

# Intonation in tone languages

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# Roadmap

## Basic terminology

- Tone and tone languages
- Intonation – its features and function

## Interaction of tone and intonation

- Pragmatic functions
  - Information structure
  - Sentence mode

# Language types

60 – 70% of the world's languages are tonal (Yip 2002:1)

Areas with many tones:

- Africa
- East & South-East Asia
- The Americas

Areas with few or no tones:

- Europe
- Australia
- New Zealand

Languages are classified according to a number of prosodic features:

- Stress
- Tone
- Word and sentence level prosody



Definition of a tone language:

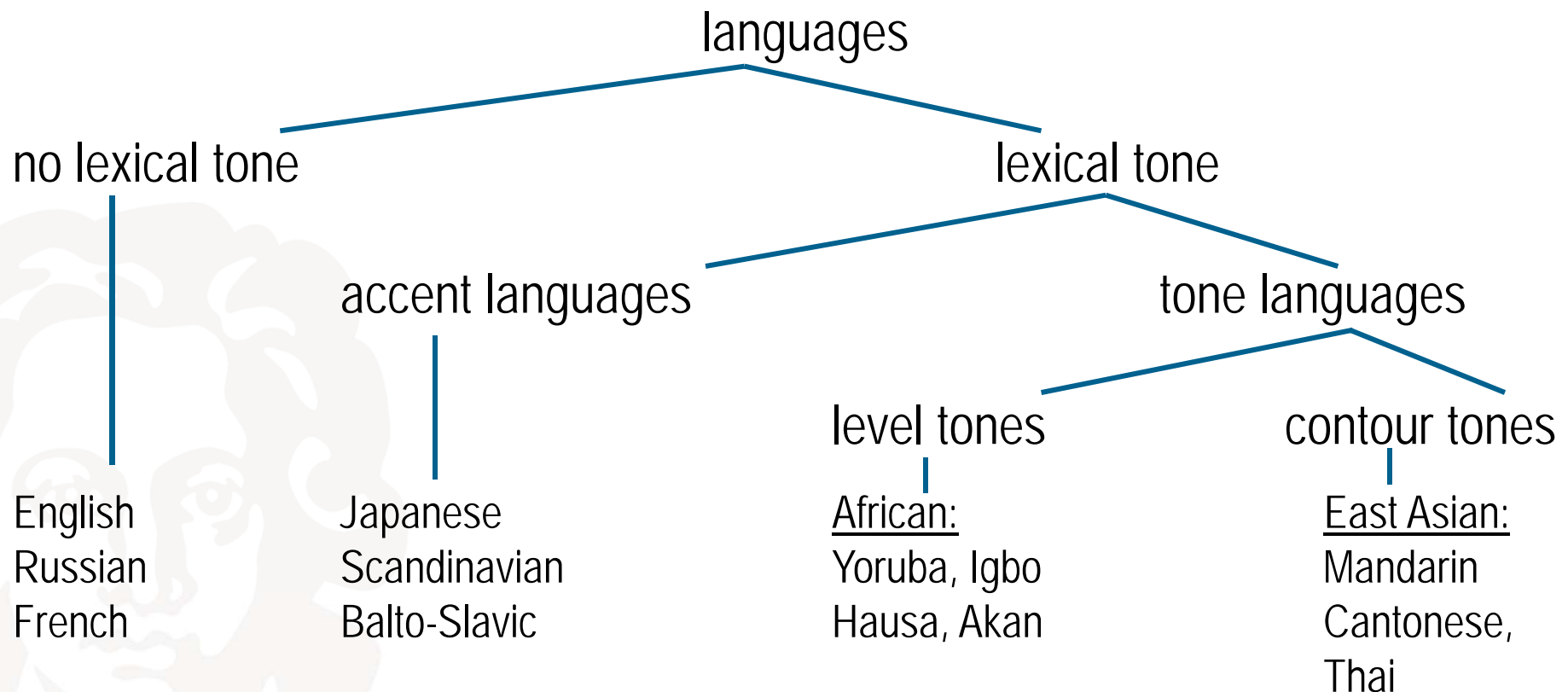
“A language with tone is one in which an indication of pitch enters into the lexical realization of at least some morphemes”  
(Hyman 2001: 1368)

Tone – a linguistic term denoting the abstract association between a tonal tier and a lexical tier.

Phonetic correlate of tone

- Fundamental frequency (F0), an acoustic measure in terms of Hertz
- Pitch – a perceptual term

# Language types – Tone typology



(Bruce & Engstrand 2006:26)

According to Hyman (2001) the word-level prosodic features [tone] and [stress] combine to four language groups.

[+tone] [+stress]	Swedish, Fasu, Mandarin, ...
[+tone] [-stress]	Yoruba, Igbo, Akan, Yucatec Maya, ...
[-tone] [+stress]	English, Russian, Spanish ...
[-tone] [-stress]	Korean, Berber

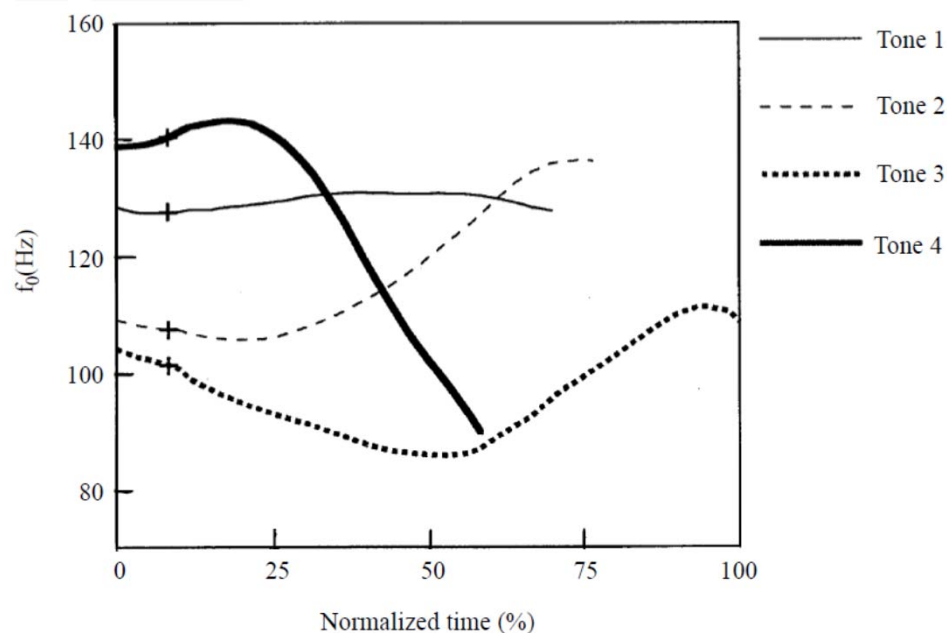
(Hyman 2001)

# Tone language – a classical example

## Tones – Mandarin Chinese tones

- $ma^{55}$  tone 1 (high) 'mother' →
- $ma^{35}$  tone 2 (mid rising) 'hemp'
- $ma^{21}$  tone 3 (low, or falling-rising) 'horse'
- $ma^{51}$  tone 4 (high falling) 'scold'

e.g. H  
|  
ma



(Xu 1997:64; 67)



# A language with lexical tone / pitch accent

Pitch-Accent (lexical)

Swedish

(2) a. [<sup>`</sup>anden] – ‘the ghost’

b. [<sup>\*</sup>anden] – ‘the duck’

c. [<sup>`</sup>mi.lan] – ‘the red kite’

d. [<sup>\*</sup>mi.lan] – ‘the kiln’

H+L\*

|  
mi.lan

|  
H\*+L

## Definition of intonation

"Intonation refers to the use of *suprasegmental* phonetic features to convey 'postlexical' or *sentence-level* pragmatic meanings in a *linguistically structured* way"  
(Ladd 1996:6)

## Suprasegmental:

- Tone – above the segments  
F0, intensity, duration (acoustic terms)

## Sentence-level:

- Expresses meaning at the level of a phrase  
(sentence type, information structure / focus, ...)
- Does not refer to stress which is lexically specified  
(e.g. *permít* vs. *pérmit*)

## Linguistically structured:

- Categorical distinct units (tones) and their metrical relation
- Basic inventory: Pitch accents and boundary tones

“It is clear that the same sentence, with the same stress pattern, can be said with many different melodies in English, and that these melodies have an important role in its expressive force” (Pierrehumbert 1980:1)

“Are you coming?”

\

yes

“yes, I’m coming”

/

yes

“yes, but I’m surprised  
you asked”

V

yes

“yes, but ...”

Intonation contour consisting of a pitch accent and following boundary tone.

H\*L L%

L\*H H%

H\*L H%

“..., the same melody can occur on many different texts.”  
(Pierrehumbert 1980:2)

“Are you coming?”

\  
yes  
no

/  
yes  
no

V  
yes  
no

A *pitch accent* is a local event of a pitch contour, which is realized as a local *minimum or maximum in F0*. A pitch accent expresses prominence at the level of the utterance (2).

*Stress* is an abstract *lexical property* of individual syllables, which may be realized as changes in F0 (1).

(1) permit (N)    permit (V)



(2)a. I TOLD you the permit had expired.



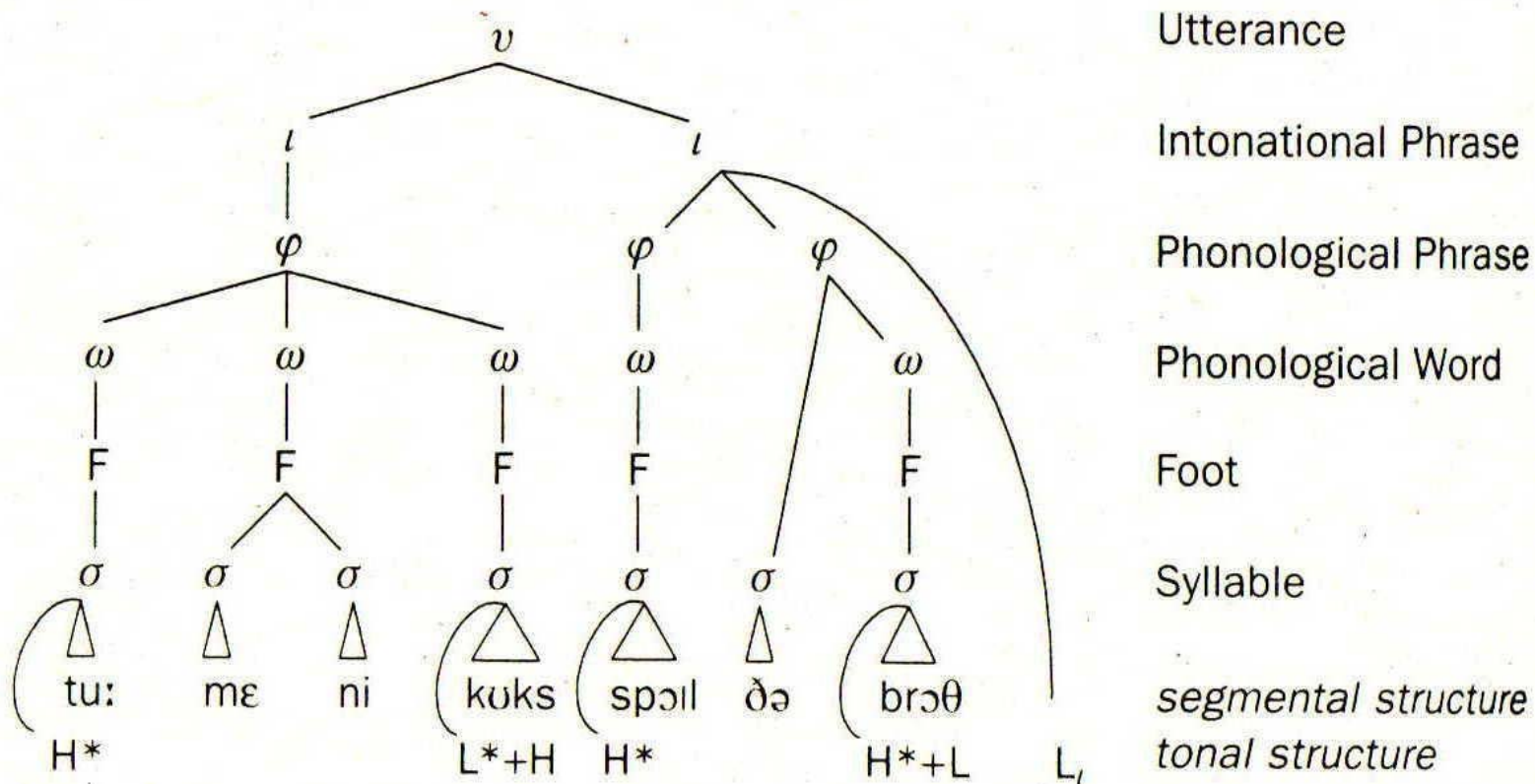
b. I TOLD you they'd permit him to retire.



