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Early Intonation in European Portuguese

Sónia Frota & Marina Vigário

Universidade de Lisboa
Dep. Linguística / Laboratório de Fonética da FLUL (LinSe-CLUL)
http://www.fl.ul.pt/laboratoriofonetica/

1. Introduction

- Early intonational development in European Portuguese (EP) is largely unstudied.
- Prior work focused only on overall contour shape (Frota & Vigário 1993, 1995): a high proportion of falling contours between 0;6 and 2;0 (both in babbling and words); rising contours appear later and are relatively infrequent (Boysson-Bardies et al. 1984, Robb et al. 1989)
- In prior work the structural properties of the target language intonation system, or the pragmatic meaning of early utterances were not taken into account.

1. Introduction

- Recent studies have reported different results on the relation between the acquisition of intonation and the development of grammar (and the lexicon):
  - Adult inventory acquired before the two-word stage; tone-text alignment mastered from the beginning; pitch scaling mastered later (Catalan: Prieto & Vanrell 2007, Prieto et al. 2008);
  - Adult inventory not acquired before the two-word stage; systematic differences in peak alignment between early CS and AS; correlation with vocabulary size (Dutch: Chen & Fikkert 2007);
  - Intonational development associated with the onset of word combinations; accent range at 1;06 similar to 4;00 (English: Snow 2006).

1. Introduction

- Our first goal: to describe the intonational properties of early utterances in EP in the AM framework
  - We address three questions:

  1. Is the inventory of pitch accents and boundary tones adult-like?
  2. Does the child master the alignment and scaling properties of tonal events?
  3. What does intonation tell us about other **prosodic properties** of early utterances, namely word stress and prosodic phrasing)?
- Our second goal: to assess whether intonational development is correlated with grammatical and lexical development

2. Method

- **A case study**

One monolingual child aged between 1;00 and 2;02 (L)

Empirical database:

- a longitudinal corpus of every other week videotape recordings of about 60 minutes each (inv+par; Lab. Psicolinguística, FLUL)

- a corpus of audio recordings made on a nearly daily basis (par; Lab. Fonética, FLUL; available)

- **Materials**

443 utterances (all 1 & 2 word meaningful utterances from 1;00 to 1;05; first 20 utterances from 1;06 to 1;11 and 2;02). 22 utts were unusable (poor sound quality) > 421

Average 32,4 utts / month

Criteria for meaningful utterances:

1. Relation to adult word
2. Context: appropriate use
3. Consistency (in relevant stage)
4. Adult confirmation (interaction)

CDS: exploratory analysis random sample of 50 utterances

2. Method

- **Transcriptions**

Video DB: targets orthographically and phonetically transcribed in PHON (S. Correia & T. Costa); actual child production transcribed by 1 of the authors; utterances exported for analysis (wav format)

Audio DB: targets and actual production orthographically and phonetically transcribed (M. Cruz & 1 of the authors)

- **Analysis**

Perceptual analysis > utterance type and pragmatic meaning

Prosodic analysis > prosodic transcription and main differences between child and adult patterns (choice of tonal events; alignment; scaling) Praat and SpeechStation2

Reliability of prosodic transcription on the basis of 20 utts: 95% (nuclear contour)

For Video DB, F0 values of H and L targets in nuclear position were measured (225 utterances)

For both DBs, duration of intervals or stop Cs within & between disyllabic words

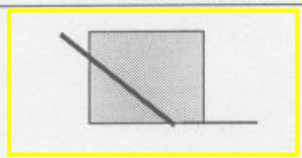
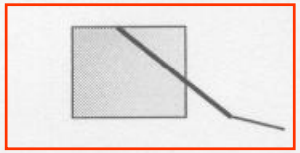
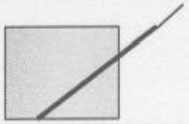
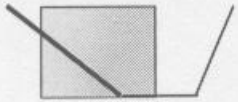
2. Method

- **Prosodic analysis**

Guided by the description of EP prosody in Frota 2000, 2002, 2008, and Viana & Frota 2007

H+L* is the most common nuclear accent

Table 1. EP tunes: labels, realization of the nuclear contour, usage.

