

Polar Question Intonation in Five Ghanaian Languages

Michael Cahill

1. Introduction

Some languages use only a change in pitch to change a statement to a question. Many languages as diverse as French, Spanish, Italian (Chapaliez 1964), Huastec of Mexico (Larsen and Pike 1949), and Kunimaipa of Papua New Guinea (Pence 1964), have a pitch which rises utterance-finally to mark a polar question, illustrated also by the English example below, in which the statement's pitch lowers utterance-finally, but the corresponding question's pitch rises.

- (1) He's going to the park.
He's going to the park? ¹

Studies in tone languages are rarer, but exist. For example, Thai raises pitch for yes/no questions (Luksaneeyanawin 1998), as does Yoruba (Fajobi 2011). Chang (1958, quoted in Ladd 2008:159) describes Chengdu Chinese with the following changes to the final syllable of a sentence when it is changed to a question:

- | | |
|------------------------|-------------------------------|
| (2) Citation form | change when a yes/no question |
| I. high-rising | often ends higher than usual |
| II. low-falling | becomes low level |
| III. high-falling | becomes high level |
| IV. low-falling-rising | becomes low rising |

To sum up, polar questions in Chengdu Chinese have some variety of raising of pitch on the final syllable.

Because of data like all the above, Bolinger (1978:471) writes: "Terminals are almost universally low or falling for finality and assertion, and high or rising for the opposite, including yes-no questions..." Similarly, Ohala (1984:2) says of the cross-linguistically common high or rising pitch to indicate a polar question:

[This] pattern is too widespread to be explained by borrowing, descent from a common linguistic source, or chance. It follows that there is something common to all human speakers, at all stages in history, which creates this phenomenon.

However, languages do exist with final falling pitch to mark polar questions, e.g. Eastern European languages (e.g. Svetozarova 1998:268 for Russian), which Ladd notes sounds like a declarative sentence to many Western European language speakers. Hungarian also follows this pattern (Ladd 2008:82).

* Michael Cahill, SIL International (mike_cahill@sil.org). I am very grateful to speakers Eden Kosiaku (Safaliba), Ernest Nniakyire (Adele), Peter Wangara (Buli), Bernard Asewie (Chumburung), and Joshua Osei and Wilford Opoku (Deg), who shared a portion of their rich languages with me, and the audience at ACAL 44, for good questions and discussion. An earlier version of this paper was also presented at the 2013 LSA as a poster.

¹ English seems to be unusual in the world's languages in having two distinct methods for expressing a polar question. Besides the change in pitch in (1), the syntactic rearrangement "Is he going to the park?" is common.

1.1. “Lax question prosody”

In contrast to other languages of the world, Rialland (2007, 2009) (see also Clements & Rialland 2008) noted that African languages commonly have *falling* final pitch in polar questions: 36 out of 78 languages act this way in Rialland (2007), and 66 of 119 in Rialland (2009). Thus she proposed a “lax question prosody,” which includes not only pitch, but a cluster of other properties. Some “lax” African languages display all of these; others display a subset.

- (3) “Lax question prosody” characteristics (Rialland 2009)
- falling pitch, specifically a Low or L% (sometimes M)
 - final vowel lengthening (not phonetically “lax,” but perhaps an enhancement feature)
 - sentence-final low vowel (generally /a/)
 - breathy termination

This contrasts with languages which have what she terms “high prosody” characteristics:

- (4) This contrasts with “high prosody” characteristics (Rialland 2007)
- register expansion
 - raising of last H, cancelling of final lowering
 - final H tone or rising intonation (H%)
 - etc.