(Ladd 1996: 46, 47)

# An example of an English utterance

Intonation contour as phrase-level phenomenon – opposed to word-level tone.



(Gussenhoven 2004:124)

Pitch accents are associated with metrically strong syllables in a phrase.

"Association [...] is the abstract structural property of 'belonging together' in some way."

(Ladd 1996:55)

# Function of prosody

(i) **highlighting** and (ii) **grouping** of information.



German (e.g. Féry & Kügler 2008, Baumann et al. 2006),  
Mandarin (e.g. Xu 1999), ...

→ Prosodic focus marking on the focused constituent.



e.g. Hindi (e.g. Patil et al. 2008)

→ Prosodic focus marking after the focused constituent.

(Presumably no marking of focus on the focused constituent, cf. Patil et al. 2008, but see Genzel & Kügler 2010 for contrast).

**The Issue:** The major phonetic correlate of intonation – F0 – is the correlate for tone as well.



# 1. Information structure



# Focus as a cognitive category (Krifka 2008)

## Focus

“**Focus** indicates the presence of alternatives that are relevant for the interpretation of linguistic expressions.” (Krifka 2008: 247)

In a question-answer pair, the answer denotes one of the alternatives and adds it to the CG. **Information focus**.

- (1) a. Who stole the cookie?  
b. [Peter]<sub>F</sub> stole the cookie. (Krifka 2008:250)

## GIVENNESS

“denotation of an expression is present in the immediate CG content” (Krifka 2008:262);

This implies degrees of givenness

Relation between focus and givenness:

- (2) A: I know that John stole a cookie. What did he do then?  
B: He [reTURNED [the cookie]<sub>Given</sub>]<sub>Focus</sub> (Krifka 2008:264)

"Languages use different linguistic means such as **phonology**, syntax, morphology or a combination thereof to express an information structural category, e.g. focus."

(Zimmermann & Onea 2011:1658)

Phonology – e.g. pitch accent / pitch register

- (1) Q: Der Hammel wollte den Rammler dem Löwen vorstellen.  
Warum hat er das nicht getan?  
'The sheep wanted to introduce the rabbit to the lion. Why didn't he do this?'

H\*L

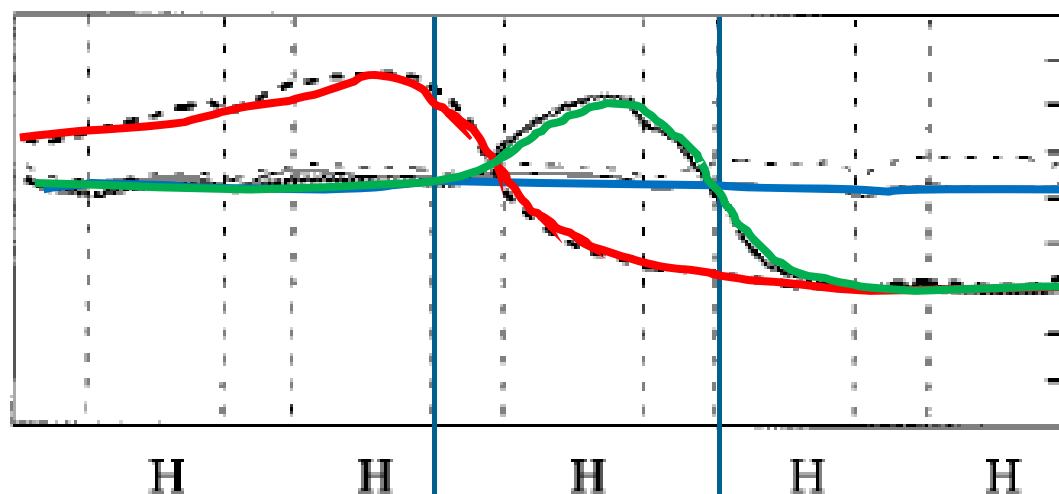
- A: Weil der Hammel den Rammler dem **HUMMER** vorgestellt hat.  
'Because the sheep introduced the rabbit to the **LOBSTER**.'  
(Féry & Kügler 2008; cf. Baumann et al. 2006, Braun 2005)

# Intonation in tone languages – Focus

Given that F0 is occupied to maintain the distinction of lexical tone the question is whether the phonetic cue F0 may also express postlexical meanings, i.e. focus?

Yes and no.

Yes, pitch register expansion in Mandarin Chinese (Xu 1999:64)



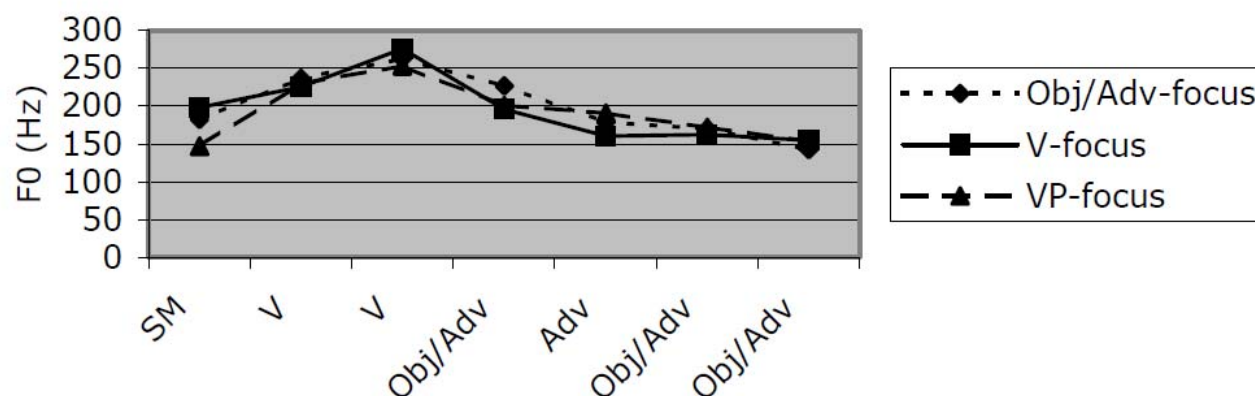
# Intonation in tone languages – Focus

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Yes and **no**.

No: Zerbian (2006) for Northern Soto, broad and narrow focus have identical F0-contours

Diagram 1: Speaker DE



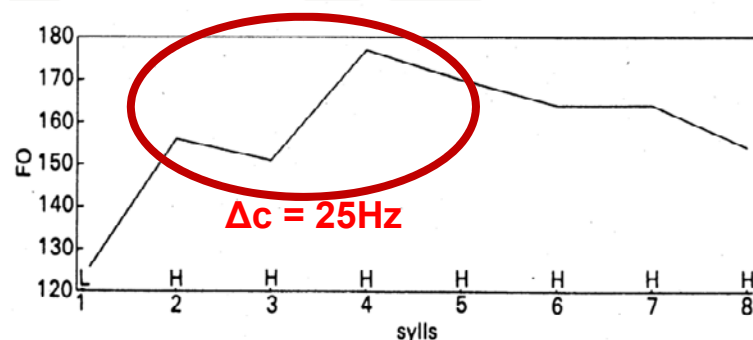
Northern Sotho

# Intonation in tone languages – Focus

Given that F0 is occupied to maintain the distinction of lexical tone the question is whether the phonetic cue F0 may also express postlexical meanings, i.e. focus?

Yes and no.

Yes and no, Hausa (Inkelas & Leben 1991, Hartmann & Zimmermann 2007)



Bàì biyaa Waali kudii ba!

(Inkelas & Leben 1990:25)

Table 2: Average maximum pitch of constituents in 'Hàliimà taa yankà X' in (Hz)

	SUBJ	AUX	V	OBJ
OBJ-focus	114,71	115,90**	105,01	91,27
VP-focus	117,98	107,98	100,67	96,46
V-focus	120,79	113,52	104,48	92,83
all-new focus	114,92	108,75	103,65	101,18

(Hartmann & Zimmermann 2007:Tab 3)

# Intonation in tone languages – a summary

Languages use different prosodic means for encoding focus:

## 1. Tonal means:

- Generally a register raising, found in intonation (e.g. German, Féry & Kügler 2008) and tone languages (e.g. Mandarin Chinese, Xu 1999)
- Different phonological tone / accent (e.g. European Portuguese, Frota 2000)

## 2. Phrasal means:

- Insertion of a phrase break after a focused constituent, Bantu languages (e.g. Chichewa, Kanerva 1990), and Kwa languages (Leben & Ahoua 2006).

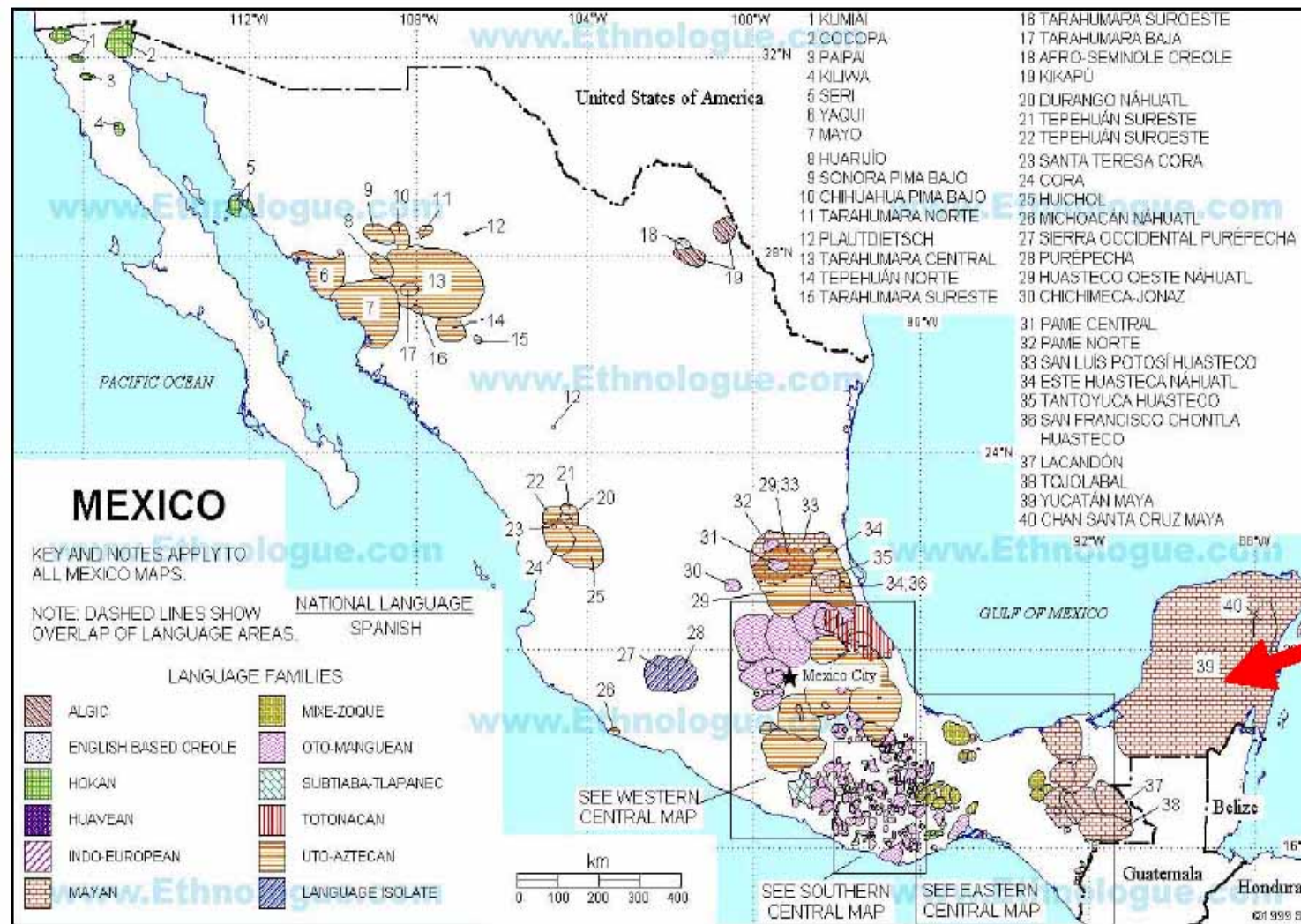
## 3. No prosodic means:

- No register raising, no phrase boundary insertion (e.g. Yucatec Maya, Kügler & Skopeteas 2007, Northern Sotho, Zerbian 2006).