Labels	Realization	Context/Meaning
(H) H+L* L%		Neutral declarative Topic phrase
(H) H*+L L% (H) H*+L !H+L* L%		Focused declarative Early focus
L*+H H%		Continuation Parenthetical
(H) H+L* L%		Wh-question
(H) H+L* LH%		Neutral yes-no question

2. Method

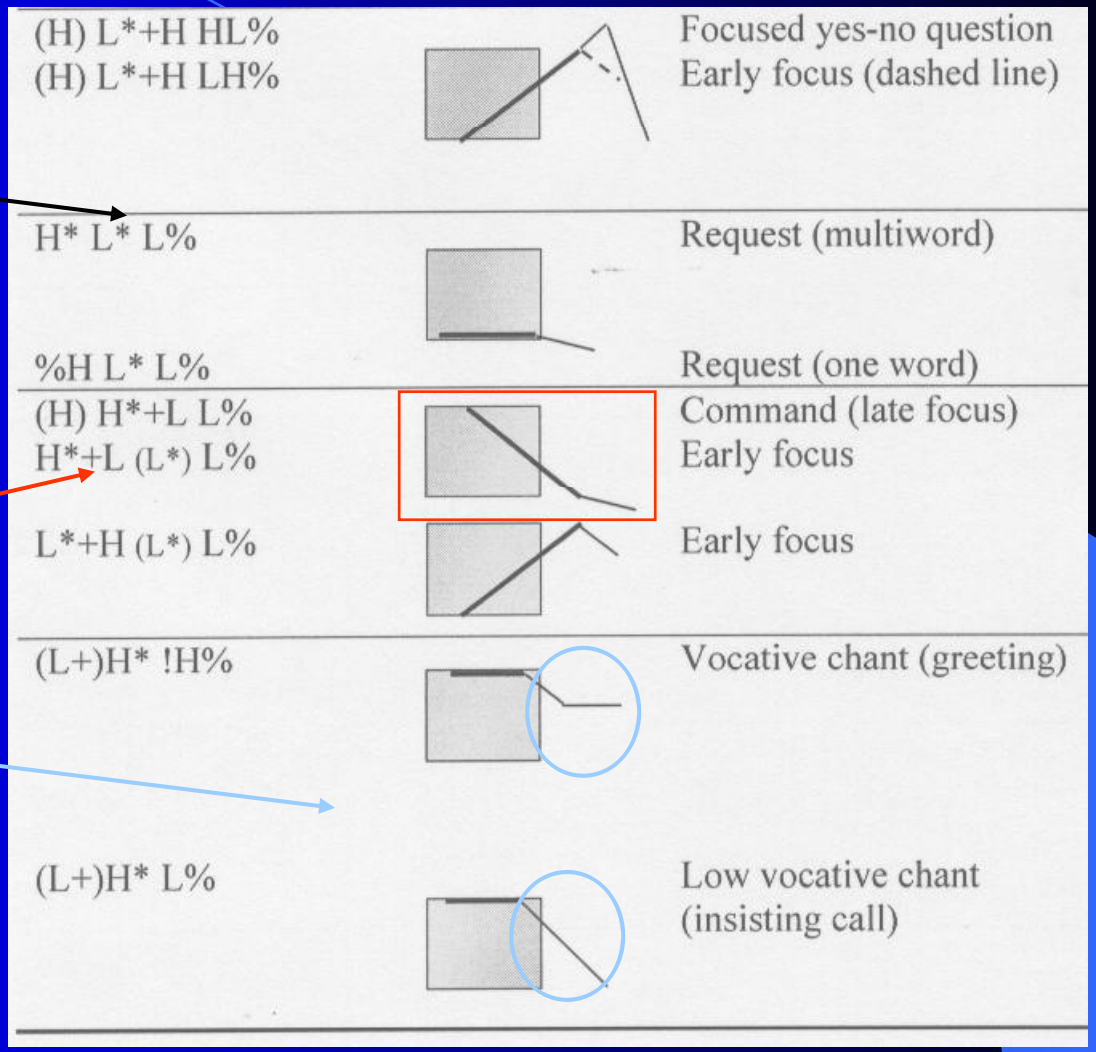
Our observations strongly suggest that the same set of contours is used in **CDS** (although with wider pitch range)

Requests are all low

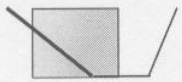
H*+L is used in focused declaratives and commands