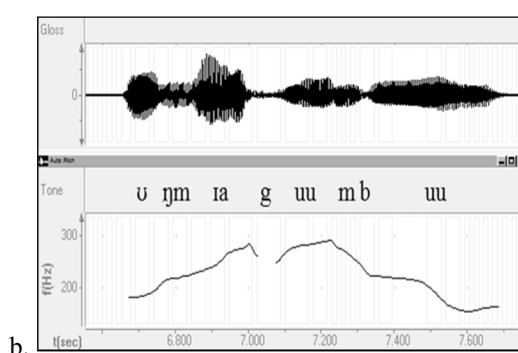
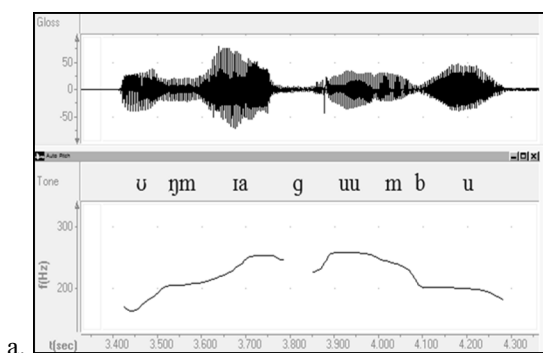
1.2. *Kɔnni* (Cahill 2012)

In *Kɔnni* [kma] of northern Ghana, polar questions lengthen the final vowel (or nasal), and have *some* variety of a falling final pitch. This can be transcribed with phonemic tones, as in the following, which adds a Low tone to the final lengthened vowel:

- (5) a. ù sié gilinsièlé ‘s/he is dancing the gilinsiele dance’
 b. ù sié gilinsièléé ‘is s/he dancing the gilinsiele dance?’

However, not all patterns are that simple, as seen in the data and corresponding pitch traces below, in which a downstepped High (with LH autosegments) is added to the statement to form a question.

- (6) a. ù ηmíá gúúm[!]bú ‘s/he is rolling rope’
 b. ù ηmíá gúúm[!]bú[!]ú ‘is s/he is rolling rope?’



- (7) a. L LH H LH
 | | | |
 ù ηmíá gúúm[!]bú
- b. L LH H L H LH
 | | | | /
 ù ηmíá gúúm[!]bú[!]ú

Also, in a sentence ending with L, the pitch is *raised* before falling (HLH autosegments added):

- (8) a. ò dàwá nígè 's/he has bought a cow'
 b. ò dàwá ní¹gè¹é 'has s/he bought a cow?'

The entire pitch in a polar question is also higher than the corresponding statement.

To sum up, both patterns above (and another not included here) have in common *some sort of* falling pitch in the final syllable, whether the original statement ends in H or L. There is some connection with Rialland's criteria, but not fully. The Kɔ̀nni pattern with a final H¹H is indeed falling pitch, but does not exactly match Rialland's falling pattern, since it does not end in Low tone. Kɔ̀nni also matches Rialland's final vowel lengthening criterion, but lacks the other criteria in her list.

2. Five more from Ghana

In this main section, I examine the Gur languages Buli, Deg, and Safaliba, and the Kwa languages Adele and Chumburung. Data were collected from various staff of the Ghana Institute of Linguistics, Literacy, and Bible Translation (GILLBT) in Accra and Tamale, Ghana, during April 2012. All speakers were bilingual in their mother tongue and English. Data was from one male speaker per language, except two speakers for Deg.

The goal was to elicit declarative sentences and their corresponding yes/no questions, with statements having varied tones on the noun which occurred sentence-finally. A first step was therefore to devise a list of nouns which had varied tones, since an expected locus of variation was the final word of the sentence, and the design was that this word should be an object. (All the languages in this study are SVO.) The carrier sentences for the noun X were most commonly "Did s/he see X? S/he saw X." For Deg, Chumburung, and Safaliba, 12 polar questions and their positive answers were recorded; for Adele, it was 16 and for Buli, it was 25. Each utterance was repeated three times. For Deg, both speakers repeated all utterances. Data was recorded at a sampling frequency of 41.1 KHz on a Zoom H2n digital recorder using its built-in microphone, and transferred to laptop for analysis. Transcription was aided by repeated listening and examination of pitch traces through SIL's Speech Analyzer program, from which all graphs in this paper are taken.²

As a preview of findings below, all five languages have some sort of falling pitch, as well as a long final vowel. This final vowel takes two forms: three of the five (Buli, Deg, Chumburung) add a sentence-final /-áà/, but Safaliba and Adele merely lengthen the final vowel or nasal. Chumburung usually has final [h] ("breathy termination") in polar questions, and Deg has it sporadically.

It is relevant to note that while polar questions have a pitch change, content questions in these languages do not change the tone of the sentence.