For a review of experimental studies on prosodic prominence realization in African tone languages see Zerbian, Genzel & Kügler (2010).



# Yucatec Maya – The Mayan Languages





# Prominence and Tone in Yucatec Maya

Yucatec Maya has lexical tone (Pike 1946), the only Mayan language with tone.

Wide focus / All-new sentence:

(14) **yàan humpéel lòol ich-e nah-o'.**  
 EXIST INDEF:CL.IN flower in-DEF house-D2



'There is a flower in the house.'

Narrow focus:

(15) **ho'lyak-e', lòol k-u yil-ik in sukú'un.**  
 yesterday flower IPFV-A.3 see-INCMPPL POSS.1.SG brother



'Yesterday, it was the flower that my brother saw.'

- Yucatec Maya expresses focus syntactically in preverbal position (*ex situ*).
- Focus and tone do not interact in Yucatec Maya (Kügler & Skopeteas 2006; Gussenhoven & Teeuw 2008)



➤ Any effect of contrastive focus on tonal realisation?

## (i) Non-contrastive condition

Q: *ba'x t-a w-il-ah ich-e kòol-o'?*  
what pfv-2.sg 0-see-cmpl in-def corn field-d2  
'What did you see in the corn field?'

A: *t-in w-il-ah hun-kúul che' kóom ich-e kòol-o'.*  
pfv-1.sg 0-see-cmpl one-cl.plant tree short in-def corn filed-d2  
'I saw a short tree in the corn field.'

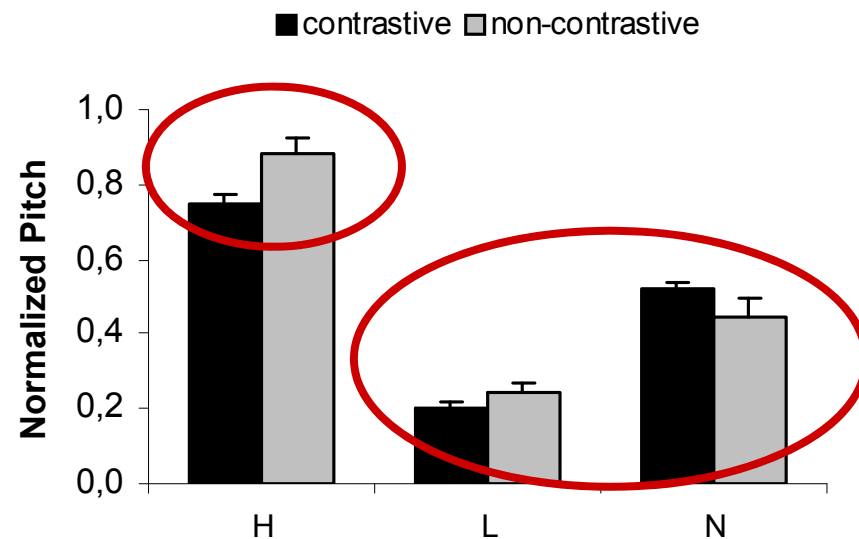
## (ii) Contrastive condition

Q: *t-in w-il-ah hun-kúul che' chowak ich-e kòol-o'.*  
pfv-1.sg 0-see-cmpl one-cl.plant tree long in-def corn field-d2  
'I saw a long tree in the corn field.'

A: *ma t-in w-il-ah hun-kúul che' kóom ich-e kòol-o'.*  
no pfv-1.sg 0-see-cmpl one-cl.plant tree short in-def corn filed-d2  
'No, I saw a short tree in the corn field.'

- Six Target items: two H-tone, two L-tone, two no-tone

# Results: Tonal Targets

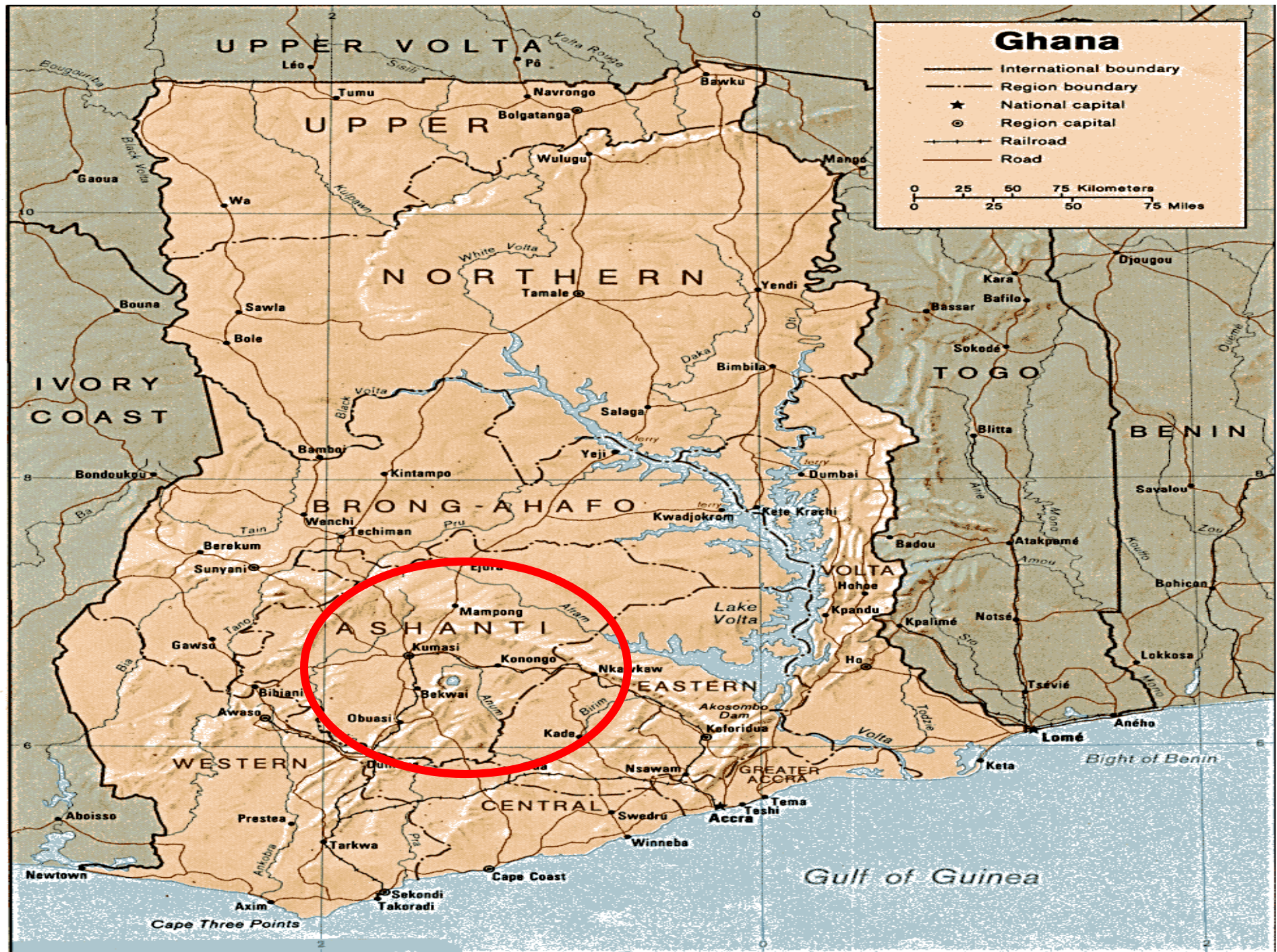


No tonal difference between contrastive and non-contrastive focus for low tones (L) and syllables with no tone (N).

In contrast to other languages, the H-tone in non-contrastive contexts is slightly higher than in contrastive contexts. (Kügler & Skopeteas 2007)

- No prosodic means to express focus in Yucatec Maya

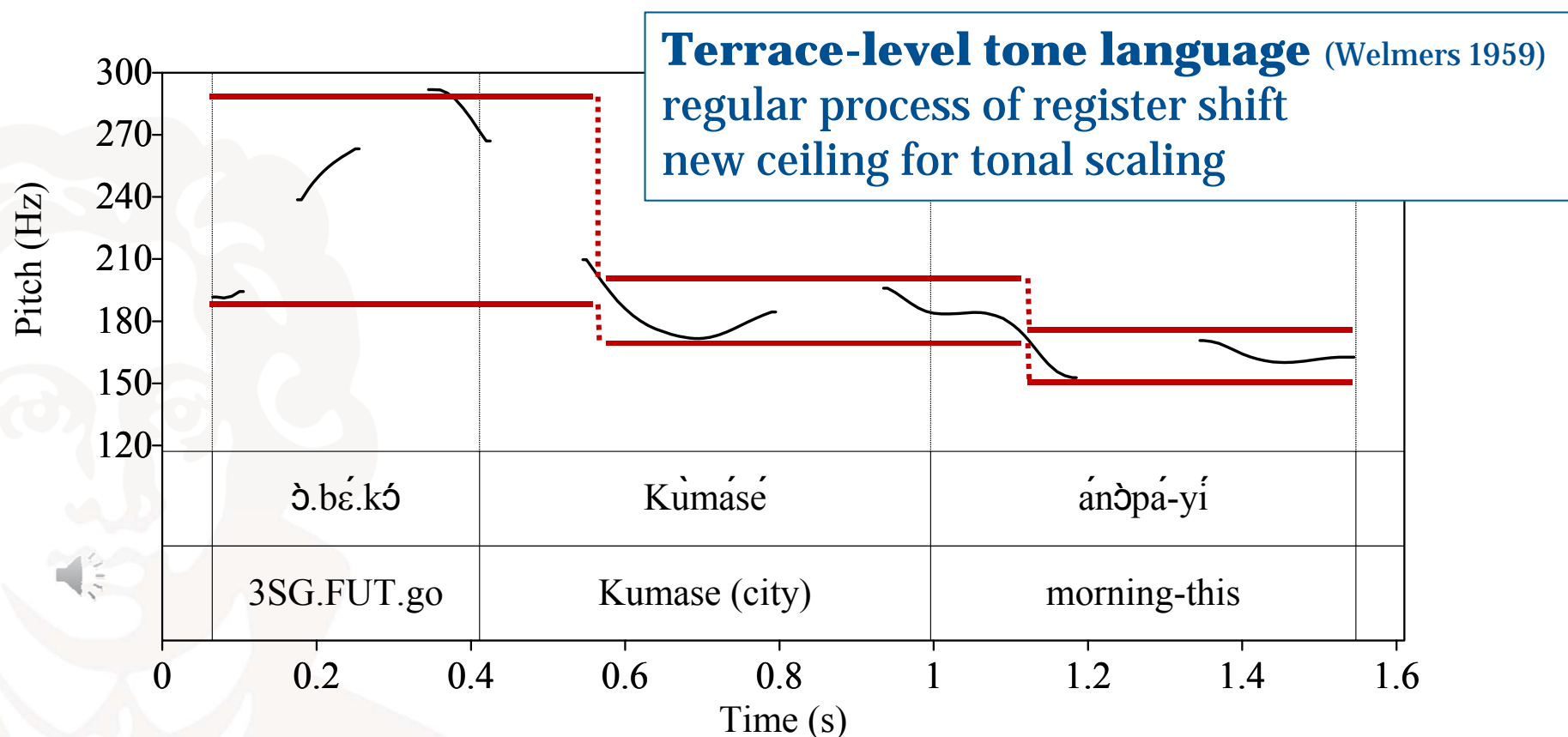






# Pitch register in Akan

- (1) ò-bé-kó                      Kùmásé                      ánòpá                      yí  
 3SG-FUT-go                      Kumase                      morning                      this  
 'He will go to Kumase this morning.'  
 (Akan, Schachter & Fromkin 1968:105)



# Picture naming task (Genzel & Kügler 2010)

## Elicitation of information structure



Pre-recorded questions to avoid variation of experimenter:

What do you see on this picture?

