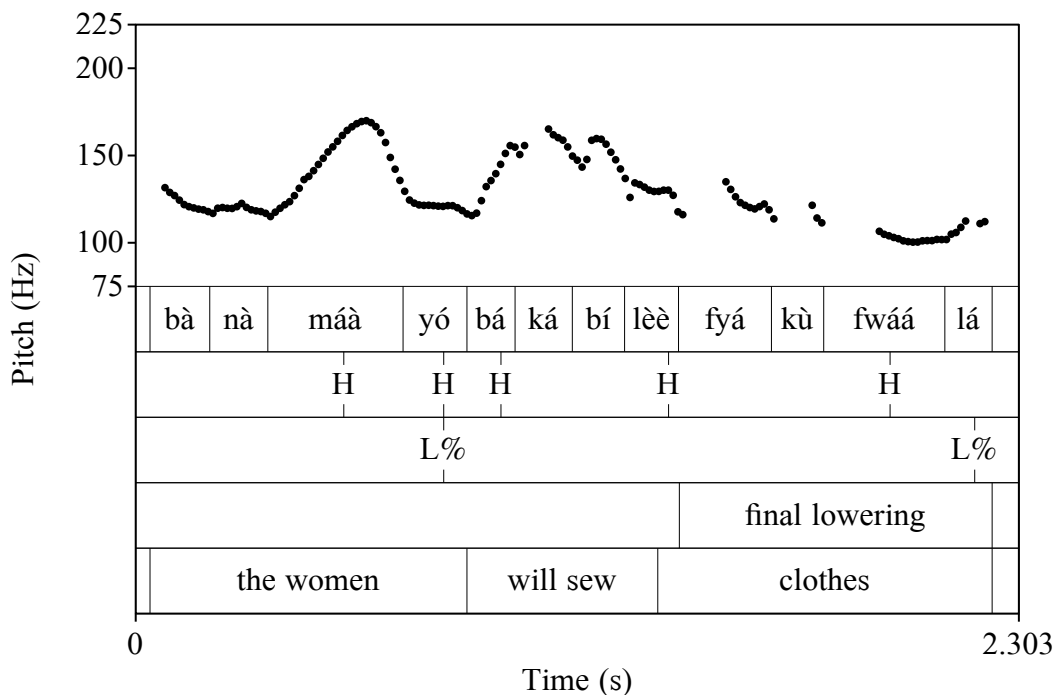


Figure 2. Boundary L% for subject and final lowering in a declarative (10b)

In both cases the subject is finally lexically H-toned but shows a boundary L% and in

addition, a boundary L% results in final lowering at the end of the declarative. These findings for declaratives are comparable to Downing and Rialland (2015) for Chichewa and Embosi where they show a local register effect of the final L% on the final and preceding tones. See also Rialland & Aborobongui (this volume) for discussion of final lowering.

A boundary L% after subjects resonates well with the pro-drop status of Bantu and the assumption that subjects are topics at least in most analyses (see [Givón 1976](#), Bresnan & Mchombo 1987, for example). If this hypothesis is correct then we expect the same boundary L% in other topicalised constituents. Similarly, if final lowering marks the end of a major constituent (such as an i-phrase) then we may expect to find it between a matrix and subordinate clause in cases where the two form independent i-phrases. We investigate these structures presently.

Finally, although there is no penultimate lengthening in Bemba, there appears to be some lengthening of the final syllable in both the initial subject and the final constituent in the declarative sentence. We have not carried out systematic durational comparisons but notice it here and in figures discussed below. This may be an issue to investigate in more detail in future work.

3.1. Subordinate clauses

We looked at two kinds of subordinate clauses: those introduced by the complementizer *àti* ‘that’ (11a-b), and relative clauses (11c). (11a) shows the complementizer sentence in its more canonical position after the verb. The intonation of (11a) shows significantly lowered pitch with a fall to the already low-toned complementizer with no pitch reset followed by final lowering after the verb. Thus in order to investigate any right edge effects we use the inverted structure in (11b).¹⁰ This is shown in figure 3.

- (11) a. abààná bá-léé-súúbil-à àti bàná^ààyó bá-ká-bíl-á máíló
 2child 2SM-PROG-expect-FV that 2woman 2SM-FUT3-sew-FV tomorrow
 ‘The children are expecting that the women will sew tomorrow’
- b. àti Chisààngà álí-sáám^ílíl-á máíló, càà-lí-m-pápúsh-á
 COMP Chisanga P3-learn-FV tomorrow COP-AUX-1SGSM-surprise-FV
 ‘That Chisanga went to learn/study yesterday surprised me’
- c. abàànákáshì à-bá-bíl-à bwìinò bá-léé-¹ángálà kùmùmàná
 2girl 2AUG.REL-2SM-sew-FV well 2SM-PROG-play-FV 16river
 ‘The girls who sew well are playing at the river’

The fronted complementizer clause in figure 3 shows a final boundary L% on the final syllable followed by a pause with the following main clause showing pitch reset and final lowering. Note that pitch reset for the main clause that starts with low tone starts at a level very similar to the sentence initial syllable, after which final lowering begins to apply.

¹⁰ We are somewhat unsure of the legitimacy of this move as this makes the complementizer clause look more like a topic, in fact a subject topic since the verb has no subject in (11b). In section 3.2 where we discuss dislocation we use a similar example but with a subject present after the topic to ascertain its topic-hood: [Topic [Subject-Verb]]. But given discussion in Cheng & Downing (2009), (11b) may as well be a CP internal topic.

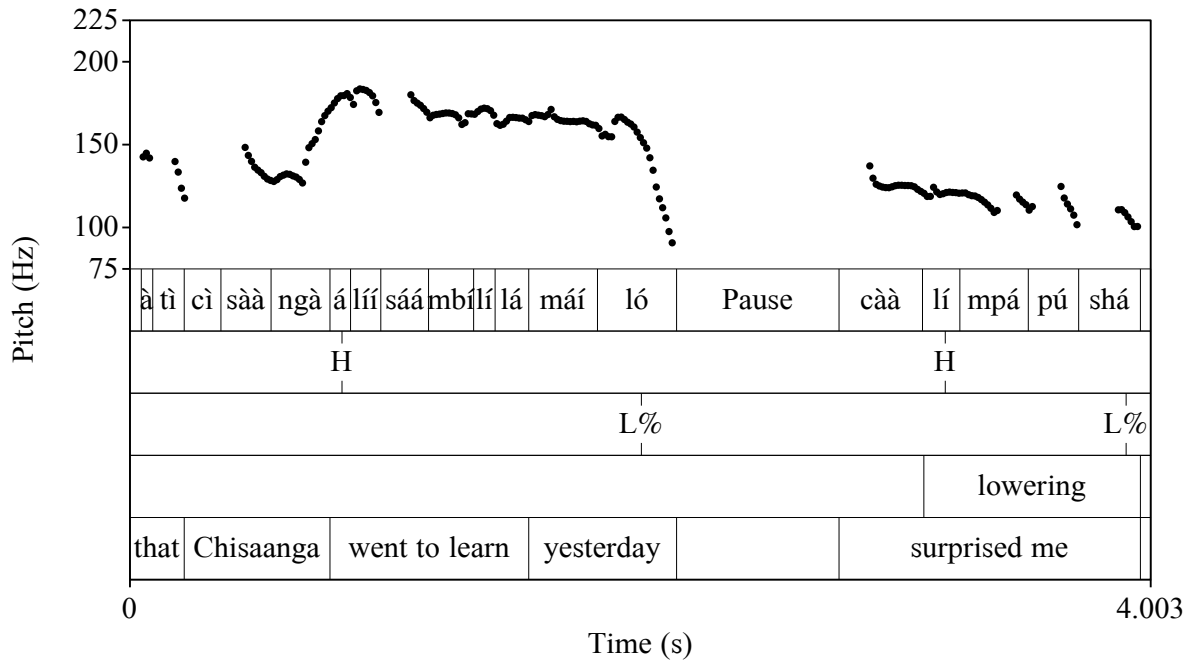


Figure 3. *Fronted complementizer clause with boundary L% and main clause with lowering (11b)*

Relative clauses, illustrated in figure 4, show a boundary H% signalling continuation on the final syllable of the relative which is itself low-toned. This is followed by a pause before the rest of the main clause. The remainder of the main clause shows pitch reset after the pause and shows expected downstep followed by final lowering indicating the end of the utterance. We again observe lengthening of the final syllable of the relative clause and of the main clause.

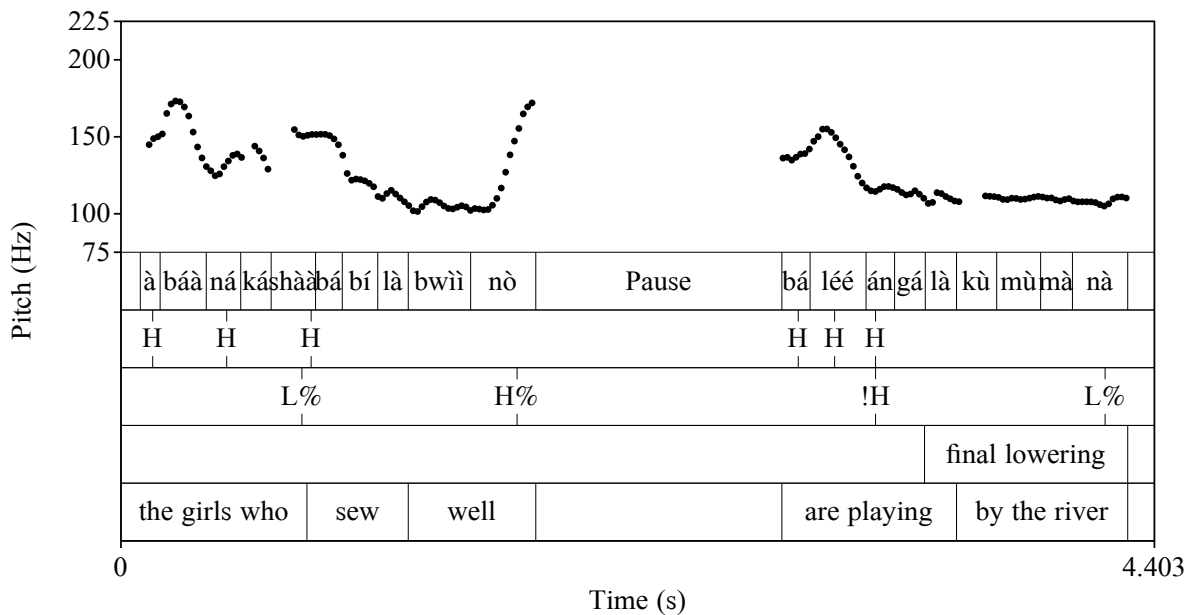


Figure 4. *Relative clause with continuation rise and main clause with lowering (11c)*