Two kinds of calling contours

Only 17% of IP-internal stressed syll are accented



(H) H+L* LH%



Neutral yes-no question

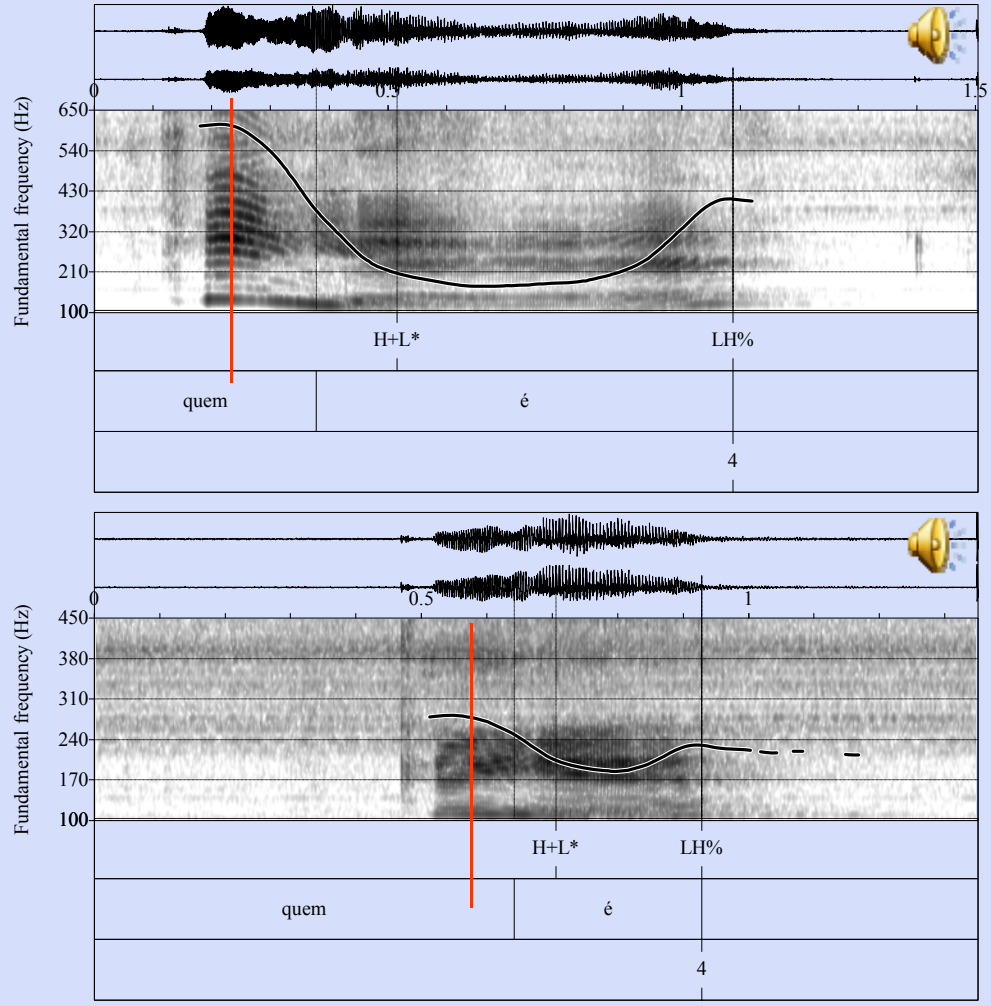
CDS: exploratory analysis

Same type of contour
Same alignment
Scaling **may** differ
(even distribution)

Random sample: 50 utterances; 1:00 – 1.10; several utt types; 20 utts unusable for acoustic analysis

Perceptual analysis: classification as AD-like (pitchwise) or Diff=Exp F0

Analysis of F0 contour: tonal shape, alignment, scaling (H & L targets)

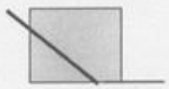


Exp

1;06

AD

(H) H+L* L%



Neutral declarative

CDS: exploratory analysis

- Same type of contour
- Same alignment
- Scaling **may** differ (even distribution)