- (9) Adele: á¹níŋ wólè What is this?
 fó¹tú wólè This is a camera.

2.1. Falling pitch

Rialland notes the autosegments L or L% as the most common manifestation of lowered final pitch, but also the occasional Mid. In contrast, falling pitch in the five languages examined here is only *sometimes* created by a L. (Mid tone occurs only in Buli.) The analysis of the lowering is language-specific, and variability can occur even within a single language.

In the data below (representative of the larger set), the listed autosegments refer to the final tones of the nouns in a statement, e.g. H-L in (10a) refers to the High-Low tones in *fóù*.

Adele [ade] always lowers the final pitch, whatever the final underlying tone of the final noun in declarative sentence form. The extra-low in (10a) may or may not be analyzable in strict autosegmental notation.

² Available as free download at http://www.sil.org/resources/software_fonts/speech-analyzer.

- (10) Adele: final lowered pitch for polar questions.
- | | | |
|--------|----------------|-------------------------------|
| a. H-L | è dé fótù | S/he is holding camera/photo. |
| | è dé fótùù | Is s/he holding camera/photo? |
| b. L-H | èé kòrò èkpeé | S/he ate dog. |
| | èé kòrò èkpeèè | Did s/he eat dog? |

Safaliba [saf], like Kɔnni above, is quite variable in the specifics of how it manifests a polar question, but there is always a lowering of the final syllable (see also Schaefer 2009:93-94).

- (11) Safaliba
- | | | |
|--------|---|----------------------------------|
| a. H-L | ò bé ¹ dínórí | S/he is at (the) door. |
| | ò bé ¹ dínó ¹ ríí | Is s/he at (the) door? |
| b. H-H | ò wòrí ò bóríbó | S/he likes her/his planting. |
| | ò wòrí ò bóríbó ¹ ó | Does s/he like her/his planting? |
| c. L-H | ò wèrí ¹ náán zàká | S/he's going to house. |
| | ò wèrí ¹ náán ¹ zákáá | Is s/he going to house? |

Buli [bwu], like the next two languages, does not lengthen the original final vowel, but adds another morpheme /-áà/, which has falling tone over the last syllable. If the final noun ends with a vowel, as in (c), the original tone remains, but the noun stem's final vowel is deleted, with appropriate re-association of tones (e.g. the noun's Low floats, creating downstep).

- (12) Buli
- | | | |
|-------|--------------------------------|--------------------------|
| a. HH | wà nyáká ¹ táná | S/he saw stones. |
| | wà nyáká ¹ tánáà | Did s/he see stones? |
| b. LL | wà nyáká ñààrùŋ | S/he saw boat. |
| | wà nyáká ñààrùŋwáà | Did s/he see boat? |
| c. HL | wà nyáká kpíínà, | S/he saw guineafowl. |
| | wà nyáká kpíí ¹ nàà | Did s/he see guineafowl? |

Deg [mzw], like Buli, adds /-áà/ to the final noun, and any normal tone rules then apply. If the final noun ends in a vowel, a glide [y or w] is inserted, as in (13b).

- (13) Deg
- | | | |
|---------------------|--|---------------------|
| a. H ¹ H | ò ná ¹ nyú ¹ hól | S/he saw louse. |
| | ò ná ¹ nyú ¹ hóláà | Did s/he see louse? |
| b. LH | ò ná ¹ wíí | S/he saw sun. |
| | ò ná ¹ wííyáà | Did s/he see sun? |
| c. HL | ò ná kálàŋ | S/he saw mat. |
| | ò ná ká ¹ lájáà | Did s/he see mat? |

Chumburung [ncu] often has a slightly different suffix than Buli and Deg, adding the falling-toned /-áàh/ to form a polar question. The final aspiration is sometimes definite and clear and sometimes barely detectable. As with Buli, if the final noun ends with a vowel, that vowel is deleted and normal tonal processes come into play. There are other data for which a complete picture is as yet unavailable. There is no tonal difference between first and second person subject pronouns.