A boundary H% (indicating continuation) is also seen to mark the right edges of restrictive relative clauses as well as other subordinate clauses in Embosi and Chichewa (Downing &

Rialland, 2015). In Bemba we see that H% only occurs at the right edge of restrictive relatives but is not seen following other subordinators as in figure 3 (11b).¹¹

3.2. Dislocations

We now consider right dislocation of both subjects and objects. Subjects are easily dislocated in Bantu owing to the presence of subject-verb agreement. See Cheng & Downing (2014) for some discussion on contrasting evidence for treating pre-verbal NPs as subjects or topics in Bantu. Similar to subjects, objects can be argued to be right dislocated most clearly in cases where the object is object marked on the verb (Cheng & Downing 2009, Downing 2011, Marten & Kula 2012, Zeller 2015). We assume that the dislocation examples in (12) below show dislocation outside the main clause. The object dislocation example uses a ‘disjoint’ form in the so-called *conjoint-disjoint* alternation attested in particular tenses in various Bantu languages (Hyman & van der Wal, to appear). In Bemba conjoint forms indicate that a following constituent is phonologically phrased together with the verb, while disjoint forms generally show phrasing that separates the verb and a following constituent. This distribution supports the clause-external status of the final constituents in (12). The conjoint-disjoint alternation also has correlations with information structure on which see Kula (to appear). In both subject (12a) and object (12b) dislocation the right dislocated constituent shows *pitch range compression* (PRC), see figures 5 and 6.¹²

- (12) a. bá-láá-bíl-à kàpùtùlà lèlò bànáamááyò
 2SM-FUT1-sew-FV 1a.trousers today 2woman
 ‘They will sew the shorts today, the women’
- b. bá-lá-¹bélééng-á bwíínó ìcítábó
 2SM-HAB-DJ-read-FV well 7book
 ‘They read well, the book/they read the book well’

¹¹ Kula & Cheng (2007) investigate the phrasing of a head noun with a following relative clause contrasting restrictive and non-restrictive relatives but do not look at the right edges of RCs.

¹² We take pitch range compression to involve a severe reduction in the f0 range in which tones occur. PRC has been used in contrast to *pitch range expansion* (PRE), which in some languages accompanies focused constituents.

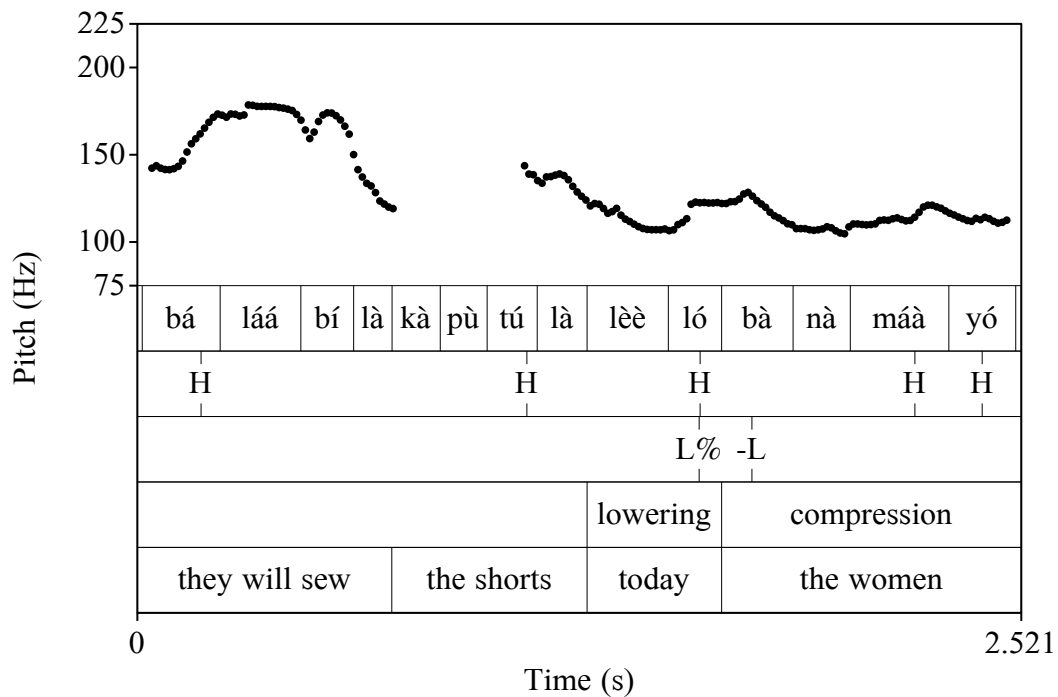


Figure 5. Pitch range compression after lowering on right dislocated subject (12a)

In figure 5 we see lowering on the adverb *lèèló* caused by the boundary tone L% at the end of the clause, and PRC on the right dislocated subject *bànàmáà yó*. PRC is seen to be a global effect affecting the whole constituent. We propose to mark this with the left edge tone -L which then has scope over the dislocated constituent. The PRC analysis is further supported by the fact that the same subject in subject position, cf. figure 2, does not show this effect. Note also that both in this figure and in figure 6 below the right dislocated constituent has a number of high tones for which we see only moderate raising under PRC.

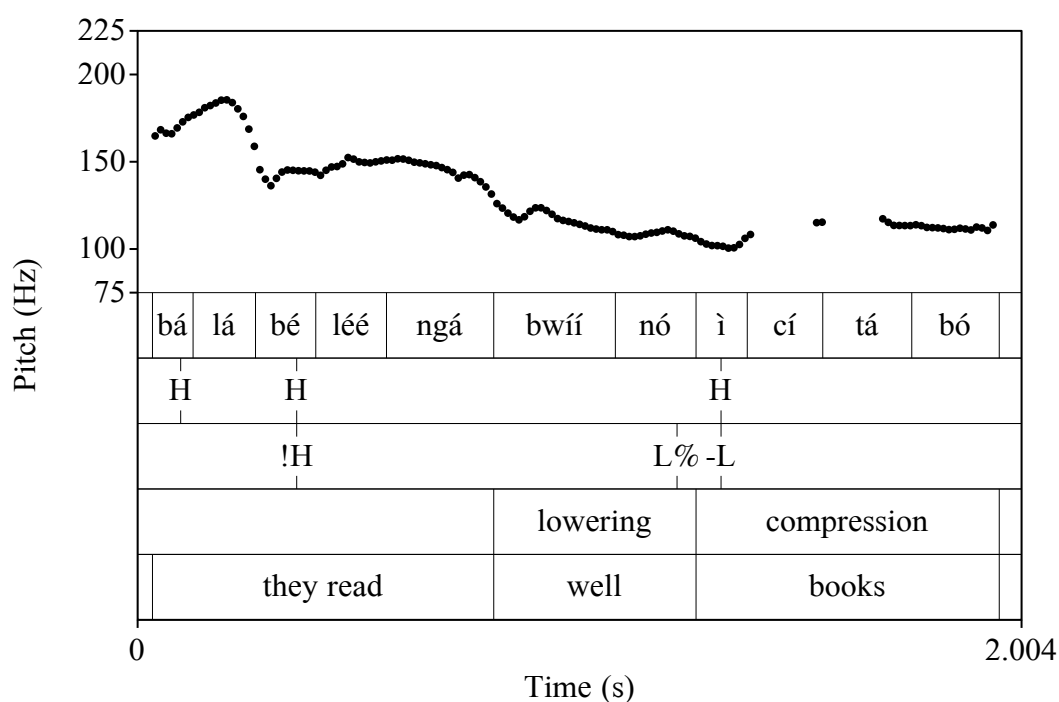


Figure 6. Pitch range compression on right dislocated object after lowering following downstep (12b)

As in the subject dislocation case, object right dislocation in figure 6 shows a boundary L% before the dislocated constituent on which PRC applies, signaled by -L on the left edge of the object. Here we can see that the object despite being High toned on the final three syllables has lower pitch than the initial H on the first two syllables of the sentence as well as the downstepped H. The downstep in this case affects everything that follows within the clause. PRC as triggered by -L in figures 5 and 6 differs from the medial L% in figure 3, for example, because in contrast to figure 3 we see no pitch reset after L% at the beginning of the constituent that undergoes PRC. In figure 3, despite the constituent following the medial L% being low toned, we see pitch reset after the pause matching the low tone level of the initial syllables. This provides justification for distinguishing L% from -L.

3.3. Preverbal topics and contrastive topics

For preverbal topics we consider both clausal objects and single constituent objects in order to compare whether the size of the fronted constituent has a different effect on the intonation. We also look at fronted topics in contrastive contexts. As work by Zerbian (2006) and Downing (2011) shows, languages vary in being either symmetric or asymmetric with respect to the prosodic phrasing of right and left dislocated topics. Bemba is symmetrical in having both kinds of topics phrased separately from the main clause (Kula & Bickmore 2015). The question is whether this translates into identical behaviour of the two topic types at the intonational level. Examples of preverbal clausal and non-clausal topics are given in (13a) and (13b) below with their respective pitch tracks in figures 7 and 8. If fronted topics pattern with initial subjects, which are considered to be topics, then as with subjects (figures 1-2) we expect fronted topics to have a boundary L%. This is the case for clausal topics but not for single constituent fronted object topics but there is possible good motivation for the difference in intonational structure, which we discuss presently.