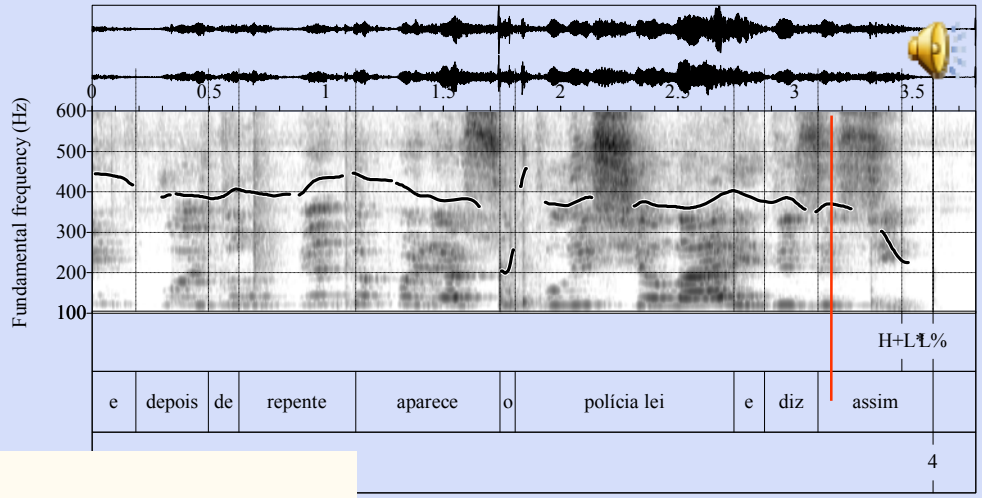
Kruskal-Wallis ANOVA

Speaker: H, L, Range NS

(p =,291; p =,322; p =,294

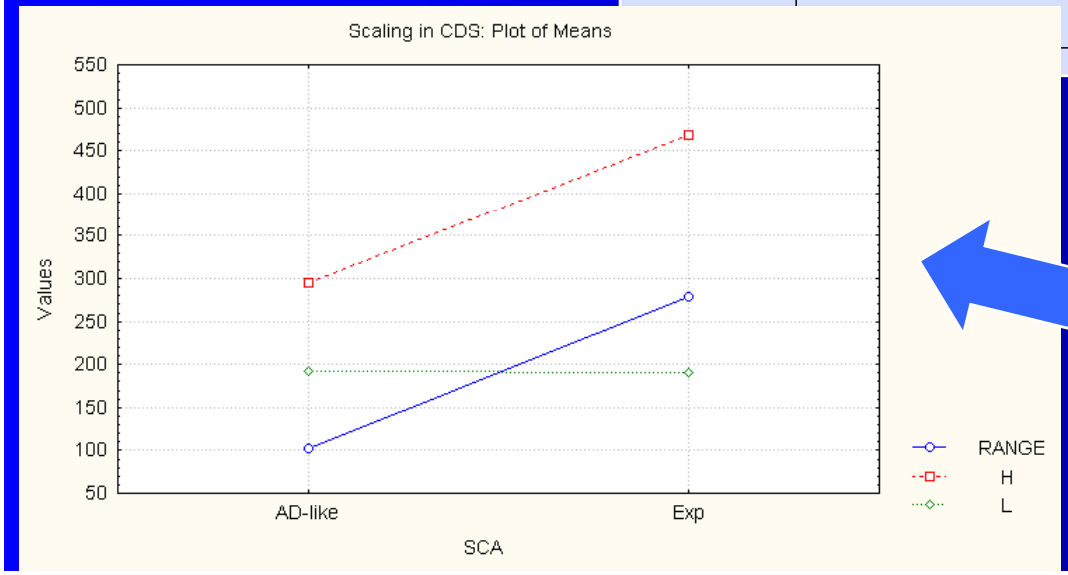
Utt type: H, L, Range NS

(p =,7095; p =,575; p =,046



Exp

1;04



Kruskal-Wallis ANOVA

Perceptual Scaling:

H, Range > Sig

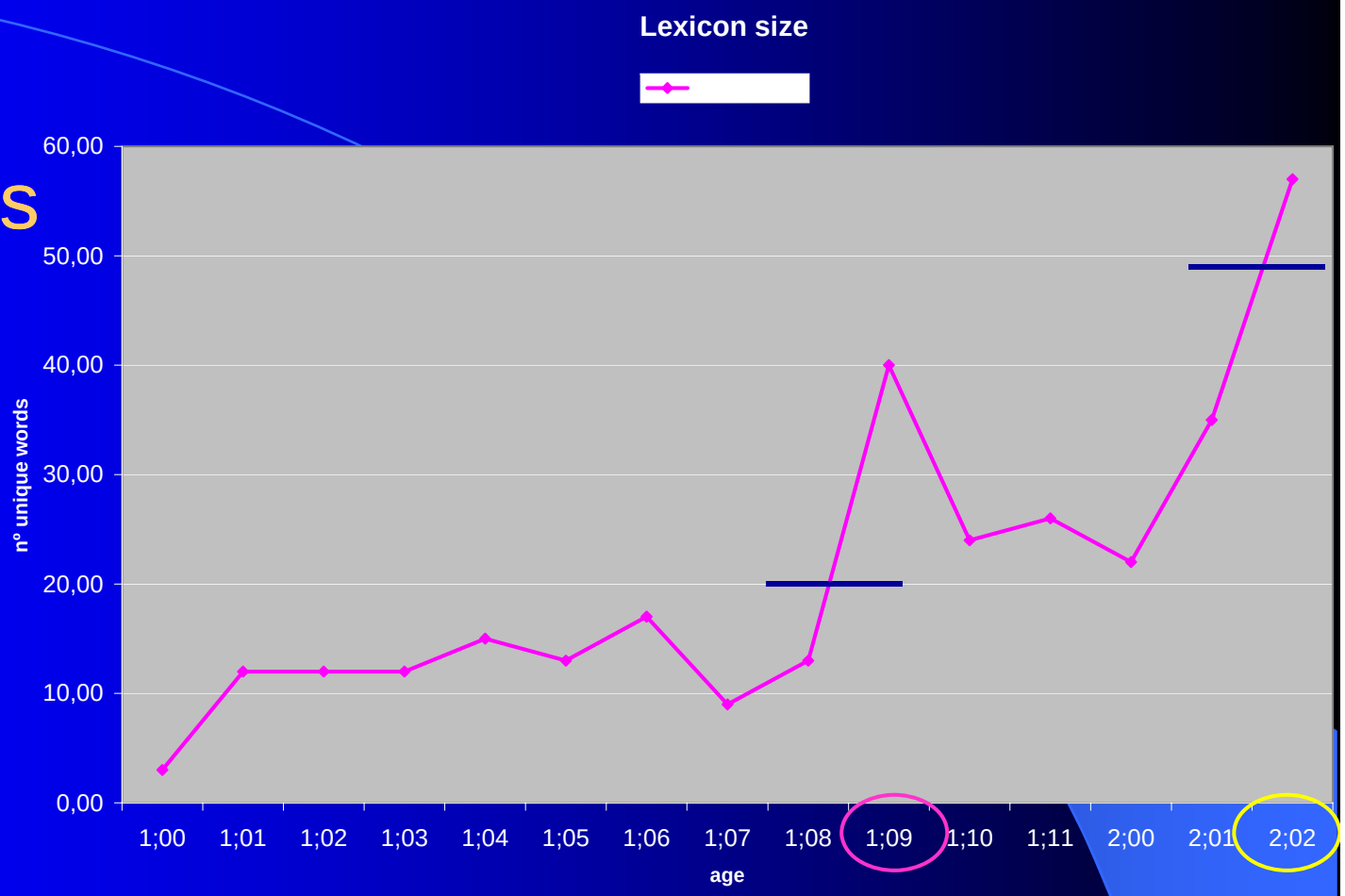
(p =,0000; p =,0000)

L > NS

(p =,5714)