Whom did Agyeman/Anum help this morning?

Did Agyeman help Anum this morning?

(cf. e.g. Calhoun 2015 for similar tasks in Austronesian languages)

# Picture naming task (Genzel & Kügler 2010)

Akan is a SVO language (Kobebe & Torrence 2006).

- (1) kòfí bòò àmà  
Kofi hit.PST Ama 'Kofi hit Ama.'

However, focus can be realised in its base position (*in-situ*) as well (Saah 1988).

- (2) Object focus  
kòfí bòò àmà (nà)  
Kofi hit.past Ama (FM) 'Kofi hit AMA.'

The picture naming task confirmed data such as in (2).

- (3) What did Anum buy this morning? / Did Anum buy fish this morning?

-- no prepared answers to elicit speakers' most frequent focus strategy.

-- questions for 2 target words, answered by 11 speakers

-- narrow focus: **17 in-situ** 2 ex-situ 3 other

-- contrastive focus: **14 in-situ** 3 ex-situ 5 other

(Genzel & Kügler 2010; Kügler & Genzel 2012)

# Interaction of Tone and Focus Intonation

(Kügler & Genzel 2012)

## Material & Factors

### Factor 1: Tone

L: àddò - proper name

H: àmángò - mango

### Factor 2: Syntactic construction

in-situ – ex-situ

### Factor 3: Information structure

- wide focus, narrow informational, narrow corrective

L: àddò (in situ)



H: àmángò (ex situ)



- pre- and post-focal givenness

### Carrier sentences:

Àgyèmàn bóàà **Àddò** ánoṗà yì  
Agyeman help.PST Addo morning this

Agyeman helped Addo this morning.

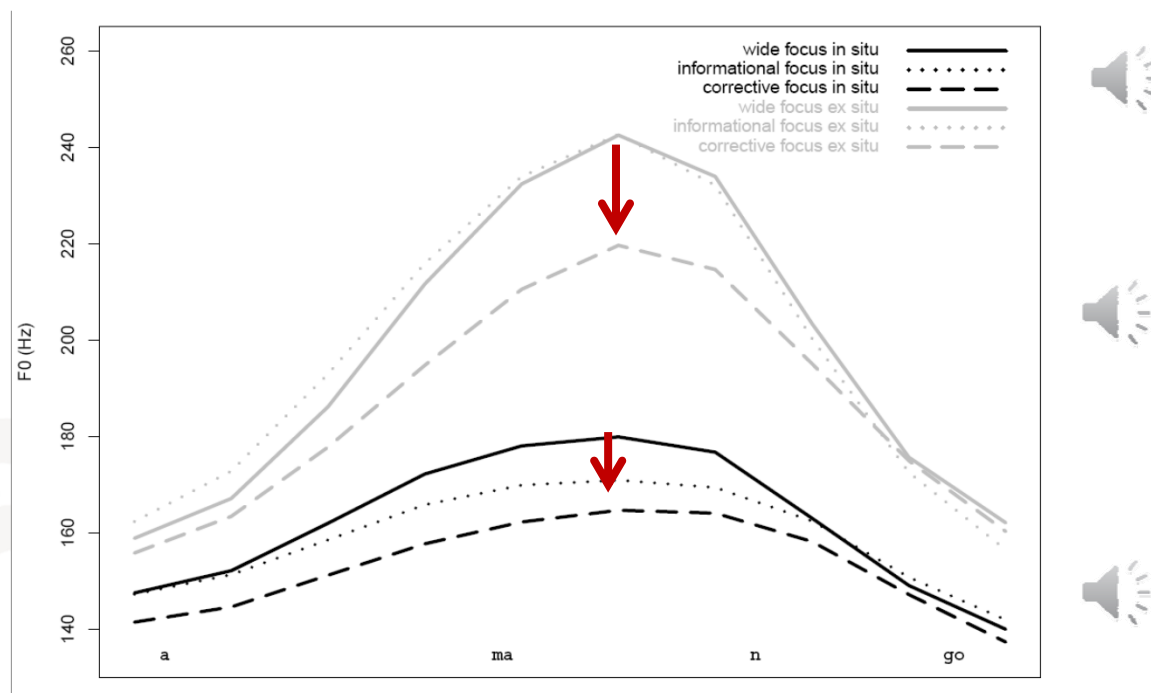
Ànúm tòò **àmángò** ánoṗà yì  
Anum buy.PST mango morning this

Anum bought a mango this morning.



# Interaction of Tone and Focus Intonation

(Kügler & Genzel 2012)



Interaction of focus and syntactic position

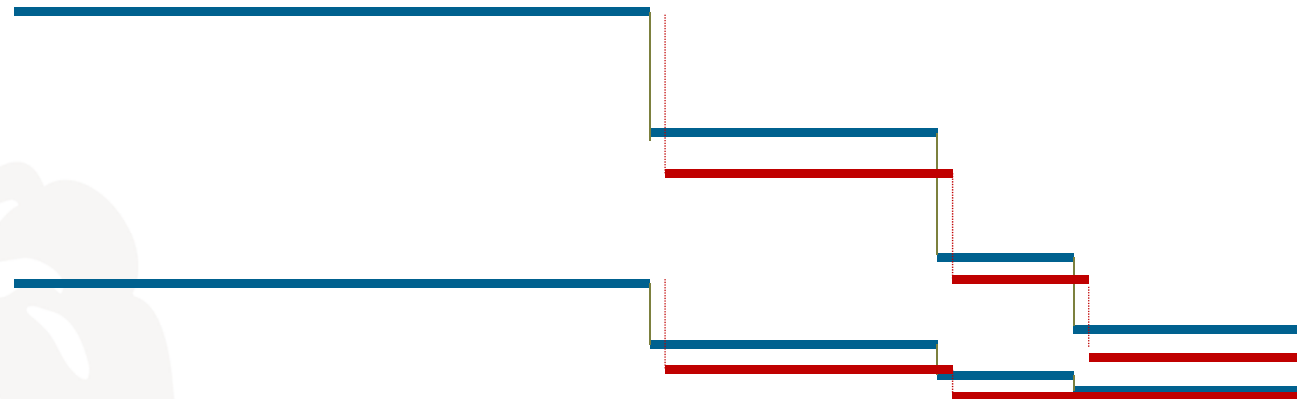
Factors (3 x 2):

- broad, narrow and corrective focus
- syntactic position (in-situ, ex-situ focus)

$\Delta c$ of lowering in (st)			
item	broad - narrow	broad - contrastive	narrow - contrastive
(1) amango in - situ	<b>0.8</b>	<b>1.6</b>	<b>0.7</b>
(2) amango ex - situ	<b>0.3</b>	<b>1.8</b>	<b>0.5</b>

# Interaction of Tone and Focus Intonation

(Kügler & Genzel 2012)



Ànúmè tò-ò **[àmán`go`]** ánòpá yí.  
Anum buy-PST **F** mango morning this  
'Anum bought a mango this morning.'

⇒ Deviation from a neutral register, no matter what direction!

# Summary – Tone languages and focus

- Tone languages may express focus prosodically in terms of pitch register changes
  - Register raising or expansion as in Mandarin (Xu 1999)
  - Register lowering as in Akan (Kügler & Genzel 2012)
  - No prosodic effects as in Yucatec Maya (Kügler & Skopeteas 2006)
- Post-focal compression appears to be a prominent feature across languages to express focus, also in tone languages (Xu et al. 2004 for Mandarin and other Chinese languages)
- Phrasing (not illustrated here) appears to be another relevant strategy to express focus by means of insertion of a phrase boundary before and/or after the focused constituent (cf. Downing & Rialland 2016)

## 2. Sentence mode



# Production of question intonation in tone languages

## Interactions of lexical tone and intonation

- *accommodation, submission* and *avoidance* (Hyman & Monaka 2008)

## Accommodation

- Peaceful co-existence of lexical and intonational tones
- Chichewa (Myers 1996): additional H% not affecting lexical tone  
H tones are in general realized higher in questions  
downdrift is reduced in questions

## Submission

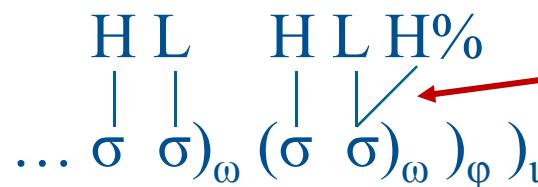
- lexical tones may be overridden by post-lexical tones
- Shingazidja (Patin 2011, 2016): super-high tone in questions on the penultimate syllable  
lexical tone on penultimate syllable is overridden

## Avoidance

- No intonational tones (Yoruba, Connell & Ladd 1990)

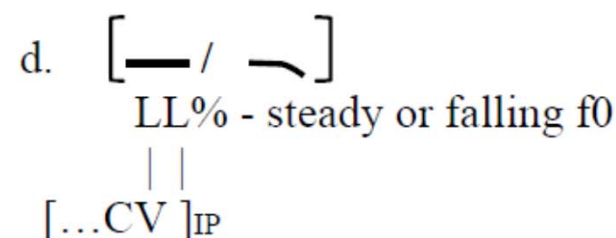
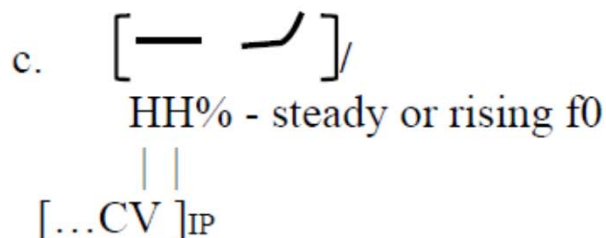
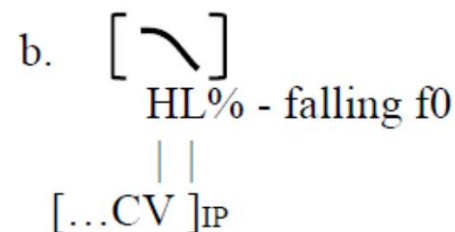
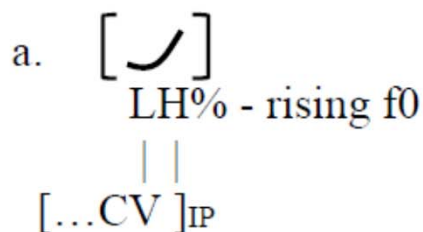
# Production of question intonation

How can boundary tones be distinguished from lexical tones?



two tonal events, which need to be articulated

- Boundary tone: observable local effect at the end of an utterance
  - Scaling differences between a question and a statement