- (13) a. àti Chisààngà á-álíí-sáám-bílíl-á, nà-àlíí-páp-á
 COMP Chisanga 3SGSM-P3-learn-FV 1SGSM-P3-surprise-FV
 ‘That Chisanga went to learn/study surprised me’
- b. kàpùtùlà, bá-léé-bíl-à lèèlò
 1a.trousers 2SM-PROG-sew-FV today
 ‘Shorts, they will sew today’

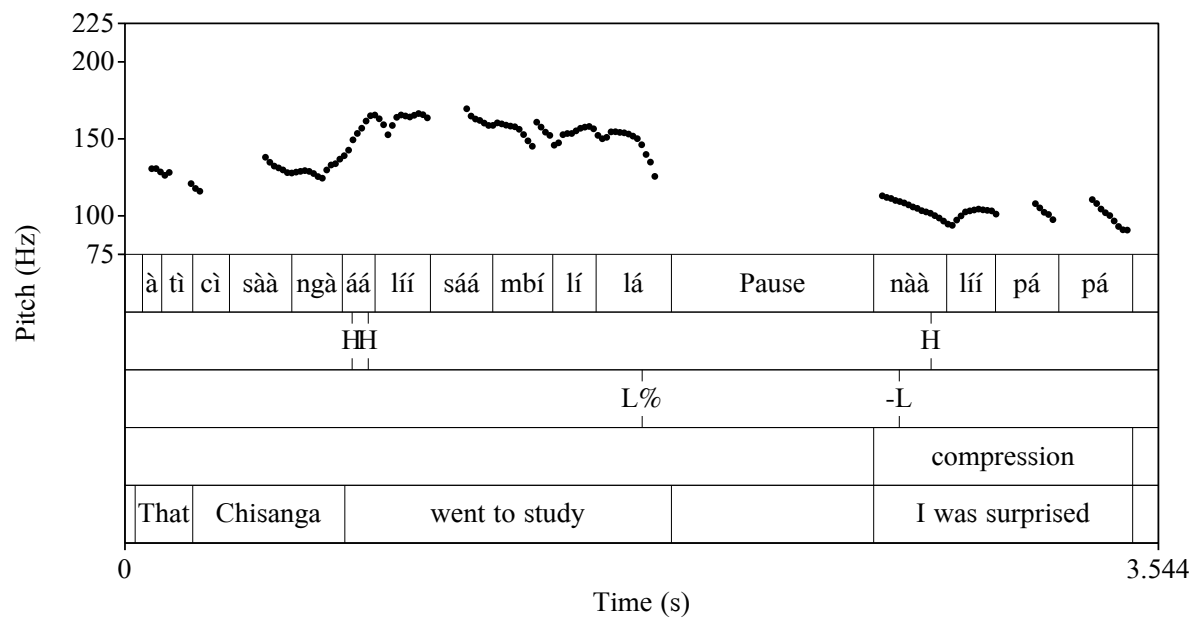


Figure 7. Fronted clausal topic marked with a boundary L% (13a)

The fronted clausal topic in figure 7 shows a boundary L% on the final syllable followed by a pause with the following main clause showing PRC with no pitch reset after the pause. The fronted clausal topic thus patterns with the subject in figures 1-2, but differs in terms of PRC of the following main clause.

A fronted non-clausal object, on the other hand, shows a continuation boundary H%, see figure 8. In this case, as with the H% we saw at the end of a relative clause in figure 4, the continuation boundary H% is superimposed onto the low tone of the final syllable of the fronted object. An optional pause follows the fronted object but notice that in this case there is no PRC of the following clause and there is pitch reset. One possible explanation for the different marking of clausal vs. non-clausal fronted object topics could be the need to more clearly disambiguate the non-clausal object topic from a subject so as to signal the following non-agreeing verb.¹³ Interestingly, a fronted headless relative clause shows a similar pattern as a fronted object, with a boundary H% marking its right edge. In this case, too, the main information is still to follow.

¹³ Perhaps the same could be said of a clausal topic but with a clausal topic it seems that the main information has already been given in contrast to the non-causal one where it is to follow. We leave the formalization of this idea to a future occasion.

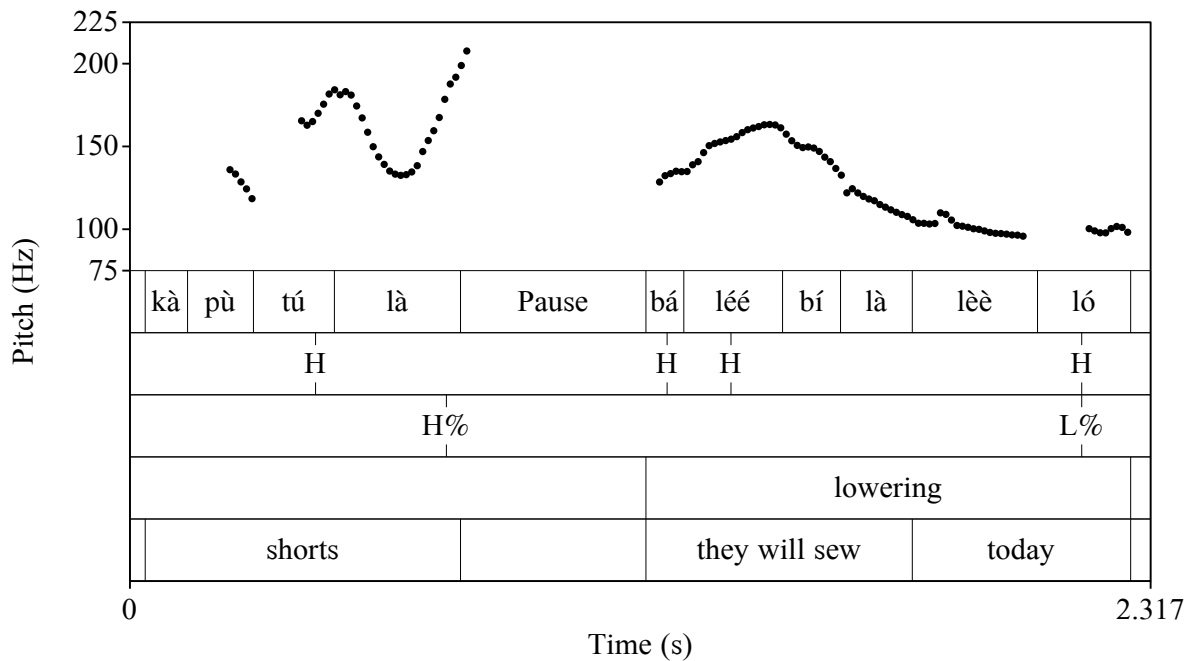


Figure 8. Fronted non-clausal object topic marked with a boundary H% (13b)

The final fronted constituents we look at are contrastive topics occurring as part of two contrastive clauses, as given in the examples in (14).¹⁴

- (14) a. *ínyáànyé náá-¹bá-shít-à kàlé, amátábá, bá-ká-shít-á máíló*
 10maize ANT-2SM-buy-FV already 6maize 2SM-FUT3-buy-FV tomorrow
 ‘Maize they have bought already, corn they will buy tomorrow’
- b. *kàpùtùlà bá-ká-bíl-á máíló, ìcísóté bá-ká-bíl-à pàcibélùshì*
 1a.trousers 2SM-FUT3-sew-FV tomorrow 7that 2SM-FUT3-FV saturday
 ‘Trousers, they will sew tomorrow, the hat, they will sew on Saturday’

The initial topic in the first clause shows *pitch register raising*, understood as the raising of the pitch contour in the f₀ space (Gussenhoven 2004: 76f.), affecting the whole topic, and which we attribute to the presence of a left edge -H. We will show in section 5 below that the domain of -L and -H is (almost always) an i-phrase, which the topic here is. The initial contrastive topic in figure 9 is followed by a right edge boundary L% and in this case followed by a downstepped High that affects the rest of the initial clause, showing declination into the pause.¹⁵ We see pitch reset after the pause. The second contrastive topic does not show pitch register raising as the first topic, but has a right edge L%. The final part of the second clause shows normal pitch lowering triggered by the right edge L%.

The first clause of figure 10 ends with a continuation H% in contrast to figure 9, making us speculate whether this may also have been the case in figure 9 with the effects of

¹⁴ (14a) is semantically odd as it contrasts the same object *maize*. Our choice of the synonymous words for *maize* is to ensure a higher number of sonorants for a better pitch track. The sentence is otherwise entirely grammatical.

¹⁵ Declination refers to the automatic gradual, phonetic lowering or tailing off effect of a series of tones towards the end of utterances or major phrases (see Connell 2001).

the expected boundary H% overridden in this case by the global !H affecting the entire following i-phrase.

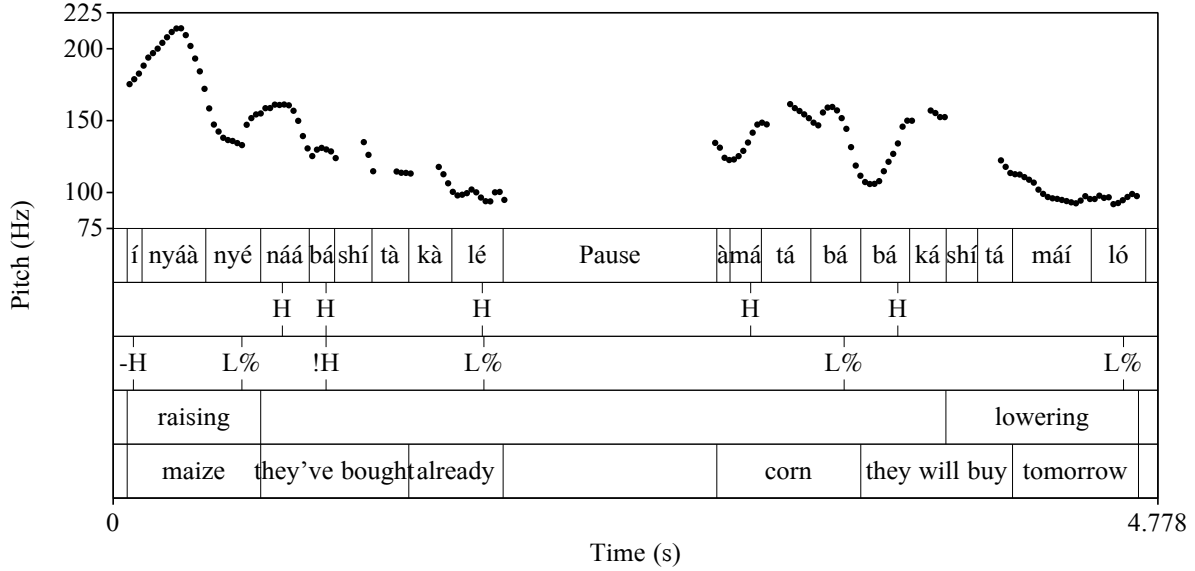


Figure 9. Contrastive topics: 1st topic (*inyanye*) with pitch raising followed by downstep and 2nd topic (*amataba*) without raising (14a)

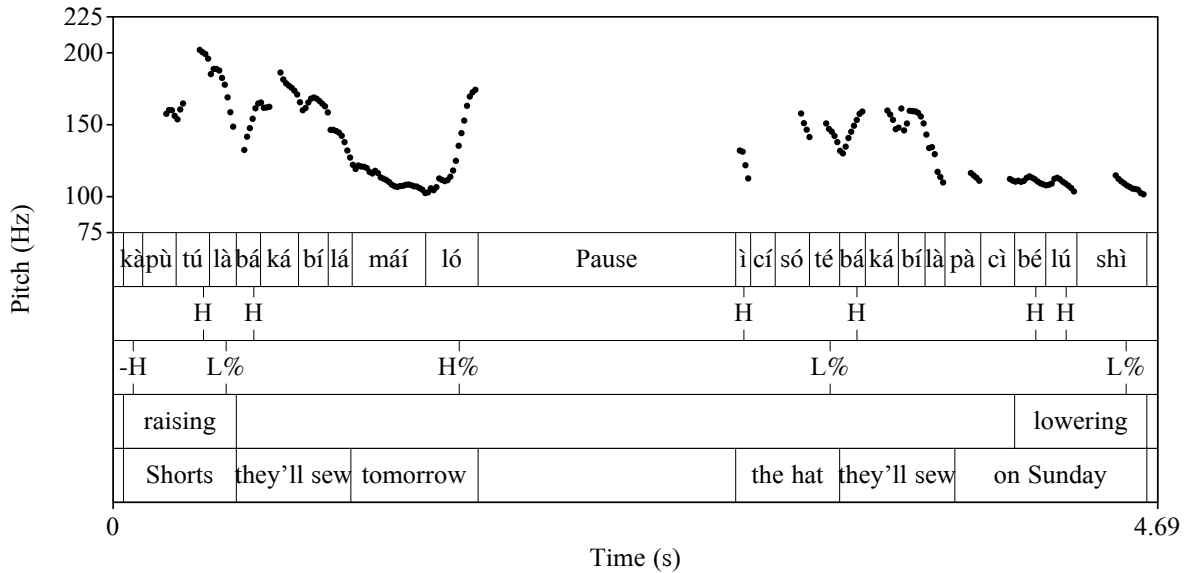


Figure 10. Contrastive topics: 1st topic (*kaputula*) with pitch raising and clause final H% (14b)

4. Questions

In this section, we investigate the two main question types; polar questions and constituent questions. We also look at multiple questions in double object constructions and evaluate any correlation between questions and focus. One of the most robust cross-linguistic characteristics associated with questions is raised intonation (see e.g. Bolinger 1978,

Cruttenden 1997, among others). This provides us with an initial testable hypothesis. We begin by first considering polar questions, which in Bemba can optionally occur with the question particle *bùshé*.