3. Results

- Intonation and language development

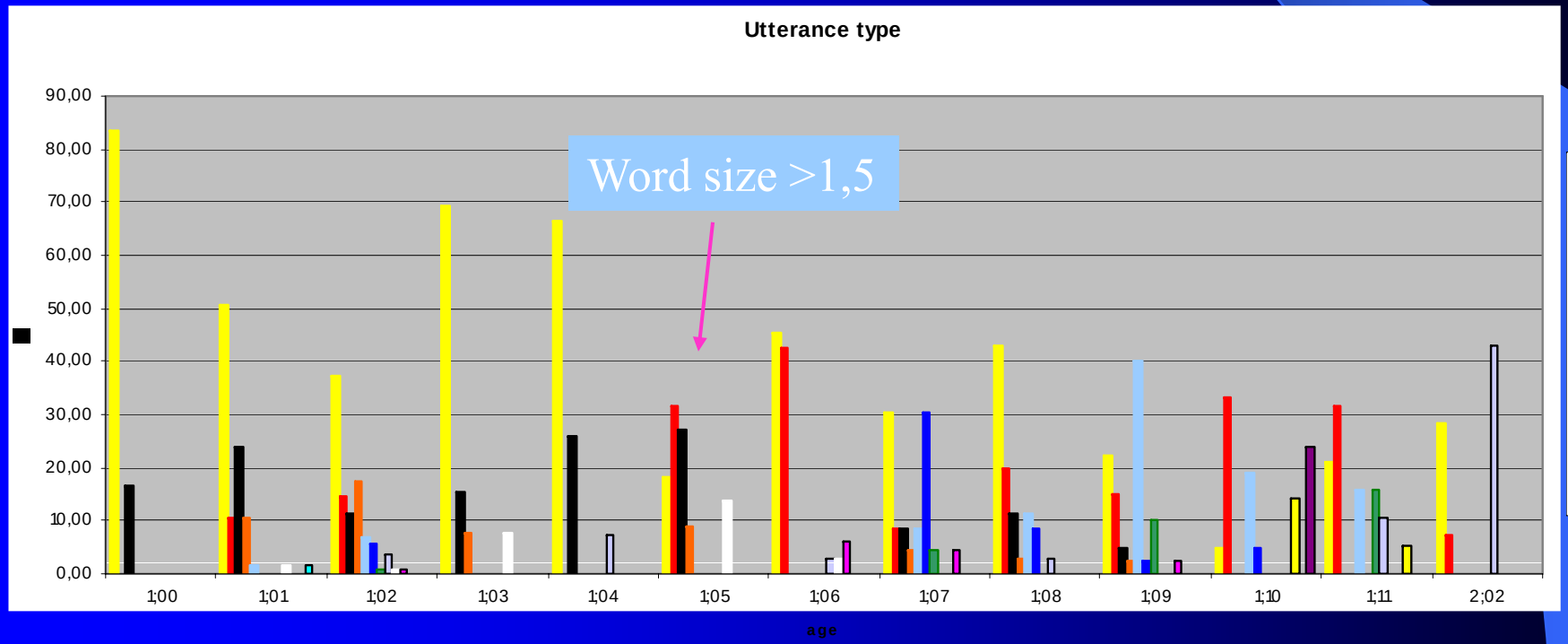


	1;00	1;01	1;02	1;03	1;04	1;05	1;06	1;07	1;08	1;09	1;10	1;11	2;00	2;01	2;02
MLUw	1,06	1,14	1,10	1;03	1,18	1,05	1,20	1,29	1,26	1,46	1,25	1,18	1,06	1,07	1,67
wsize	1,13	1,37	1,62	1,40	1,52	1,54	1,53	1,72	1,43	1,63	1,70	1,88	nd	nd	1,80