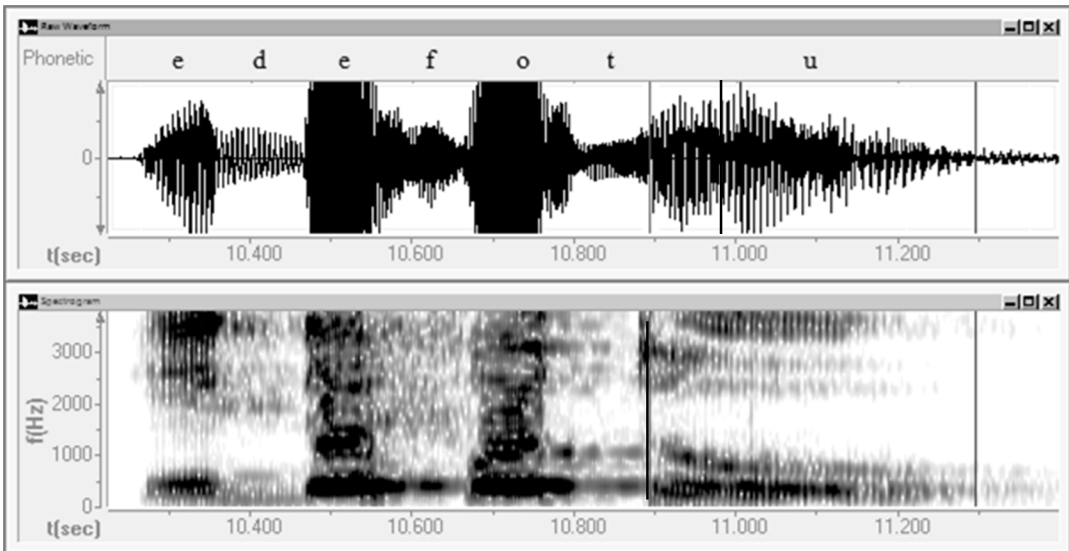
- (14) Chumburung
- | | | |
|-------|----------------------------|--------------------|
| a. HH | mǎŋú ¹ kípárí | I see pool. |
| | fǎŋú ¹ kípáráàh | Do you see pool? |
| b. LH | mǎŋú kòtí | I see monkey. |
| | fǎŋú kwàtáàh | Do you see monkey? |
| c. L | mǎŋú kèrì | I see lizard. |
| | fǎŋú ¹ kéraàh | Do you see lizard? |

Most of the languages in this paper appear to be analyzable with autosegments, as Konni was, with the possible exception of Adele.

2.2. Final vowel lengthening

The languages which add /-aa/ to make a polar question obviously end in a long vowel. Vowel duration of the others, Adele and Safaliba, can be measured (here using Speech Analyzer), placing the cursors at vowel boundaries, and reading the duration off the graph itself, as marked in (15).³

- (15) Adele *è dé fòtiùù* he is holding camera/photo?



To get a quantitative measure of how much a vowel lengthens in a polar question, the final vowel duration was measured for both the statement and the question, and divided to obtain the ratio of Question/Statement. A complicating factor is that both Adele and Safaliba have a contrast between underlying short and long vowels, e.g. see the Adele examples in (10). Consequently, there is a difference in the ratios of Question/Statement depending on a short vs. a long underlying vowel.

For Adele, an underlying short vowel becomes 2.6 times longer in a polar question. An underlying long vowel becomes only 1.6 times longer.

For Safaliba, an underlying short vowel becomes 2.1 times and an underlying long vowel becomes 1.4 times longer.

The question may arise whether these different ratios converge on a single target duration, that is, whether for Adele the 2.6x for short vowels and 1.6x for long vowels are approximately the same. The answer is no. For Safaliba nouns ending with /a/, the question duration averaged 265 msec, while for nouns ending with /aa/, the question duration averaged 420 msec. Vowel length contrast is preserved.

³ Speech Analyzer offers readings of duration between vertical cursors to the nearest 0.1 msec. The cursors on which the measurement is based are shown in (15), but the actual readings are on a different location in the program, not shown here.

The other three languages end with a long vowel (/aa/) but do not have vowel lengthening, since the underlying vowels remain the same.

2.3. Sentence-final low vowel

As noted, Buli, Chumburung, and Deg have a sentence-final /-aa/ added to make a polar question. Deg separates this out in the practical orthography, e.g. <O na bwe aa?> ‘does he see stone?’ (Patricia Herbert, pc).