- Boundary tone: global f0 effect on the entire prosodic phrase

# Perception of question intonation in tone languages

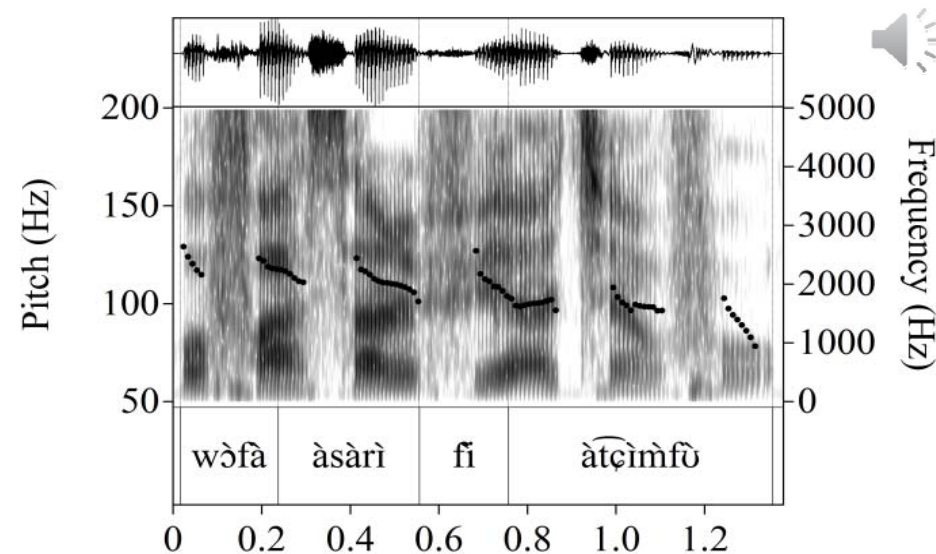
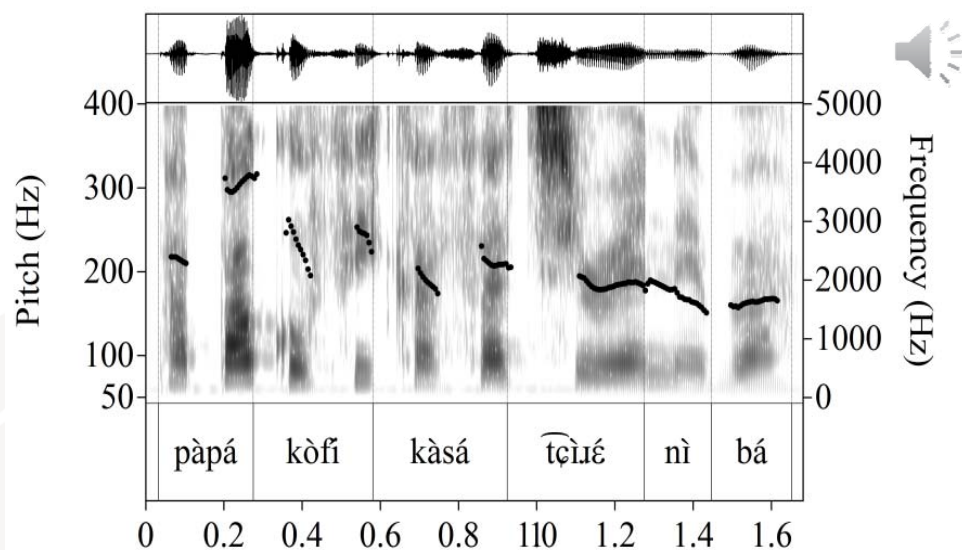
- Understudied issue
- Local phrase-final phonetic parameters are relevant for the identification of sentence mode:
  - Cantonese (Ma et al. 2011): **final f0-rise**, raised pitch register
  - Sesotho (Mixdorff et al. 2011): **shorter penultima**, raised pitch register
  - Xhosa (Jones et al. 1998): **shorter penultima, a higher f0 on the penultima**, a raised pitch register and a higher intensity
- Local language-specific cue appears to have more perceptual relevance than a global cue.

- Level tone language (Hyman 2011:199)
- Two contrasting tones (e.g. Stewart 1965, Dolphyne 1988)
- Syllable = TBU in Akan (but see Paster 2010)
- Duration of a syllable depends on its tone:
  - L tone by about 80 – 100 ms shorter than H tone (Manyah 2006)
- Both lexical and grammatical function of tone in Akan (e.g. Dolphyne 1988, Paster 2010)
- SVO language with head-initial properties (e.g. Saah 1988, Boadi 2005)
- Downdrift (terraced-level tone language; Welmers 1959, Clements 1979, Dolphyne 1988, Abakah 2000, Genzel & Kügler 2011)



# Akan tone and intonation

Downdrift – lowering of a H tone that is preceded by a L tone



# Akan yes-no question intonation

Global properties:

- Higher pitch register (Berry & Aidoo 1975, Dolphyne 1988)

Local, phrase-final properties:

- Falling intonation or final L tone (Dolphyne 1988, Abakah & Koranteng 2007)
  - Cancellation/reduction of final lowering (Dolphyne 1988)
  - Lengthening of final word (Christaller 1875, Boadi 1990)
  - Higher intensity (Boadi 1990)
- 
- Findings based on impressionistic observations
  - Production study to test quantitatively which of the parameters Akan speakers use to differentiate yes-no questions from statements.

# Production experiment (Genzel & Kügler accepted)

Speech materials:

- 16 question-statement pairs
- 5 tonal configurations

H	ákú tó búbá	'Aku buys a stone. / Aku buys a stone?'
L	àdù dò jàw	'Ado loves Yaw. / Ado loves Yaw?'
LH	pàpá kòfí kàsá	'Father Kofi talks. / Father Kofi talks?'
HL	ánàní bìsá sàkà	'Anane asks for money. / Anane asks for money?'
LH	kòfí dò mäsà	'Kofi loves master. / Kofi loves master?'

Speakers: 23 (8f, 15m) native speakers of Asante Twi

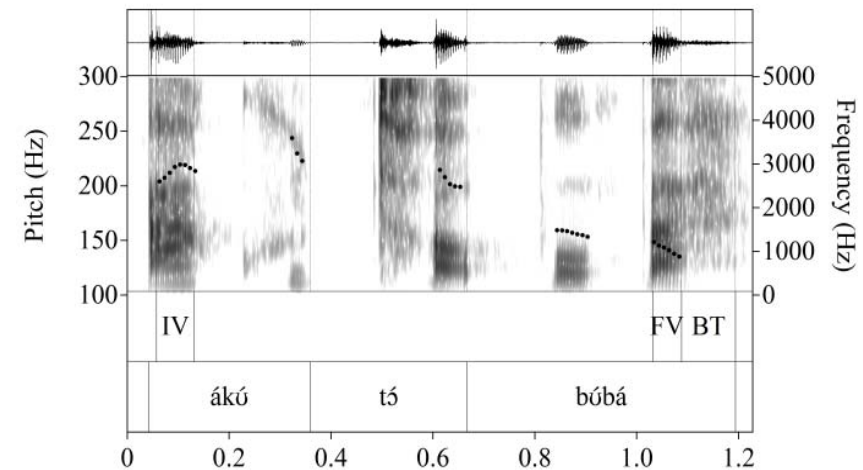
Recordings: quiet rooms in Minot (US), Accra, Kumasi

Akan orthography, unrelated filler sentences, sentence mode: ? or .

# Method – acoustic measurements

## Annotation of initial and final vowels

- Initial vowel = pitch register (Huang 1980)
- Final vowel = local parameters (Rialland 2007)
- F0, duration and intensity measured with ProsodyPro (Xu 2013)
- Measures at initial vowel (pitch register)
  - mean F0 (Hz)
- Measures at final vowel (local cues)
  - mean F0 (Hz)
  - duration (ms)
  - mean intensity (dB) in relation to mean intensity of initial vowel
  - final F0 (Hz)
  - final F0 excursion (st)



Initial vowel:

- **Pitch register is significantly higher in Yes-No questions**  
(statement 165 Hz – question 174 Hz;  $p > 0.006$ )

Final vowel:

- **Duration is significantly longer in Yes-No questions**  
(statement 80 ms – question 101 ms;  $p > 0.002$ )
- **Relative intensity is significantly lower in Yes-No questions**  
(statement 6.7 dB – question 4.0 dB;  $p > 0.005$ )
- **Final F0 value of the final tone does not differ**  
(statement L 114 Hz – question 117 Hz )  
(statement H 114 Hz – question 113 Hz )
- **F0 excursion is larger in Yes-No questions**  
(statement L 2.3 st – question 3.2 st)  
(statement H 1.0 st – question 2.1 st)

# Results

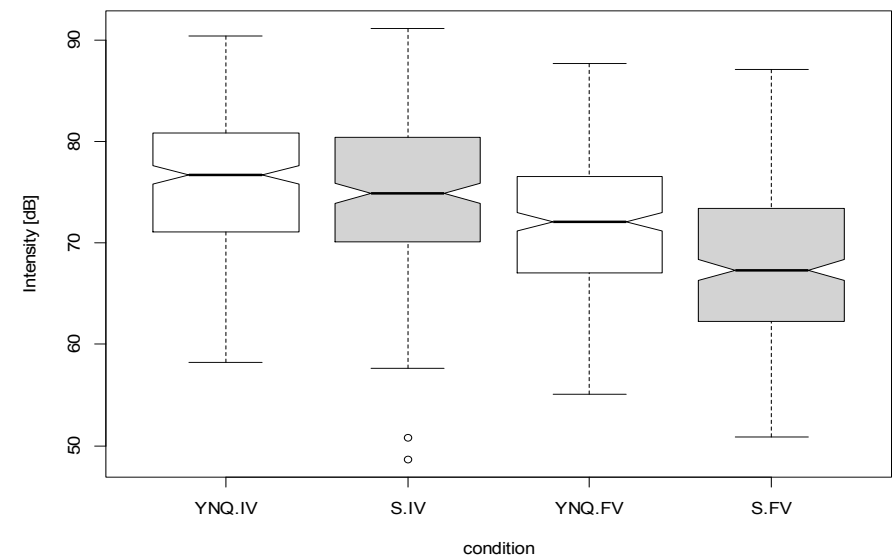
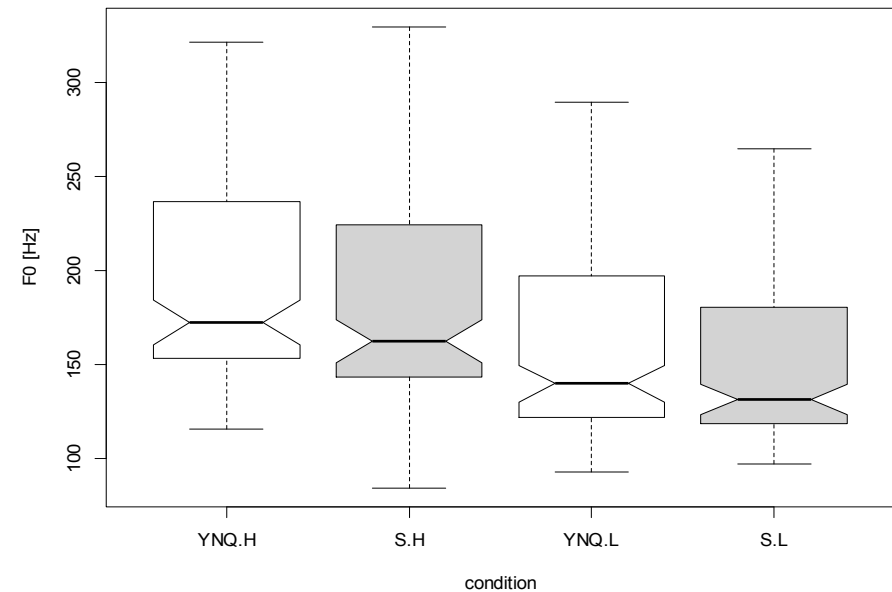
- Significant difference of mean F0 in initial vowel concerns both lexical H and lexical L tones.

statement – question

H: 184 Hz      193 Hz

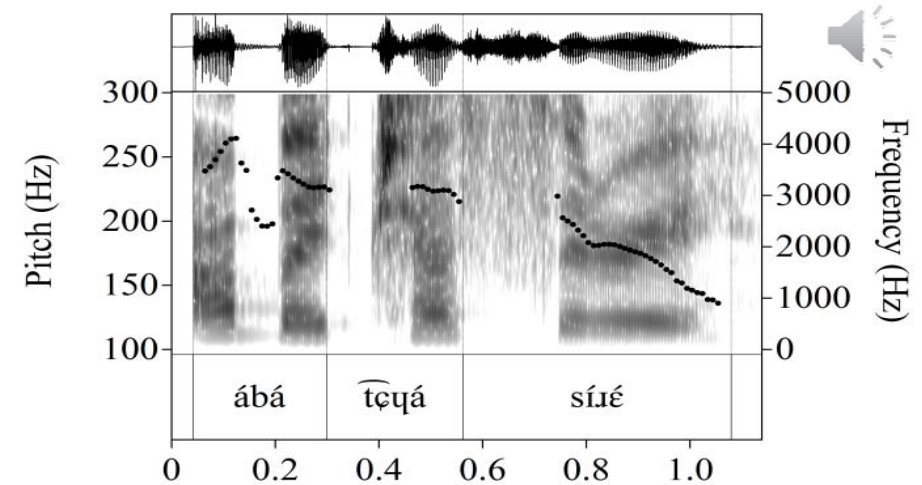
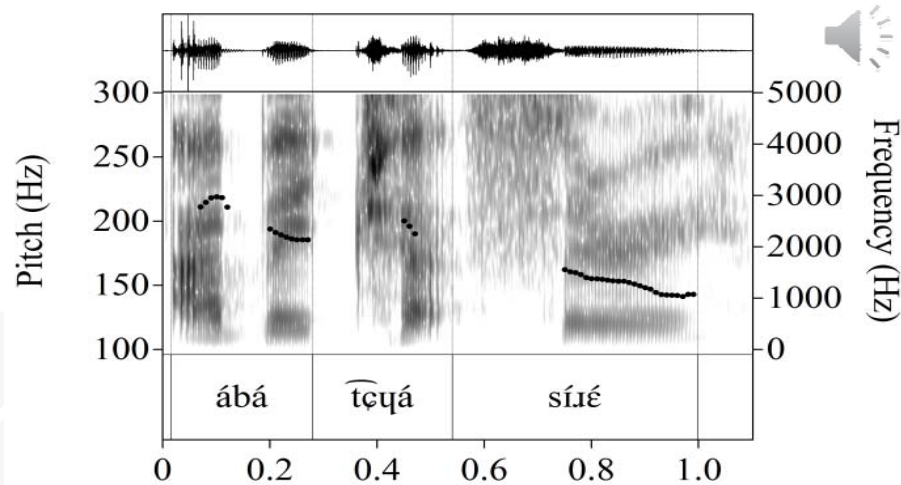
L: 149 Hz      159 Hz

- Initial vowel: Significant higher mean intensity (questions and statements)
- Final vowel: Significantly lower mean intensity in statements.