4.1. Polar questions

The seminal work of Rialland (2007, 2009) on yes-no questions in a large-scale study of African languages identifies what she terms a *lax* question prosody. Contrary to expectation, the lax question prosody is characterised by a falling pitch contour occurring in isolation or in combination with other phonetic characteristics. These characteristics may involve a sentence final low vowel, vowel lengthening and/or breathy voice utterance termination. Although the lax prosody has mainly been found in the Sudanic belt it is worth investigating whether any of its features occur in Bemba.¹⁶ We consider the examples in (15) that illustrate polar questions without (15a) and with (15b) the question particle. In both cases, as figures 11-12 show, we see pitch range expansion (PRE) involving increase in the f0 range of tone (indicated by -H on the left edge) throughout the clause. A final boundary L% occurs but in this case only targets the final syllable. Notice that both in figure 11 and 12, the subject boundary L% is produced at a higher pitch than seen earlier in declaratives. Furthermore, in figure 11 the downstep on both the verb and the final two syllables is suspended as a result of PRE. By comparison in Kano Hausa (Lindau 1986) and Dschang (Hyman 1985) we see suspension of declination rather than PRE in questions. In Dschang, in particular, there is then no downstep suspension in questions. In Yoruba, Connell & Ladd (1990) show that there is no consistent effect of pitch raising in questions. These languages show that PRE in questions must be treated as a language specific effect rather than a universal assumption.

As has been discussed, despite Bemba showing PRE in polar questions it nevertheless shows a final fall in pitch, contrary to cross-linguistic expectations, although this occurs fairly late in the utterance. Cahill (2012, 2014 and this volume) shows a more gradual fall in polar questions in Kɔnni (Gur) also providing evidence for a final falling pitch in polar questions. See also Kügler's description of Akan (this volume). The final fall in pitch in Bemba is not associated with low vowels, vowel lengthening, nor breathy voice utterance termination and therefore does not show the lax question prosody.

- (15) a. *bànáamááyó bá-ká-¹péél-à úmú¹káátè?*
 2woman 2SM-FUT3-give-FV 3bread
 'The women will give the bread?'
- b. *bùshé ábààná bá-ká-bíl-à kàpùtúlà?*
 Q 2child 2SM-FUT3-sew-FV 1a.shorts
 'Q the children will sew the shorts?'

In figure 12, with the question particle, we see similar PRE of the whole clause with a late final fall on the last syllable. The final word unfortunately has three voiceless stops disrupting the pitch track but PRE can still be discerned before the final fall.

¹⁶ A final falling contour can also be found in some Eastern European languages such as Hungarian, Greek, Serbo-Croatian and some varieties of Romanian, as surveyed by Grice et al. (2000). In these languages question intonation involves a low nuclear accent (L*) followed by a high phrase final accent (H-) and a low boundary tone (L%).

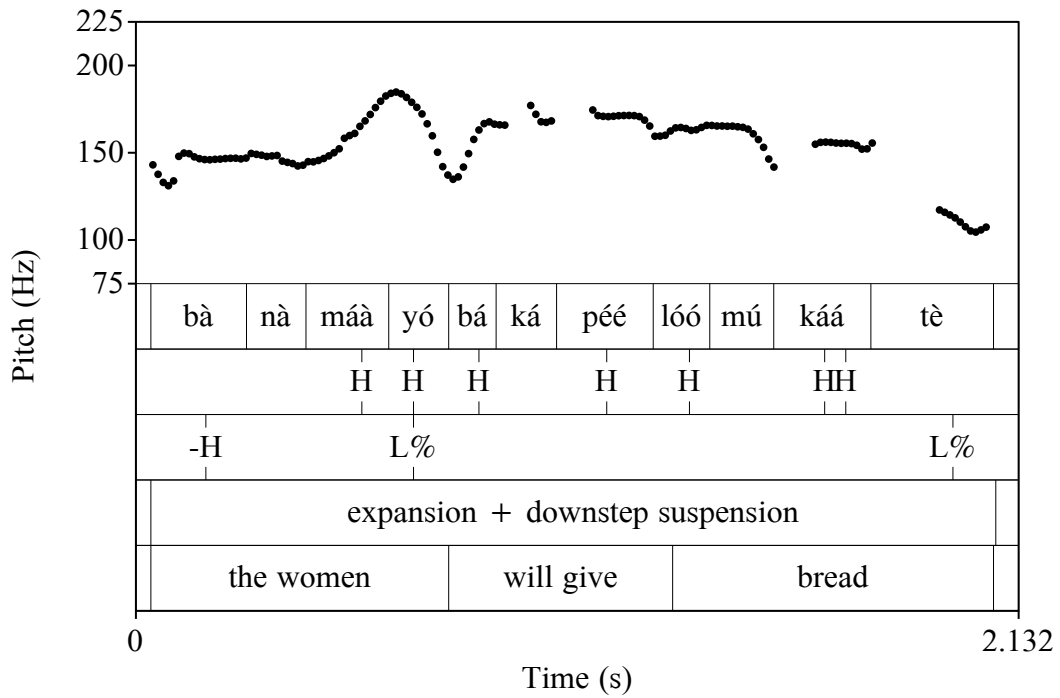


Figure 11. Pitch range expansion in polar question without *Q* particle with downstep suspension (15a)

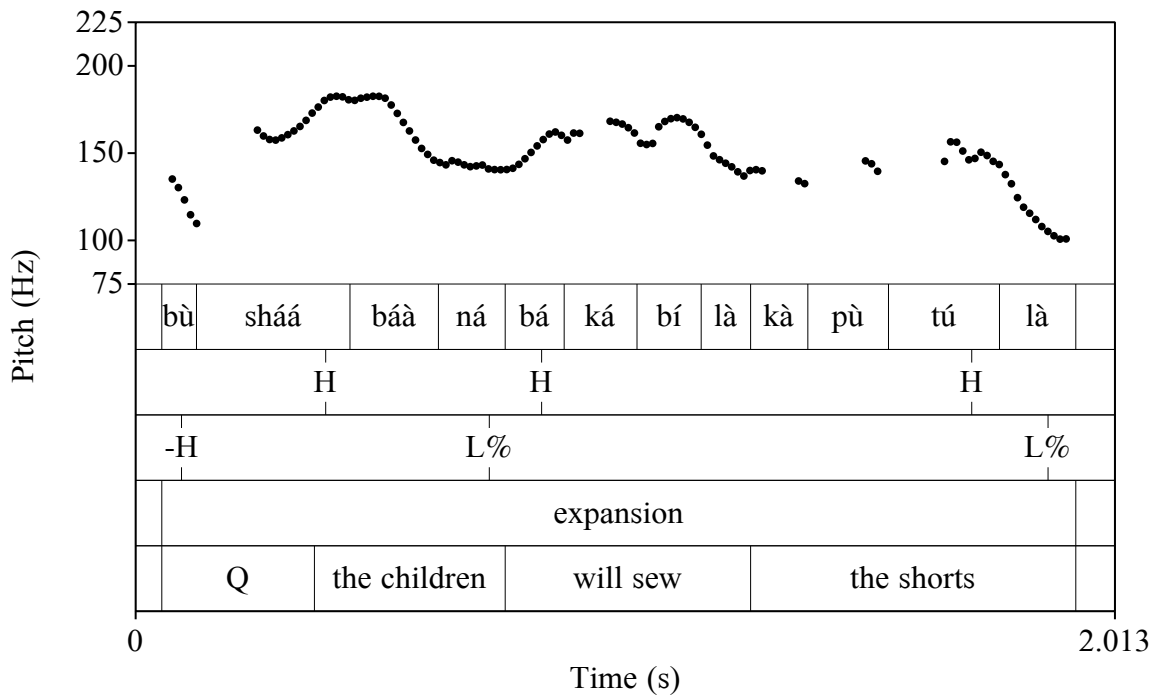


Figure 12. Pitch range expansion in polar question with *Q* particle (15b)

A comparison between a declarative and a polar question for the example in (15a) above shows the difference in pitch we argue indicates pitch range expansion in polar questions. Figure 13 shows the declarative and the polar question of (15a) recapped here as (16) superimposed on the polar question. The polar question shows sustained pitch range

expansion before final lowering, while the declarative shows two downsteps and declination before final lowering. This contrasts with the findings of Lindau (1986) on questions in Hausa, which show no pitch range expansion but only suspension of declination (referred to as ‘downward slope’ in Lindau’s work).

- (16) bànàmááyó bá-ká-peèl-à úmu¹kááte
 2woman 2SM-FUT3-give-FV 3bread
 ‘The women will give the bread?’