Adele and Safaliba (like Kɔnni) can have a sentence-final *high* vowel, since they lengthen the original underlying vowel.

2.4. Breathy termination

Chumburung is the only language of the five that fairly consistently had a final [h] in polar questions (see (14)). It very sporadically occurred in the Deg data as well, but not frequently enough to note it as normative.

Rialland (2009) connects “breathy termination” to falling pitch, due to laryngeal relaxation occurring at the end of questions. She also describes it in a variety of ways:

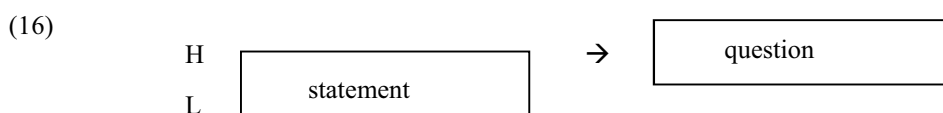
- Ncam - “gradual and extended decay of intensity ending in aspiration”
- Mooré – “long decrease in termination” (Rialland suspects the related Dagara has it also, but does not document it)
- Moba – “gradual intensity decrease” (contrasting with an abrupt decrease in a statement)

Of the languages in this study, Chumburung is the only one which has definite final breathiness as it is more commonly defined. With the variety of definitions above, it is possible that the breathiness criterion for “lax prosody” may be overgeneralized.

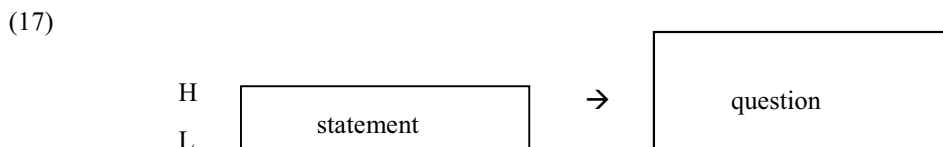
2.5. Raising of entire question register

The question to be addressed here goes beyond the previous “lax question prosody” criteria, and examines what happens to the overall pitch of a statement when it becomes a question. Of course, no change at all is a possibility, but others include the following, graphically represented.

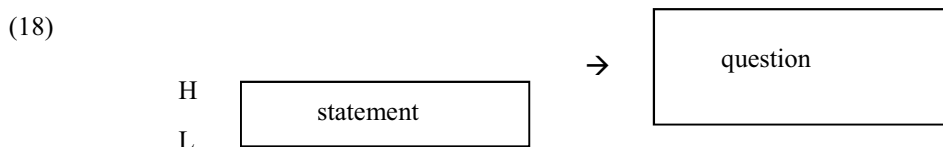
In Register Raising, the entire sentence pitch is raised:



In Register Expansion: the range of the register increases:



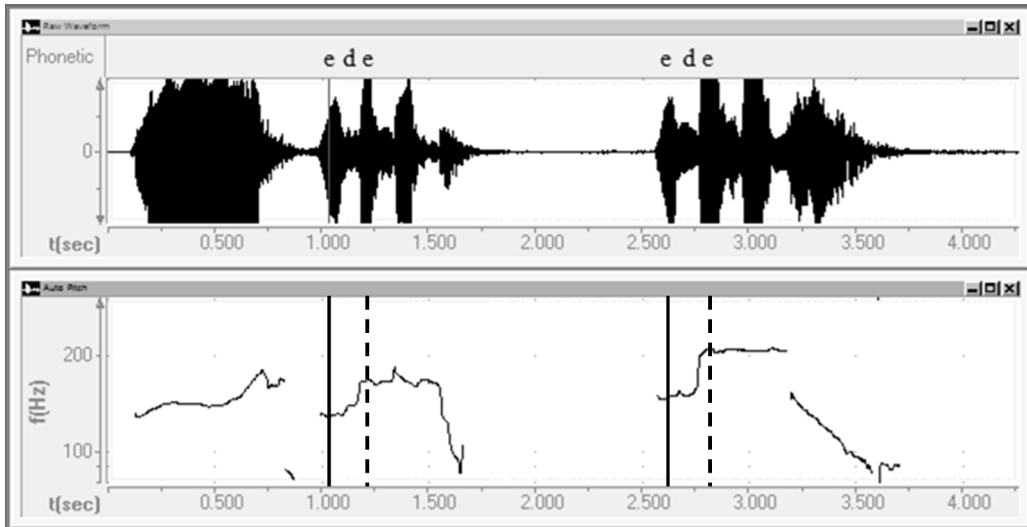
Both Register Raising and Register Expansion could happen:



These phenomena would be predicted to occur with high prosody languages, as Rialland (2007) writes, but not with lax prosody ones. However, both occur in all the five languages examined here.