# Results

## Statement and question containing H tones

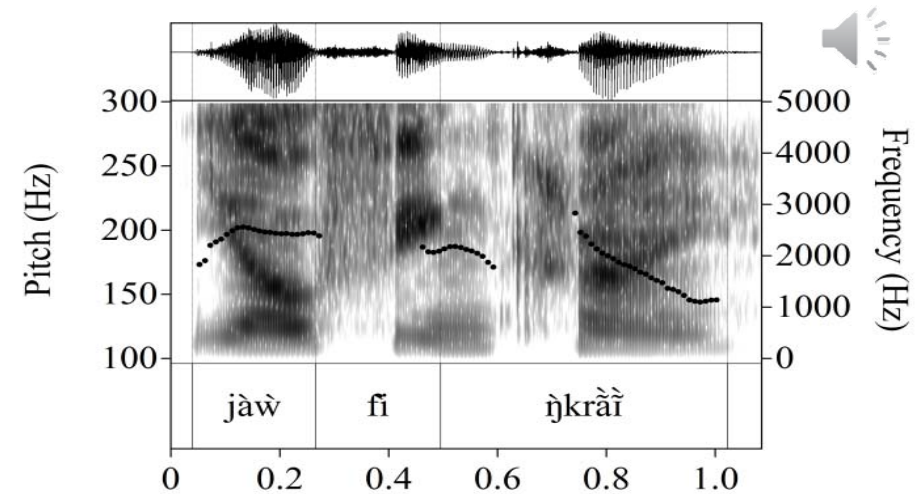
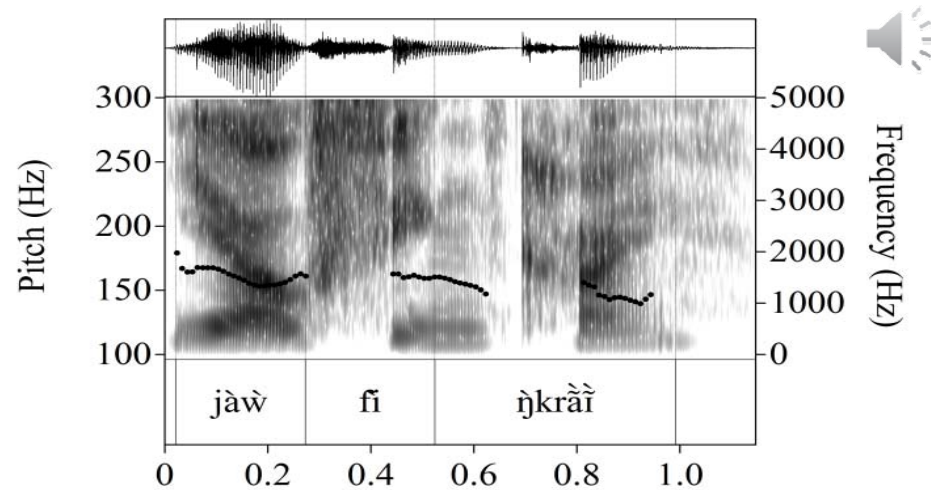


Downdrift occurs.



# Results

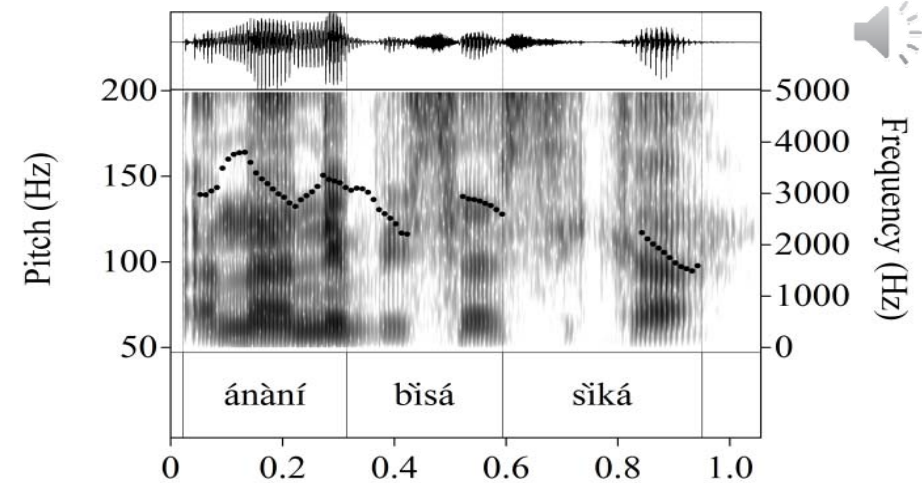
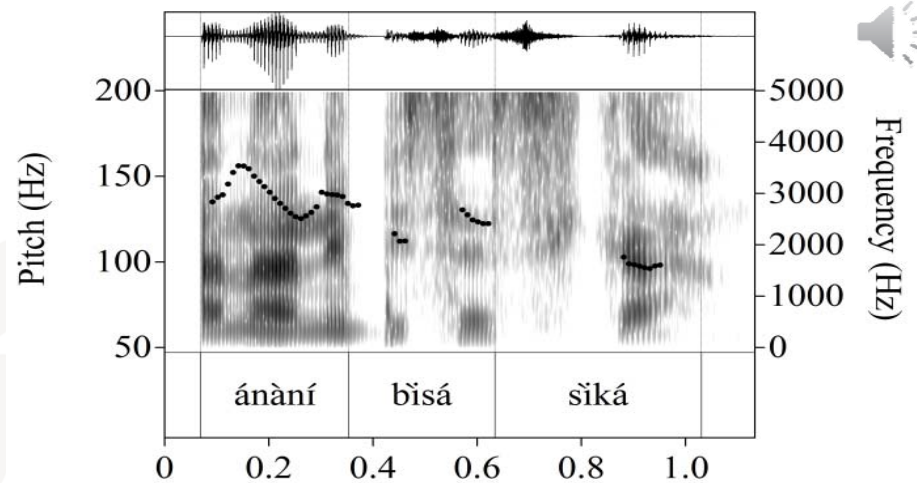
## Statement and questions containing L tones





# Results

Statement and questions containing alternating HL tones



# Summary

- Yes-No questions differ in several phonetic parameters from statements.
- Initial F0 is assumed to be an indicator of pitch register (Huang 1980) and clearly shows higher register in questions.
- Higher register in questions appears to be a common property of Gur and Kwa languages (Rialland 2007, Cahill 2015).
- The downdrift pattern in statements with alternating LH / HL tones is maintained in questions and the size of the step down is remains equal.
- Hence, yes-no questions show a global prosodic parameter in speech production.

- Locally, yes-no questions differ from statements in the realisation of the final vowel.
- Lengthening of the final vowel is about 20 ms (30% longer).
- Intensity is higher in final vowel, which confirms Boadi's (1990) observation of "extra voicing".
- Final F0-excursion is larger in questions than in statements (1.0 st in H tones and 0.8 st in L tones on average).
- The final fall in F0 arises due to higher register in questions.
- **Question remains which of these parameters function as perceptual cues to differentiate a yes-no question from a statement.**

- Forced-choice identification (cf. Ma et al. 2011, Mixdorff et al. 2011)
- Two types of stimuli, natural and cross-spliced ones.
- Cross-spliced stimuli to test for affects of global and local parameters.

## Method

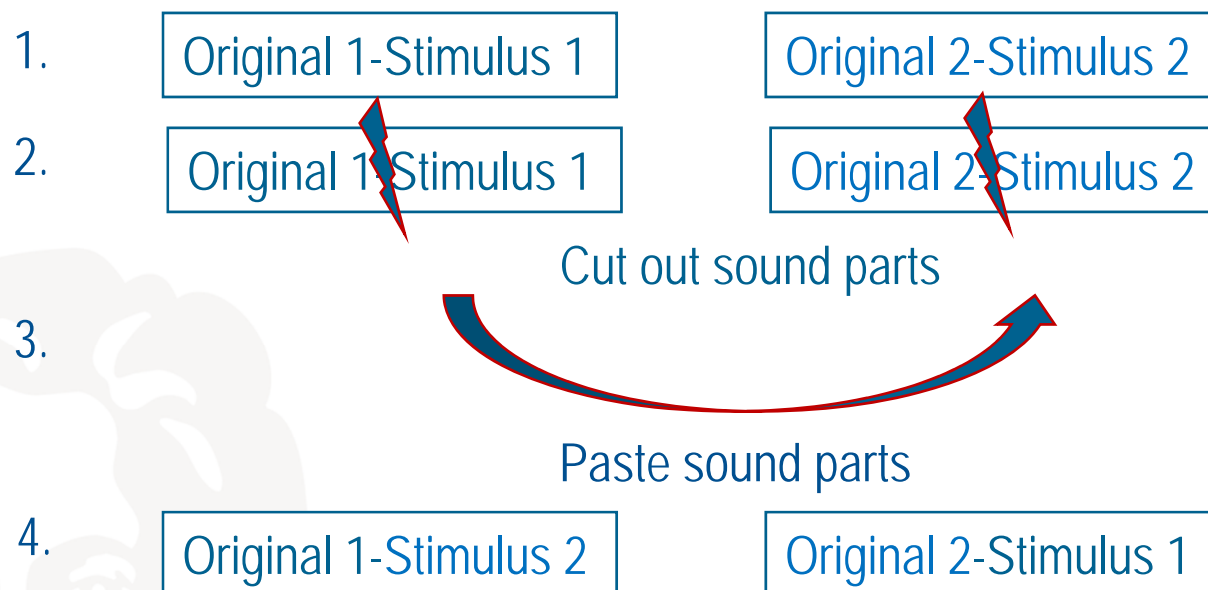
- Stimuli: two sets from production data, 1 female and 1 male speaker
- (1) pàpá kòfí kàsá tɕìɛ̀ nì bá      'Father Kofi talks to his child?'
- (2) ánàní bìsá sìká      'Anane asks for money?'
- Cross-spliced stimuli
    - raised question pitch register combined with the final local parameters of a statement.
    - statement pitch register combined with the final local parameters of a yes-no question.
  - 16 stimuli (2 speakers x 2 sentence mode x 2 items x 2 stimulus types) and 3 repetitions