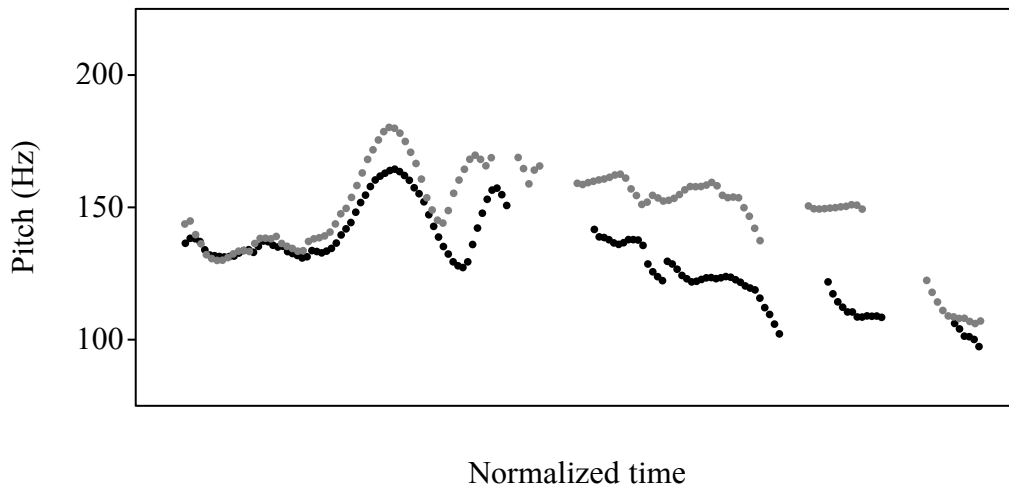


Figure 13. Pitch tracks of a declarative sentence (black) and the corresponding polar question (grey) (16)

As noted earlier downstep is suspended in the polar question where we see that the final fall comes very late in contrast to the declarative.

4.2. Constituent questions

For constituent questions in Bemba, objects are questioned in-situ, although clefts can also be used, and are identifiable through their relative clause morphology. Constituent questions can also optionally take the question particle *bùshé*, as in polar questions, showing that the particle is not a specific marker of polar questions. Like in a number of Bantu languages (see Sabel and Zeller 2006), subjects are never questioned in-situ in Bemba with clefts as the only available strategy. *Why* uses the same question word as *what*. However, *why* is used with applicatives and literally means ‘for what reason’. *Which* either uses the same word as *what* or another independent form. Both forms immediately follow the questioned argument in subject or object position. We will consider *what* and *who* in object questions in the following discussion, using the examples in (17). We consider only simple sentences excluding questions in embedded clauses but see Kandybowicz & Torrence (2015) for a study on the latter in Tano languages of Ghana.

- (17) a. bàkàfúndishá bá-ø-sáám**il**ish-à ínshì lèèlò
 2teacher 2SM-HAB.CJ-teach-fv what today
 ‘What does the teacher (usually) teach today?’
 b. abààná bá-!mwééné bààni kúsúkùlù
 2child 2SM-see.PRF who 1school
 ‘Who did the children see at the school?’

In figures 14-15 illustrating (17a-b) respectively, constituent questions, like polar questions, show pitch range expansion but the question word does not show specific significant pitch raising. When the question word occurs in clause-final position it is subject to final lowering. In contrast to polar questions, final lowering in constituent questions starts earlier: all syllables of the final word usually show lowering triggered by the final boundary L%. In figure 15 downstep applies contrary to expectation when there is pitch range expansion that affects all following constituents.

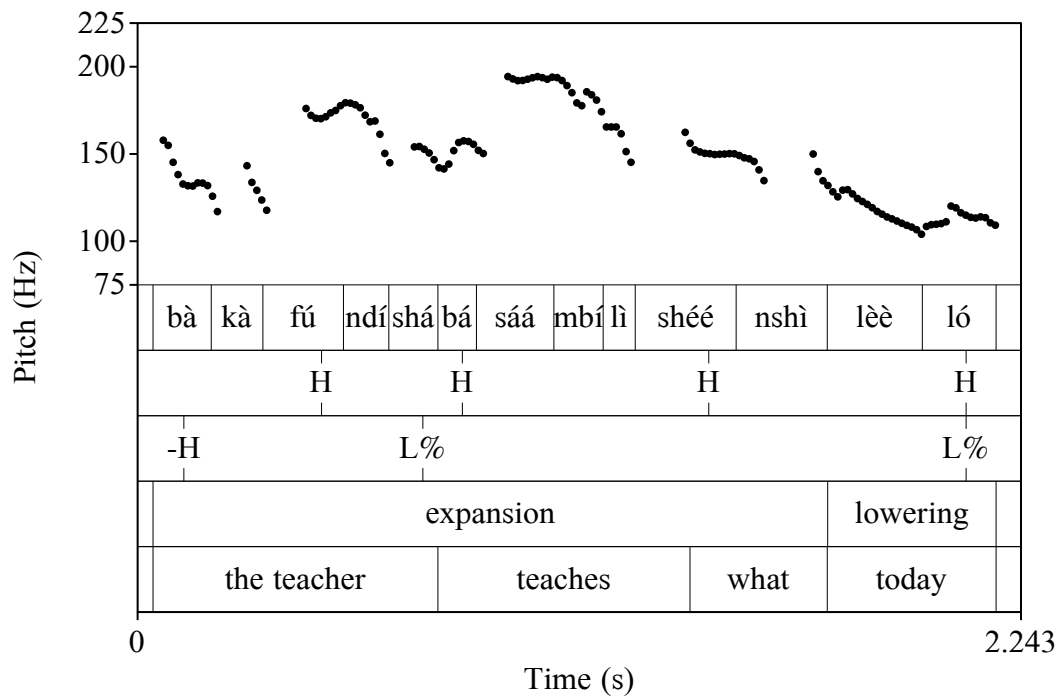


Figure 14. Pitch range expansion in constituent question with question word part of declination (17a)

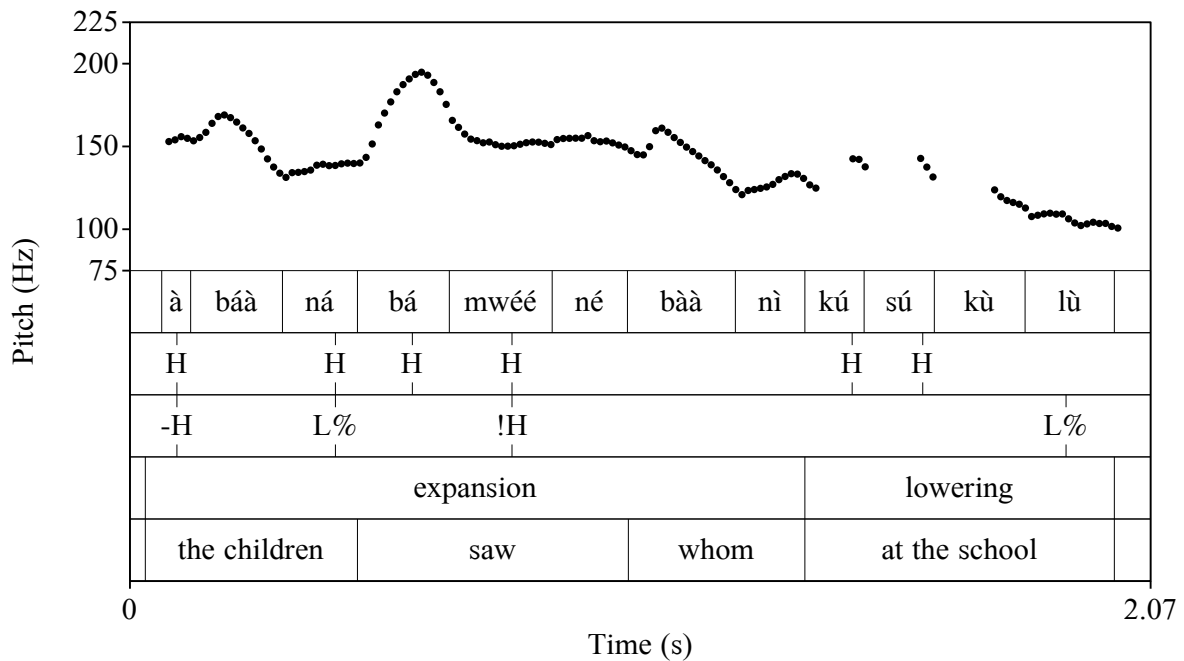


Figure 15. Pitch range expansion in constituent question with question word affected by downstep (17b)

The average pitch differences between declaratives, polar questions and constituent questions we find in the cases discussed mirrors the findings in Kula (2011). Table 1 below shows average f0 on a verb and following complement which we distinguished in order to assess whether question words showed pitch expansion. The same verb and complement were used for all scenarios with results averaged over three repetitions. As can be seen, the question word itself shows much less expansion than a complement in a polar question. There is some increase in pitch when the question word is non-final, but notice that this is still lower than a final polar question complement relative to the preceding verb.

QUESTION TYPE	VERB	COMPLEMENT/ Q WORD
Declarative	149.5 Hz	116 Hz
Polar question	182.5 Hz	150 Hz
Constituent question (QnW final)	181.2 Hz	132 Hz
Constituent question (QnW non-final)	189 Hz	146 Hz
Constituent question (combined)	183 Hz	136 Hz

Table 1: Average f0 values on the verb and complement/question word in declaratives vs. questions

Thus in both polar and constituent questions we see an effect of a left edge -H resulting in pitch range expansion. PRE is, however, seen to undergo declination in constituent questions so that they show more drop in pitch towards the final L% than polar questions. Functionally, this difference in phonetic implementation can be regarded as resulting from the functional load of the question word. This fosters the correct interpretation of the utterance as a question in contrast to polar questions where there is more reliance on pragmatic inference carried by pitch expansion. This supports a longer sustained pitch range expansion in polar question contexts. We leave more detailed exploration of the possible interaction between pragmatic inference and phonetic implementation to future research.

4.3. Multiple questions in double object constructions

Bemba is an asymmetric double object language with the requirement that the benefactive object precedes the theme object (Marten et al. 2007). Double objects generally retain their in-situ order when they are questioned although there is some unexpected flexibility in this, perhaps related to focus as discussed below. Riedel & Patin (2011) also show that in some dialects of Fipa (Milanzi and Kwa) a direct object may precede an indirect object in questions in contrast to a non-questioned direct object. It is also possible to have multiple questions in Bemba although these occur infrequently in natural speech. We will consider these using the examples in (18) below where (18a) is an example of a double object construction, (18b) shows a questioned benefactive object, (18c-d) show both objects questioned in alternating order.¹⁷

- (18) a. abààná bá-péélé bà-kàfúndishà ìfítábó
 2child 2SM-give.P4 2teacher 8book
 ‘The children gave the teacher the book’
- b. bàkàfúndishà bá-áci-péél-à bààni ìcítábó
 2teacher 2SM-P2-give-FV 2who 7book
 ‘The teacher gave who the book?’
- c. abààná bá-péélé bààni ínshì pàlicísàànó
 2child 2SM-give.P4 2who 9what 16.fiday
 ‘Who did the children give what on Friday?’
- d. abààná bá-péélé ínshì bààni pàlicísàànó
 2child 2SM-give.P4 what 2who 16.fiday
 ‘What did the children give whom on Friday?’