To examine possible register raising and expansion, the frequency of the first L and the first H of the utterances were measured. A sample is given in (16), with the solid cursor line showing where the initial L was measured, and the dashed cursor line showing where the initial H was measured.

(19) Adele èèé, è dé fòtù ---- è dé fòtù 'yes, he is holding photo ---- is he holding photo?'



The L measure shows the starting setting of the register. The difference in initial L's between statement and question shows whether the range has shifted up. Comparing the difference L-H in the statement to the question reveals if the entire range of the register has expanded.

For the Adele utterances in the figure above, in the statement, L = 129 Hz, and H = 167 Hz, so there is a L-H difference of 38 Hz. In the question, L = 147 Hz and H = 211 Hz, so there is a L-H difference of 64 Hz. So for this Adele utterance, the register has *both* shifted up (Low changed from 129 to 147) and expanded (range changed from 38 to 64).

(20) Summary of results for all languages, in Hz:

	Register raises	σ for raising	Register expands	comments
Adele	20	6.6	25	vigorous raising and expansion
Buli	13	2.9	8	mostly raising, little expansion
Chumburung	21	7.2	2	definite raising, basically no expansion
Deg	6	9.7	18	wide variation, but raising and expansion
Safaliba	12	4.1	8	some raising and expansion

For all languages, the register is raised – a question is pronounced on a higher pitch than a statement. The register is significantly expanded for some languages, but not for all.

3. Discussion and conclusions

These results must be regarded as preliminary, but still are quite suggestive. The main limitation of this study, of course, is the number of speakers surveyed. The one speaker recorded in four of the languages may or may not be representative of the whole language. Part of this is the personality of the speaker. The Buli speaker, for example, has a calm personality, and thus it is not surprising that his register raising and expansion in (17) is not very large. There may well be other individual parameters

that can be isolated and tested as well. The number of data points per language could also be increased as well; for three of the five languages, only a dozen target nouns of various tones were recorded. Finally, as a referee noted, the length of sentence may well have an impact on register expansion, and this dimension should be explored.

In spite of these limitations, some clear patterns emerged, which I expect would likely be replicated in a more extensive study of these languages.

Of Rialland's four criteria for "lax question intonation," all showed up at least somewhat in this sample. However, the only criteria always present in all languages were falling intonation and long final vowels, and even these were not uniform:

- "Falling intonation" does not have to be a L or L% tone. It can be an added [!]H tone, or even HLH (Kɔnni). It is not always consistent within a single language.
- Long final vowels were sometimes lengthened root vowels, and were sometimes the added /-aa/ vowel.

"Breathy termination" is not consistently defined by Rialland, and it seems that any lengthened fading would qualify. It may be that the occurrence of this is overestimated. Still, a clear final [h] showed up in this data for Chumburung and occasionally in Deg, so it does occur in this data at times.

Rialland (2007) associated register expansion with the "high prosody" languages, and limited her examination of "raising" to High tones. However, measurements here have revealed that these are common in these five Ghanaian languages, which are indubitably otherwise "lax question intonation." Chung & Rose (2012) likewise noted register raising for the otherwise lax-question prosody Moro.

It is likely that there is not a clear and feature-exclusive demarcation between lax prosody and high prosody languages. Rialland herself noted the existence of "hybrid languages" that combine some characteristics of both high and lax prosody, such as Bambara and Izon.

A hypothesis worth investigating is whether register raising is universal, and not just characteristic of high prosody languages.⁴ It is possible that this simply has not been widely documented. We trust that future studies will illuminate this question.

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⁴ Rialland 1985 displays one disyllabic, H-toned Moba word which exhibits no register raising. It is not clear whether further data, e.g. with a HL or LH, also shows this pattern.

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