# Cross-splicing in Praat

Creating sound files for perception experiment

Cross-splice: Original-Stimulus 1

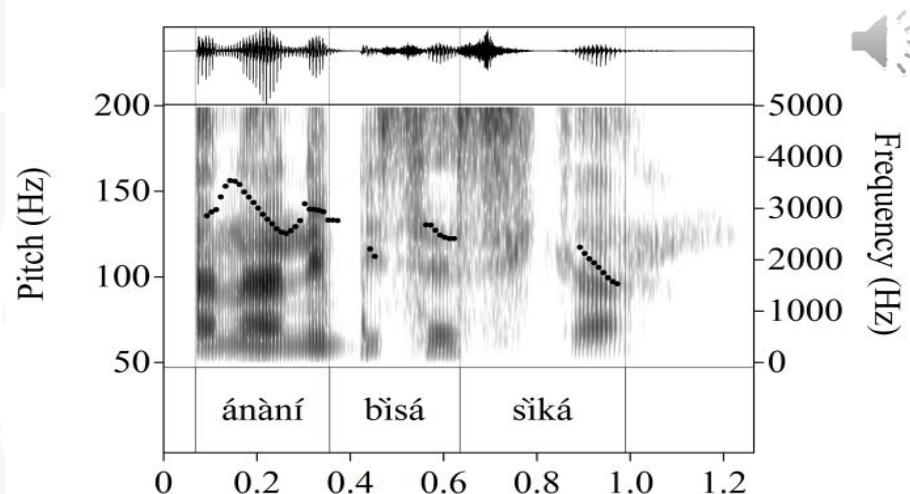
Original-Stimulus 2



# Cross-spliced stimuli

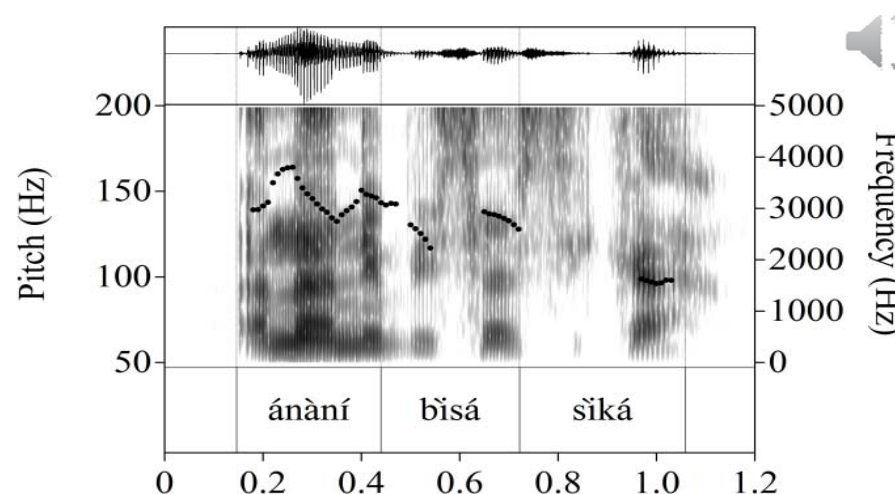
A statement-question (SQ)

- Lower register
- Slight falling terminal F0
- Shorter final duration



a question-statement (QS)

- higher register
- sharply falling terminal f0
- longer final duration

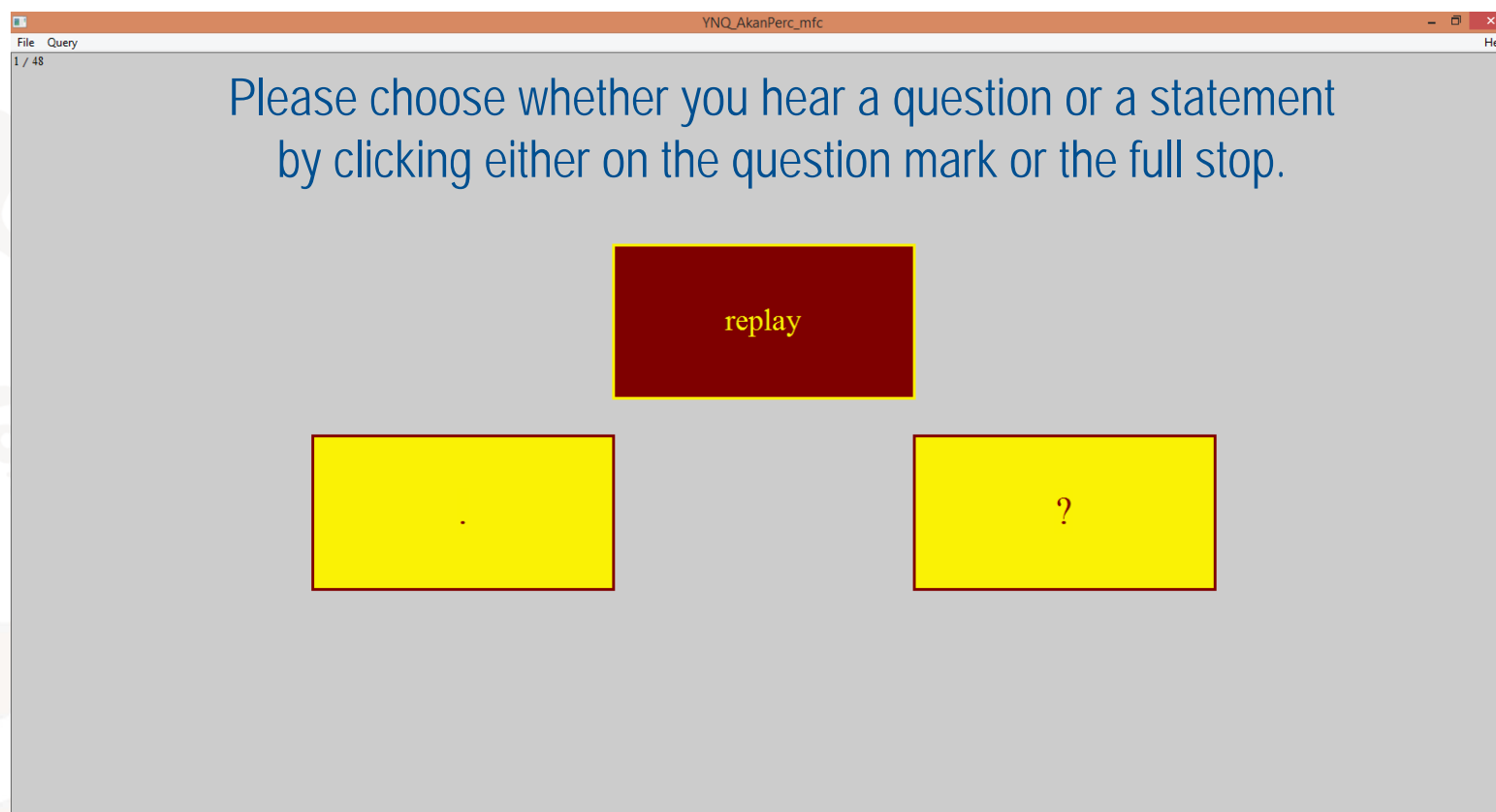


# Forced-choice identification test

Participants: 17 native speakers of Twi

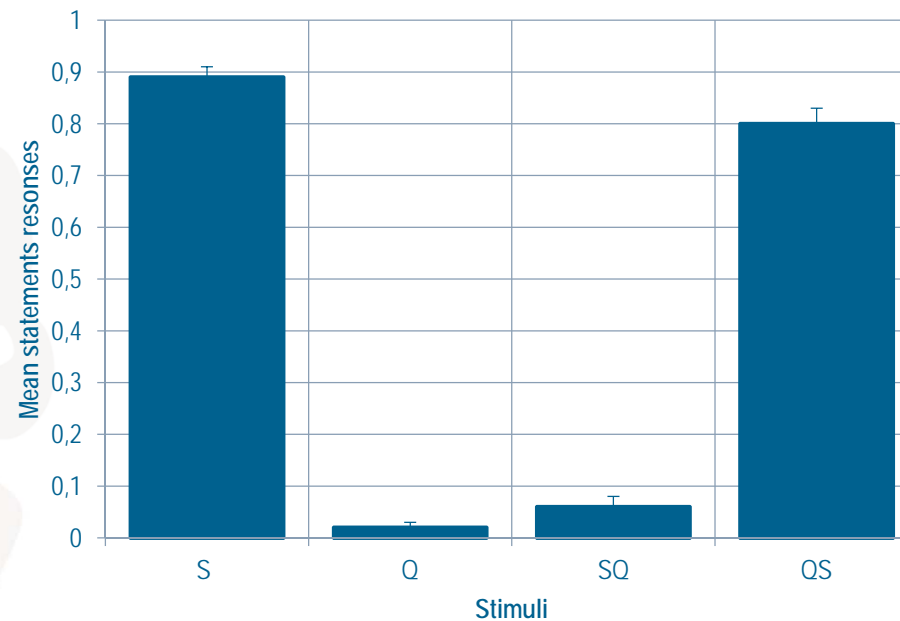
Procedure

- Praat MFC-function (approximately 15 min)
- 16 stimuli, 3 repetitions, 17 speakers = 912 data points



# Results

- Significant effect of SENTENCE MODE  
S/QS stimuli were more often identified as statements ( $\bar{x}=0.84$ ) than Q/SQ stimuli ( $\bar{x}=0.04$ )
- No effect of STIMULUS TYPE occurred, thus no difference between natural and cross-spliced stimuli





# Gating experiment

- Same stimuli as before, but only natural questions, to test for early effects of pitch register
- Two stimuli differing in length (gates) – 3 and 6 words

(1) ánàní bìsá sìká?

Gate 1: ánàní

Gate 2: ánàní bìsá

Gate 3: ánàní bìsá sìká

(2) pàpá kòfí kàsá tɕìɪ́é nì bá?