The expectation is that a single questioned object in a double object construction as well as multiple questions will show pitch range expansion as already seen in the questions discussed above. This, however, does not seem to be the case. Instead, pitch raising of only the verb occurs. This can be seen in figures 16-18 illustrating (18b-c), respectively. In figure 16, for example, there is no pitch difference between the question word and the following non-questioned object with both being fairly low in contrast to the preceding verb. Given the observed pitch raising on the verb, which in figures 17 and 18 can be seen to be higher than the initial otherwise H toned subject, we are committed to assuming a -H on the left edge of the verb which only targets the verb. In terms of phonological phrasing (Kula & Bickmore 2015) the first object in double object constructions phrases with the verb, while the second object phrases separately. We will discuss the implications of this left edge -H for the prosodic domains in section 5.

There are three alternative analyses of these data, which we consider briefly. One would be to assume that the -H is present on the left edge of the verb and has the same pitch range expansion effects as seen in the other questions already discussed. But in this case declination and eventual final lowering, triggered by the final L%, sets in much earlier, as early as the first verbal complement. This then instantiates a different phonetic implementation of the final L%. We find this explanation highly improbable as we would expect to see this in at least some declaratives, but we do not.¹⁸ The second possibility would

¹⁷ The verb stem *-péélé* in (18a, c-d) contains a V2-FV MH. It seems that this MH is applied to the second mora of the verb stem as we see no downstep within this form. The underlying lexical Hs are fused on the surface.

¹⁸ Needless to say we will have to explore structures with multiple complements to see if final lowering begins much earlier in those cases to rule out the possibility that the final L% is the trigger of the effect.

be to have no -H and simply argue that there is no special phrase accent associated to questions in double object constructions. We also do not favour this characterisation because it implies that questions in double object constructions should look like declaratives but they do not, precisely because of the raised pitch on the verb in the question. In addition, this second analysis would fail to capture any similarity with constituent questions with one object which are treated as involving pitch expansion. The third option would be to have a -L on the left edge of the two objects marking pitch range compression/deaccenting which then has the effect of making the verb appear to be raised in pitch. Although the figures in 16-17 show less consistent PRC than we have seen in right dislocations, there may be some mileage in this argument if we compare this to Turkish (Ipek 2011) which shows post-focus compression. We momentarily treat the restricted expansion as pitch raising on the verb. This leaves us with the question of what prosodic domain is the target of the postulated left edge -H. We offer a possible solution in section 5.

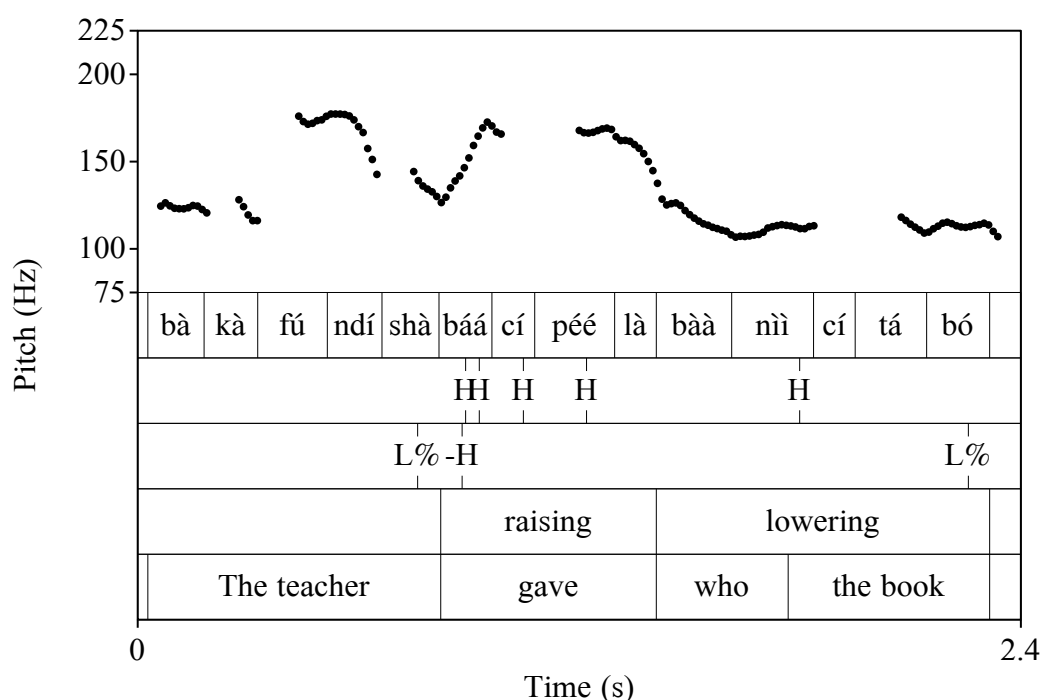


Figure 16. No raising on question word with following complement (theme object) (18b)

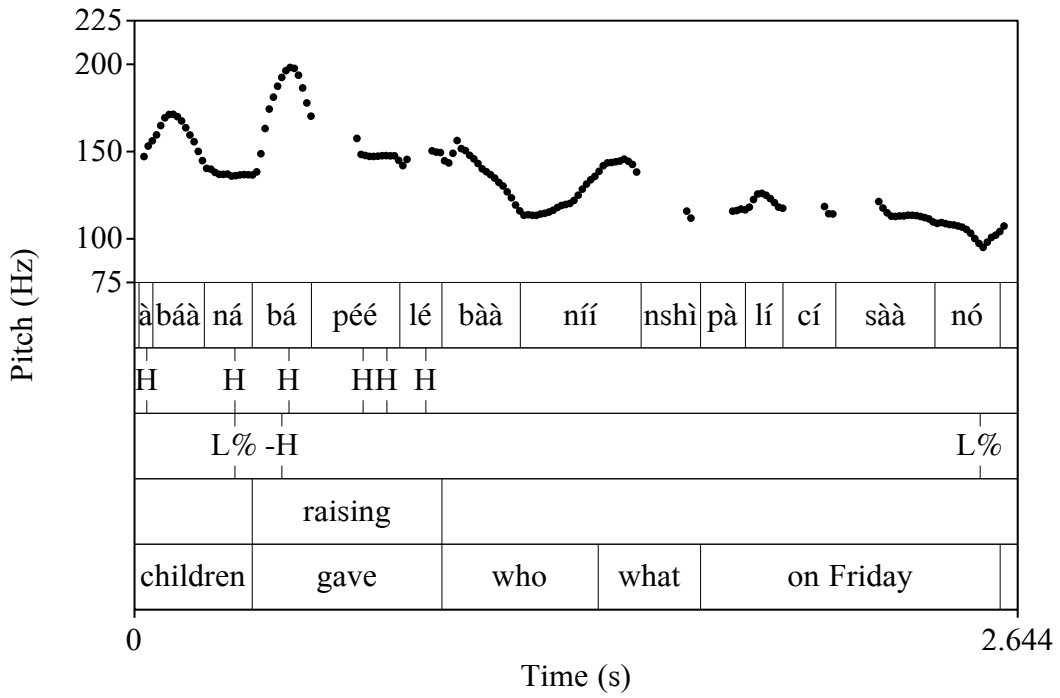


Figure 17. Pitch raising on the verb in a multiple question (18c)

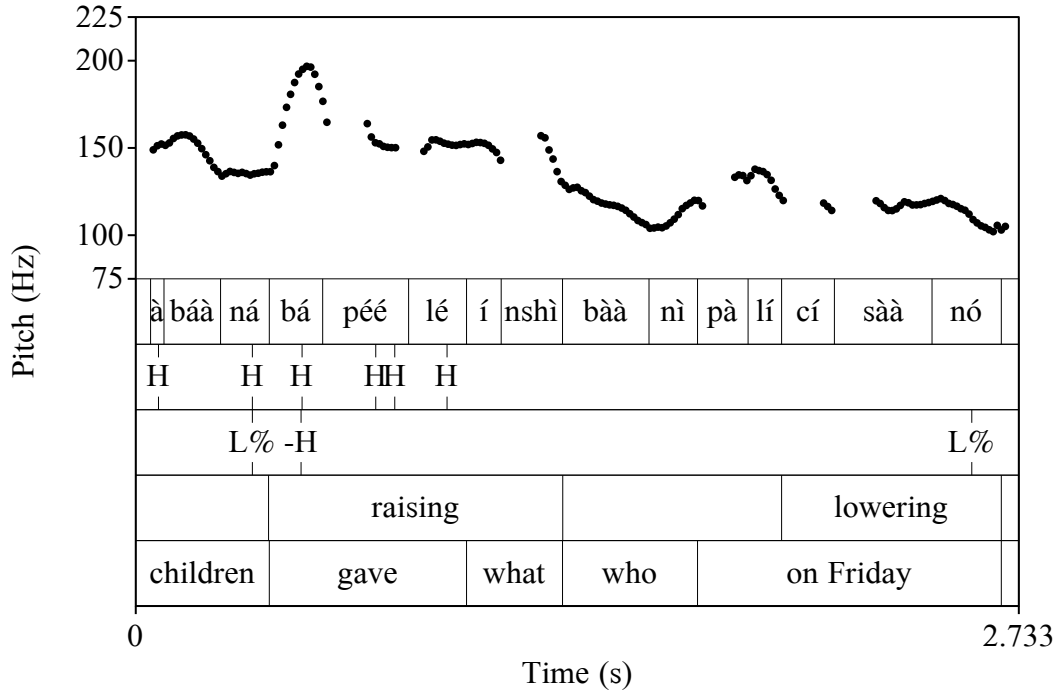


Figure 18. Pitch raising on the verb in a multiple question (18d)

The final issue related to questions that we consider is focus constituents that occur in similar contexts as question words. Since question words have shown no specific prominence we evaluate whether this also holds for other focus bearing constituents.

4.4. Focus and questions

Since question words are considered to be inherently focused, there is an established correlation between focus and questions. A number of languages show identical prosody for focused constituents and question words (see, for example, [Deguchi and Kitagawa, 2002](#), for Japanese). There are different kinds of focus that can be considered (see [van der Wal 2009](#) for some discussion) but for simplicity we will only consider new information focus. Like the restriction we saw in questions, subjects cannot be focused in subject position in Bemba and must obligatorily involve a cleft. [Costa & Kula \(2008\)](#) show that focused constituents occur in post-verbal position in Bemba, in the so-called *Immediate After Verb* (IAV) position (see [Buell 2009](#), [van der Wal 2006](#), among others, on IAV in Bantu). The examples in (19b-c) below illustrate this for locative and adverbial focus from the base sentence (19a).

- (19) a. *tù-kà-byáál-à ínjànjé mwííbala màìlò* (broad focus)
 1PLSM-FUT3-plant-FV 9maize 16garden tomorrow
 ‘We will plant maize in the garden tomorrow’
- b. *tùkàbyáálà mwííbàlà ínjànjé màìlò* (locative focus)
 ‘We will plant maize *in the garden* tomorrow’
- c. *tùkàbyáálà màìlò ínjànjé mwííbàlà* (adverbial focus)
 ‘We will plant maize in the garden *tomorrow*’

If IAV is the canonical position for focused constituents in Bemba then we expect questions to occur in this position and this is the case in the constituent questions discussed in section 4.2. The question for double object constructions is whether the requirement for IAV focus will force a violation of the requirement of asymmetric double object structures. The variation seen in the possible positions of question words in double object constructions suggest this might be the case in some instances although it is not categorical. We leave the exploration of this issue to future research and here focus on the intonational structure of focus in relation to questions. Previous work ([Costa & Kula 2008](#), [Kula & Bickmore 2015](#), [Kula to appear](#)) argues that focused constituents occur at the right edge of a p-phrase determined by either unbounded H spreading (verb focus) or bounded H spreading (IAV focus). The question is whether these boundaries are signaled in intonation and whether both focused constituents and questions get the same marking. Let us consider this using the question-answer pairs in (20) whose answers we can then compare in terms of intonational structure to that of questions already discussed above. In both answers in (20a-b) the IAV constituent is focused. The answer in (20b) uses a conjoint verb form further confirming the focused status of the complement. Figures 19 and 20 respectively illustrate the answers of (20a-b).

- (20) a. *question-answer pair (i)*
- Q: *bàkáfúndíshà bá-léé-ípík-à ínshi lèèlò*
 2teacher 2SM-PROG-cook-FV what today
 ‘What is the teacher cooking today?’
- A: *bá-léé-ípikà ùbwáálí lèèlò*
 2SM-PROG-cook-FV 14ubwaali today
 ‘He is cooking *ubwaali* today.’

b. *question-answer pair (ii)*

Q: bùshé Chisààngà bá-mú-sáàm̀bilish-à bùshíkù nshì?
 Q Chisanga 2SM-1OM-teach-FV day what
 ‘What day is Chisanga instructed?’

A: bá-ø-mú-sáàm̀bilish-à pàcibélúshì (Chisanga)
 2SM-CJ-1OM-teach.CAUS-FV 16saturday Chisanga
 ‘They teach him *on Saturday*.’

There is no intonational prominence of the focused constituent in both figures 19 and 20 despite the lexical high tones in these forms. In fact, the sentences here only differ from declaratives (figures 1 and 2) in having a verb with raised pitch. We thus see a complementarity in the intonational structures of focused constituents, whether they are question words or not, particularly when these figures are compared to those of multiple questions (figures 16-18).¹⁹

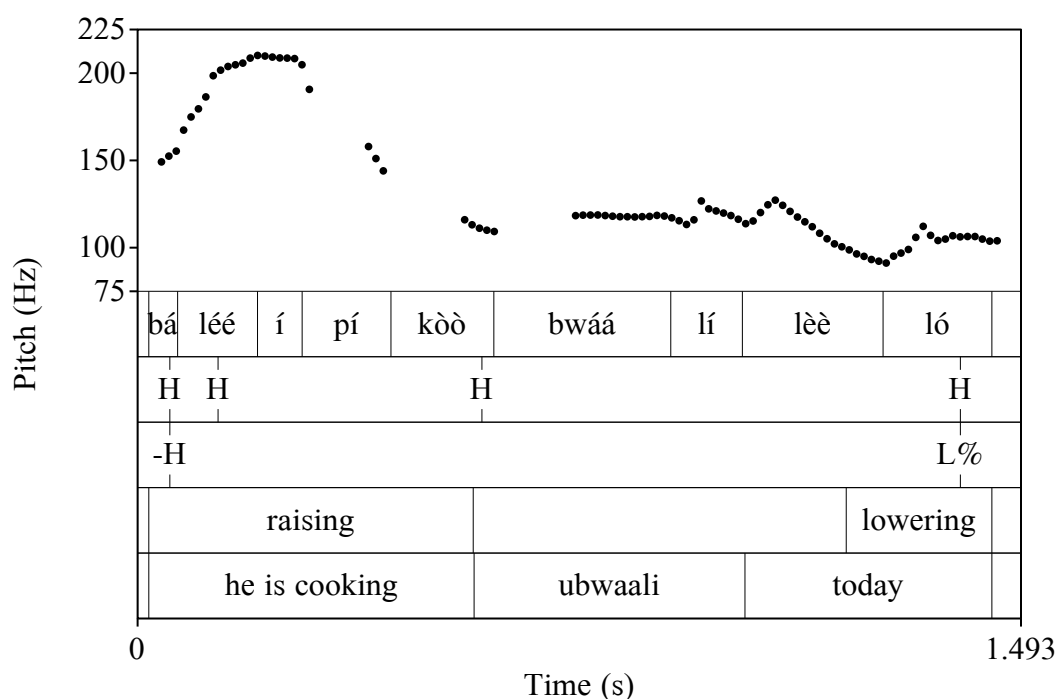


Figure 19. *Pre-focus raising in new information focus after the verb (20a answer)*

¹⁹ We leave to future investigation the idea mooted in Kula (2011) that this intonational structure as well as the one in questions, which both show significant pitch expansion on the verb (in comparison to declaratives), may indicate an intended intonational structure signaling focus anticipation, comparable to focus delay as discussed for Nagoya Japanese in Tanaka (2010). This contrasts with Turkish, where Ipek (2011) shows that – like in Bemba – focused words show no pitch range expansion but are followed by PRC in the post-focus domain.

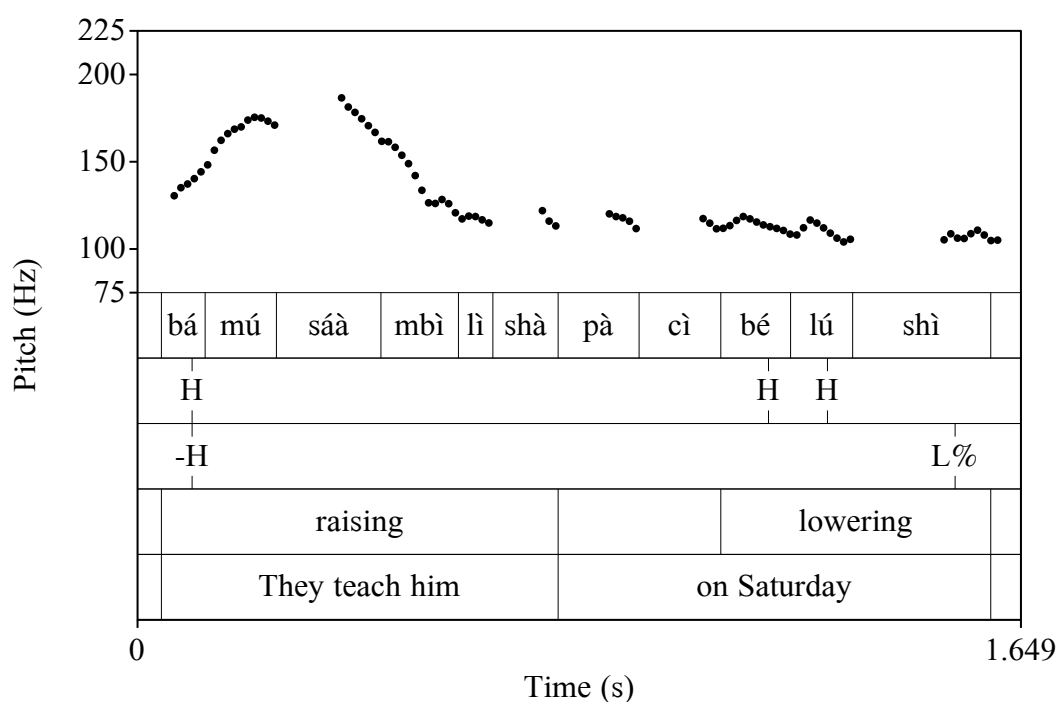


Figure 20. *Pre-focus raising with a conjoint verb form (20b answer)*

In summary we can identify the presence of a left edge -H in questions (polar or constituent) that has the effect of pitch raising. Such pitch raising is manifested as pitch range expansion which is sustained throughout a polar question but is more restricted in constituent questions, particularly in double object constructions. The latter effect implies that despite the focus status of question words they show no intonational prominence. The same is seen in focus structures, which after the verb, differ only minimally from declaratives.

We briefly discuss in the following section how the preceding intonational structures in both declaratives and questions correspond to prosodic phrasing.

5. Prosodic phrasing and Intonation

We follow standard assumptions in syntax-phonology mapping as in Nespor & Vogel 1986, Selkirk 1986, Truckenbrodt (1999, 2005), which assume prosodic constituents as the domain of interface relations between phonology and syntax. In Align XP-theory, for example, XPs map to p-phrases and CPs to i-phrases. Our approach is to elaborate on what prosodic cues reference which prosodic constituents and then correlate these prosodic constituents to syntactic edges. The assumed syntactic edges are given in table 2. Table 2 provides a summary of the attested boundary/intonational marking and the contexts in which they occur. The motivation for the assumed target prosodic domains is provided in the following discussion.

STRUCTURES	INTONATIONAL EFFECTS	SYNTACTIC EDGE	PROSODIC DOMAIN	EXAMPLES
DECLARATIVES	L% after subject (optional pause)	RIGHT XP	minimal i-phrase	Figs. 1, 2
	L% (final lowering)	RIGHT CP	maximal i-phrase	Figs. 1, 2
SUBORDINATES				
a) that-clause (complementizer)	L%	RIGHT CP	maximal i-phrase	Fig. 3
b) Relative Clause	H% (continuation) pause	RIGHT CP	minimal i-phrase	Fig. 4
c) Dislocations				
- RD subject	-L (pitch range compression)	LEFT XP	maximal i-phrase	Fig. 5
- RD object	-L (pitch range compression)	LEFT XP	maximal i-phrase	Fig. 6
d) Preverbal topics				
- clausal topic	L%	RIGHT CP	maximal i-phrase	Fig. 7
- non-clausal topic	H% (continuation)	RIGHT XP	minimal i-phrase	Fig. 8
- contrastive topics	1 st topic -H ; L%	LEFT XP ; RIGHT XP	minimal i-phrase	Figs. 9, 10
	2 nd topic L%	RIGHT XP	minimal i-phrase	Figs. 9, 10
QUESTIONS				
a) polar questions	-H ; L% (pitch range expansion)	LEFT CP ; RIGHT CP	maximal i-phrase	Figs. 11, 12, 13
b) constituent questions	-H ; L% (<i>partial</i> pitch expansion)	LEFT CP ; RIGHT CP	maximal i-phrase	Figs. 14, 15
c) multiple questions	-H ; L% (pitch raising)	LEFT XP ; RIGHT CP	minimal i-phrase?; maximal i-phrase	Figs. 16, 17, 18
d) focus	-H ; L% (pitch raising)	LEFT XP ; RIGHT CP	minimal i-phrase?; maximal i-phrase	Figs. 19, 20

Table 2: Summary of intonation marking in Bemba

The most significant marker of the right edge of an intonational phrase is the boundary tone L%. In all cases where L% appears, an i-phrase is signaled. Recall, however, that in most utterances we had more than one L%, e.g. in declaratives, where the subject is followed by L% and the end of the utterance is also followed by L%. The question is whether this implies nested/recursive structures and whether the two i-phrases are of the same status and same level. Recursive intonational phrases, as well as phonological phrases, have already been established in the literature (see e.g. Ladd 1986, Gussenhoven 2005, Itô & Mester 2012). We therefore assume recursive i-phrases in Bemba but distinguish minimal and maximal i-phrases where at least three different relations are assumed. (i) Minimal i-phrases can occur recursively to project a maximal i-phrase. (ii) Minimal i-phrases may adjoin to maximal i-phrases to project a maximal i-phrase. (iii) Maximal i-phrases may occur recursively to

project an utterance.²⁰ As can be seen from table 2, minimal i-phrases generally coincide with XPs while maximal i-phrases coincide with CPs. The assumed structures are given in (21) for illustration.