Gate 1: pàpá

Gate 2: pàpá kòfí

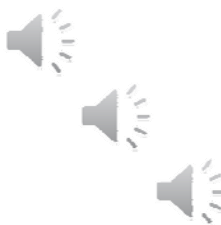
Gate 3: pàpá kòfí kàsá

Gate 4: pàpá kòfí kàsá tɕìɪ́é

Gate 5: pàpá kòfí kàsá tɕìɪ́é nì

Gate 6: pàpá kòfí kàsá tɕìɪ́é nì bá

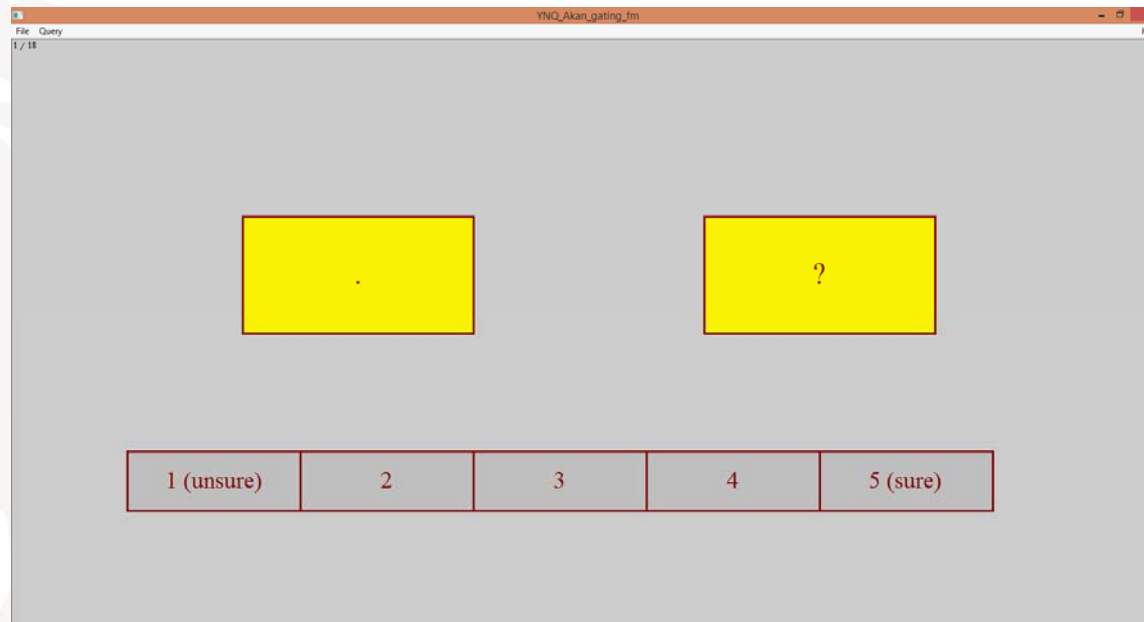
- 18 native speakers of Twi



# Gating experiment

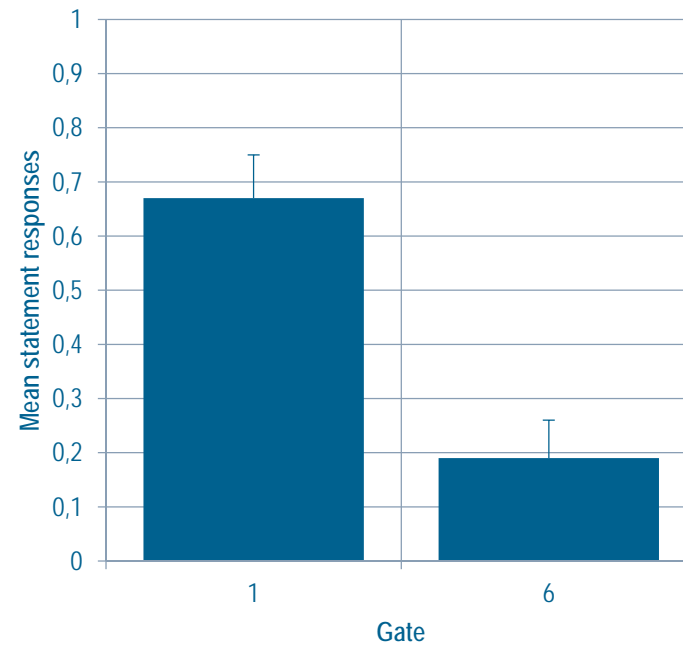
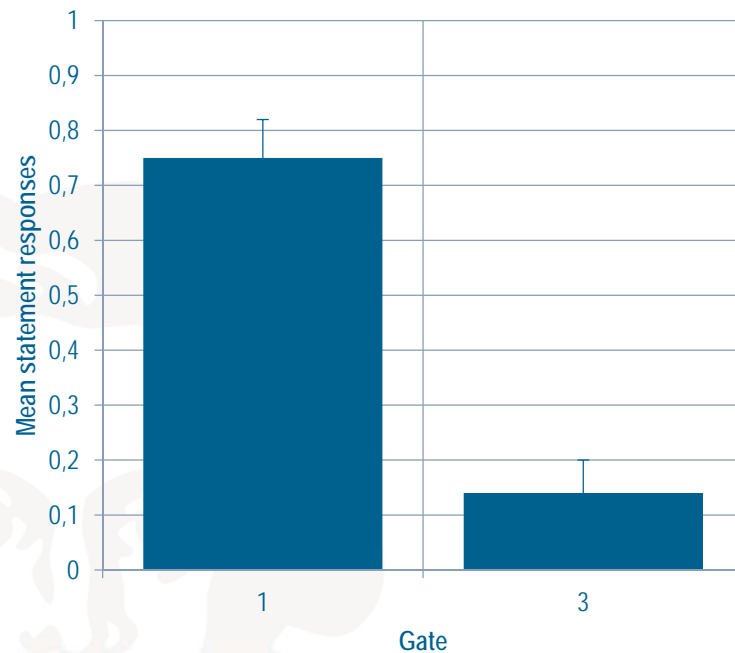
- Similar set-up as before
- Expectations: Identification as question only at the last gate
- Instructions:

You hear parts of a sentence. Please choose first whether you hear a question or a statement by clicking either on the question mark or the full stop.  
Select then how confident you are with your choice on a scale from 1 (unsure) to 5 (sure).



# Results

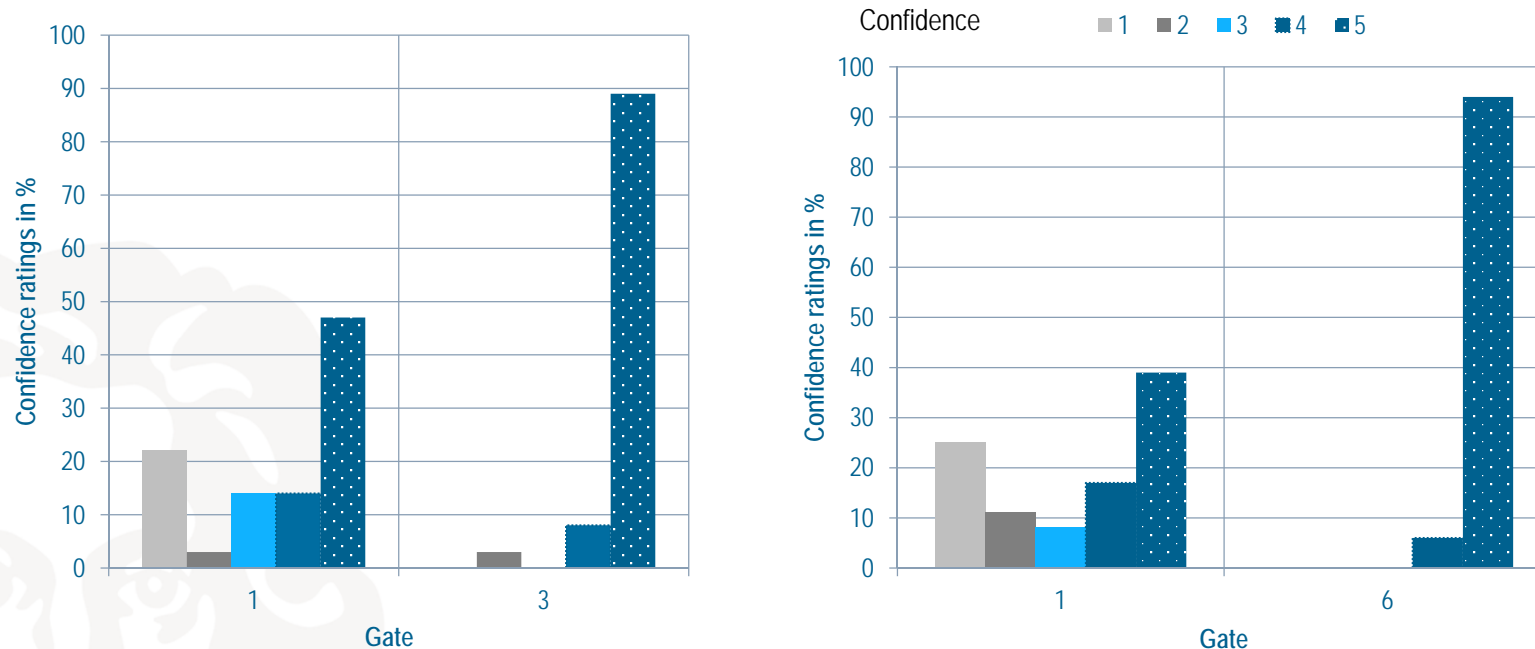
- Main effect for GATE  
significantly less statement responses at the final gate ( $\bar{x}=0.17$ ,  $SD=0.38$ ,  $n=72$ ) than at the initial gate ( $\bar{x}=0.71$ ,  $SD=0.46$ ,  $n=72$ ).



- Statement responses at the initial and following gates.
- Question response (low scores for statement) at the final gate.

# Results

- Higher probability of observations in the high categories at the final gate ( $\bar{x}=4.89$ ,  $SD=0.43$ ,  $n=72$ ) than at the initial gate ( $\bar{x}=3.47$ ,  $SD=1.64$ ,  $n=72$ )



- Less confident at the initial and following gates
- Very confident at the final gates (about 90 to 93% "sure = 5")

- In forced-choice identification:
  - stimuli with final statement cues were identified as statements
  - stimuli with final questions cues were identified as questions.
- Natural and cross-spliced stimuli did not differ
- No statement bias as neutral sentence mode (Yuan 2004, Peters & Pfitzinger 2008)
- Results are similar to Cantonese (Ma et al. 2011), Sesotho (Mixdorff et al 2011), and Xhosa (Jones et al. 1998)
- In the gating experiment:
  - stimuli were identified as questions only at the final gate
  - listeners were confident at the final gate
- Both experiments show that
  - (i) sentence final cues are decisive for identification of sentence mode
  - (ii) raised pitch register is not used for sentence mode identification

- The data suggest that in Akan, sentence mode is signalled both globally with raised pitch register and locally with increased duration and intensity, and with a larger final fall in F0.
- The data further suggest that sentence mode perception relies on sentence-final local cues.
- Phonological representation:  
Akan yes-no questions exhibit a L% intonational boundary tone.
- Hence Akan belongs to the “accommodation”-type of tone-intonation interaction (cf. Hyman & Monaka 2008)
- Lexical tones and intonational tones peacefully coexist.

- Phonological representation:  
Akan yes-no questions exhibit a L% intonational boundary tone.
- Alternative analyses:
  - Addition of a mora would require greater lengthening effect (approx. as duration of single mora) (e.g. Rialland 2007).
  - Durational range variation in the data:
    - 43/279 questions – great lengthening of about 80-100%
    - 79/279 questions – slight lengthening of about 0-48%
  - An additional mora would require a lengthening of all realizations
- An extra tone, here a low boundary tone, causes durational lengthening.



- Akan yes-no question prosody shows both global and local phonetic parameters in production.
- In perception, only local parameters are necessary to identify sentence mode.
- The local phonetic parameters in combination with perception data suggest an analysis of a L% intonational boundary tone.  
(Phonological tones bear a functional component, which perceptually showed up in sentence mode identification)
- Akan belongs to the “accommodative”-type of languages with respect to tone-intonation interaction.

# Summary – Intonation in tone languages

- Tone languages indeed use intonation – which is in line with universal claims that every language uses intonation (e.g. Bolinger 1962, 1978)
- Ingredients of intonation are pitch accents and boundary tones; Tone languages use predominantly boundary tones (e.g. Akan L% in Yes-No-Questions, Genzel & Kügler accepted, Kügler 2016)
- However, superimposed tones are assumed in some languages, prominent example Emboshi (Bantu) (Rialland & Aborobongui 2016)
- In addition, variation in pitch register occurs wrt the prosodic expression of focus (cf. Mandarin register expansion, Xu 1999, and Akan register lowering, Kügler & Genzel 2012)
- Pitch register variation can also be found wrt sentence mode – all tone languages mentioned today showed a global pitch register raising in case of Yes-No-Questions

# Summary – Intonation in tone languages

Recommended recent volume on African tone languages:

Downing, L.J. & Rialland, A. 2016. Intonation in African Tone Languages. Berlin: Mouton

- Overview of focus prosody (p.7)  
Four out of 12 languages use focus prosody

	Focus prosody?	If so, type of marking
Akan	<u>yes</u>	phrasing; pitch lowering
Basaa	no	
Bemba	<u>yes</u>	pre-focus pitch raising; pitch compression from the focussed word
Chichewa	no	
Chimiini	<u>yes</u>	suspension of downstep; accent placement
Embosi	no	
Konni	no	phrasing
Mambila	no	
Moro	no	
Shingazidja	<u>yes</u>	
Tumbuka	no	
Tswana	no	

# Summary – Intonation in tone languages

Recommended recent volume on African tone languages:

Downing, L.J. & Rialland, A. 2016. *Intonation in African Tone Languages*. Berlin: Mouton

## ■ Overview of prosody in sentence mode (p.7)

- Many languages use boundary tones (L%, H% or more complex ones)
- Almost all languages show an effect of register raising
- Other cues as lengthening or local tonal raising occur

	Tones	Falling intonation	Downdrift suppression	V length	Raising of first or last H(s)	Register raising/ expansion
Akan	H/L	L%	–	lengthening	–	+
Basaa	H/L	– (but -è in some contexts)	–	lengthening in some contexts	–	+
Bemba	H/∅	L%	+	–	–	+
Chichewa	H/∅	L H L%	+	–	–	irregular
Chimiini	H/∅	L%	–	–	+ last H (optional)	+
Embosi	H/L	L%	–	–	+ last H	+
Konni	H/L	'H, L, H'H	–	lengthening	–	+
Mambila	T1, T2, T3, T4	–	–	–	–	–
Moro	H/∅	L% -à (optional)	–	–	+ first H(s) or all H(s)	+
Shingazidja	H/∅	L%	+	–	+ penultimate supra-high	+
Tumbuka	H/∅	L H L%	–	–	+ last H(s)	+
Tswana	H/∅	L% only in all L sequences à (optional)	–	Suppression of penultimate lengthening	–	+

# Summary – Intonation in tone languages

## Other phenomena

- Pitch reset at phrase boundaries (e.g. Akan, Kügler 2016)

## More local, word-level phenomena such as

- local tonal interactions like downtrends
- tonal coarticulation
- tone sandhi

may all shape and influence the surface intonation contour of a tone language (cf. the collection of studies in Downing & Rialland 2016).



## Sonderforschungsbereich 632

Informationsstruktur:  
Die sprachlichen Mittel der Gliederung von Äußerung, Satz und Text



# Thank you!



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