(21) Recursive i-phrases

- a. ((min i-phrase) (min i-phrase))_{Max i-phrase}
- b. ((min i-phrase) (max i-phrase))_{Max i-phrase}
- c. ((max i-phrase) (max i-phrase))_{Utterance}

The crucial indicator of a following minimal i-phrase after a boundary L% is pitch reset. In fact this also extends to a boundary H% so that all boundary tones followed by pitch reset indicate nested structure involving a following minimal i-phrase. This holds for declaratives, complementizer clauses, relative clauses and some topics. Complementizer clauses which are themselves CPs are minimal i-phrases marked by L% and followed by pitch reset of the following minimal i-phrase. Complementizer clauses therefore have the structure in (21a). Relative clauses are the same but end with a H% that is followed by pitch reset into the following minimal i-phrase. Restrictive relatives where the head noun phrases with the relative clause would then have two recursive minimal i-phrases, while non-restrictives, where the head noun phrases separately from the relative, would have three recursive minimal i-phrases. Preverbal topics (in particular objects) and contrastive topics all show a following boundary tone (L% or H%) followed by pitch reset and are thus treated as minimal i-phrases. Downing & Rialland (2015) also treat topics in Chichewa and Embosi as consisting of minimal i-phrases. In Bemba contrastive topics are in addition marked with pitch raising (-H), targeting the initial minimal i-phrase. If there is a following contrastive topic within the same utterance this does not receive pitch raising. Consider the illustration of this below using example (14a) illustrated in figure 9.

(22) Overt multiple contrastive topics

- ((ínyàányé)_{min-ip} (náá-¹bá-shít-à kale)_{min-ip})_{max-ip}
 -H L% + pitch reset ... L% + pause
- ((amátábá)_{min-ip} (bá-ká-shít-á mailo)_{min-ip})_{max-ip}
 pitch reset L% + pitch reset.... L%

10maize ANT-2SM-buy-FV already 6maize 2SM-FUT3-buy-FV tomorrow
 ‘Maize they have bought already, corn they will buy tomorrow’

In this case in (22) the pause is significant in indicating the right edge of a maximal i-phrase (in each case a CP) composed of multiple minimal i-phrases. We treat the different intonational marking of (different) topics as probably following from their different discourse status and syntactic positions, details of which in Bemba we leave to future work.²¹

²⁰ We leave open the possibility of structures like (max i-phrase (min i-phrase))_{Max i-phrase} and other such permutations but leave detailed discussion in a more fully developed analysis to future work perhaps via constraint interaction in Optimality Theory.

²¹ Frascarelli & Hinterhölzl (2007), for example, adopting a cartographic approach argue that different topic constituents are located in specific positions according to their discourse properties. They identify at least three different topics that are also associated with different intonation marking: Aboutness-Shift Topics, Contrastive Topics and Familiar Topics. Similarly, Cheng and Downing (2009) identify CP internal and external Topics.

Structures where a boundary L% does not show following pitch reset usually have a following left edge phrasal accent that indicates a following maximal i-phrase. Most significantly this is marked by -L after clausal topics and preceding right dislocation. The phonetic effect of a left edge -L is pitch range compression. These structures (figures 5, 6, 7) thus involve the nesting of maximal i-phrases as in (21c). Note that when -L is present on the left edge, and pitch range compression applies, there is no final L% or at best its effects are subsumed by the -L effect. Although it is generally assumed that languages activate a single prosodic edge, either Left or Right, we show that both edges may be referenced in different constructions. There is, however, a difference in effects at the two edges in that on the right edge phrase accents target boundaries (with variable phonetic implementation) while on the left edge phrase accents are global and target the whole following minimal or maximal i-phrase.

Questions and focus constructions are the other cases that involve left edge phrase accents (-H) with global effects in different domains. Polar questions have a -H on the left edge of a maximal i-phrase that results in pitch range expansion of the whole i-phrase terminating in abrupt L%. In constituent questions we see partial PRE targeting a minimal i-phrase and in this case, because expansion does not affect the whole maximal i-phrase, downstep is not suspended and can apply. Note also that final lowering affects a larger domain than just the final syllable in contrast to what is seen in polar questions.

The unexpected finding is the marking observed in multiple questions and in focus constructions where the verb is targeted for pitch raising. The problem as noted earlier is establishing what prosodic domain this coincides with or in what sense this may be deemed a minimal i-phrase as depicted in table 2. The most comparable case, where the right edge of a verb is prosodically referenced is the case of verb focus where a p-phrase boundary (indicated by unbounded H spreading) follows the verb. Such contexts coincide with disjoint forms in Bemba. However, as Givón (1975) and Kula (to appear) show, disjoint forms can also occur with a following complement that is part of the focus. This demonstrates that, rather than indicate that only the verb is in focus, disjoint forms instead show that the verb is always *part* of the focus. In such cases the verb shows unbounded H spreading and must be treated as signaling a following p-phrase boundary. In this case we have a mismatch between syntactic structure and prosodic phrasing as depicted in (23) drawn from Kula (to appear).

- (23) a. Disjoint pattern (i) (Verb focus, following constituent not part of focus)
- | | |
|--|---|
| [bá-ka-luk-il-a] _{VP} [Kabwe] _{ADJT} | Syntactic Structure |
| (bá-ka-luk-il-a) _φ (Kabwe) _φ | Prosodic Structure |
| (bá-ká-lúk-íl-á) _φ (Kabwe) _φ | Unbounded Spreading |
| (bá-ká-lúk-íl-á) _φ (Kábwé) _φ | Inter-word Doubling & Unbounded Spreading |
- ‘They will weave for Kabwe’
- b. Disjoint pattern (ii) (VP focus, following constituent part of focus)
- | | |
|--|---|
| [bá-ka-luk-il-a Kabwe] _{VP} | Syntactic Structure |
| (bá-ka-luk-il-a) _φ (Kabwe) _φ | Prosodic Structure |
| (bá-ká-lúk-íl-á) _φ (Kabwe) _φ | Unbounded Spreading |
| (bá-ká-lúk-íl-á) _φ (Kábwé) _φ | Inter-word Doubling & Unbounded Spreading |
- ‘They will weave for Kabwe’

We could thus argue that multiple questions and focus structures pattern with the distribution in (23b) and therefore that the prosodic domain marked by -H is a p-phrase. This, however, has the problem of being the only structure where a p-phrase would be targeted by a phrase accent. The alternative is to treat this p-phrase as coinciding with a minimal i-phrase. In

declaratives, the initial minimal i-phrase consisting of the subject also coincides with a p-phrase so this is already attested. Although we have not indicated this in the pitch tracks there may be evidence of a boundary L% after the verb in these instances which would support a minimal i-phrase analysis. This would support an analysis of the facts as involving pre-focus raising as was discussed earlier.²² Another possibility would be to have a -L after the verb to mark the focus as compressed. Intuitively, pre-focus raising resulting in a perception of the focus as compressed is more preferable. More arguments in favour of this analysis will have to be investigated.

We thus see robust prosodic cues in the form of boundary L% and H% followed by pitch reset as indicating the right edge of an i-phrase and a following one, respectively. Final lowering and a continuation H% are both seen to be local effects that can either be abrupt, affecting only one syllable, or wider and affecting the last few syllables. These intonational tones are contrasted with left edge phrase accents that mark i-phrases at different levels, minimal or maximal. Left edge phrase accents generally tend to be global in nature. Our analysis of the phrasal patterns has assumed nesting of i-phrases reflecting recursive structures.

6. Conclusion

This paper has provided an initial investigation of intonation in particular structures in Bemba. The data show final lowering in *all* sentence types, marked by a boundary L%. Thus, the rightmost CP edge, which coincides with the right edge of an i-phrase, is always marked by a L%. Subordinate clauses show a contrast between a fronted complementizer clause and a relative clause, which are respectively marked by L% and H% at the right edge of the i-phrase. Preverbal topics, including subjects, also show a following boundary tone whose phonetic implementation differs depending on the discourse function of the topic. Topics are treated as minimal i-phrases, which then form a maximal i-phrase with the following minimal i-phrase of the matrix clause. Right dislocations show pitch range compression marked by a left edge -L and form an independent maximal i-phrase. Questions and focus constructions show register raising marked by a left edge -H with pitch expansion affecting the whole maximal i-phrase in polar questions but affecting only a restricted domain (suggested to be a minimal i-phrase) in constituent questions and focus structures.

Future work will have to provide a formal analysis of these findings and in particular explore more complex structures and with more speakers in order to evaluate how robust the current findings are. The paper draws attention to a number of issues for future research. As in a number of languages the data impressionistically show lengthening of the final syllable that requires some systematic study. The discussion of topics and fronted constituents require a more fine-grained investigation of the left periphery to better understand possible different topics as well as contrastive focus in such positions. Related to this, multiple questions in double object constructions also reveal that multiple complement structures need to be further investigated as well as questions in embedded clauses. Finally, a fuller understanding of the constraints on downstep suspension and sentential downstep would also be beneficial. We take the findings in this work as well as the issues for further exploration as revealing the fertile ground that African languages more generally, and tone languages more specifically, provide for the study of intonation.

²² The structure involved in this case could be (min i-phrase (max i-phrase))_{Max i-phrase}. Another alternative is to not reassign the p-phrase if there is no consistent prosodic evidence and rather derive the phrasing through constraint interaction in Optimality Theory. In this case the structure would simply emerge as the most optimal in a system that otherwise aims to match i-phrases with CPs, for example.

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