3. Results

- Utterance type

38,95	Decl
17,10	Foc
12,35	Req
7,36	Com
8,79	Call
4,28	Low call



3. Results

- Utterance type

H L

38,95	Decl
17,10	Foc
12,35	Req
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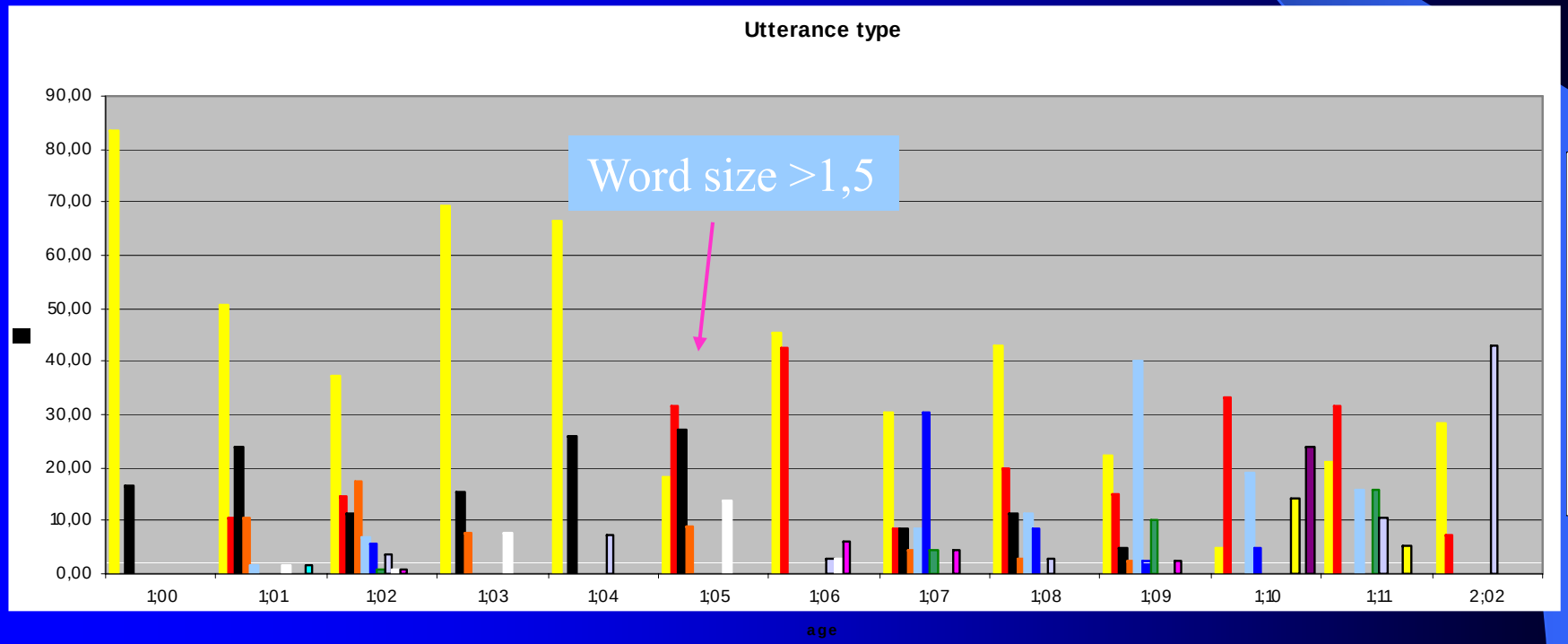
8,79	Call
4,28	Low call



H* L* L%

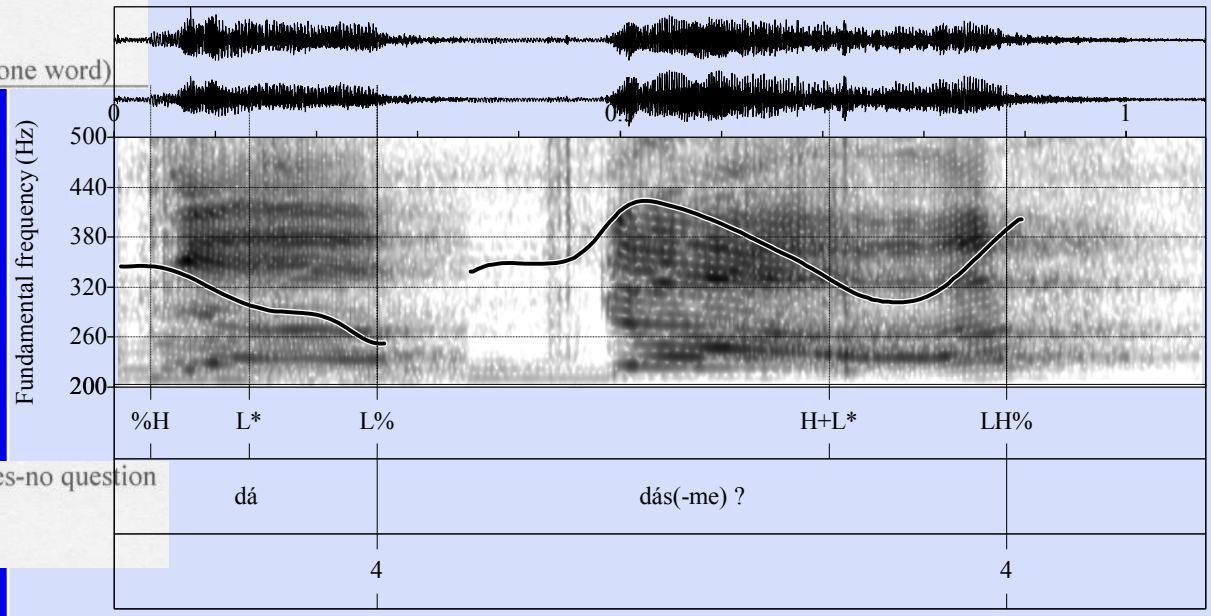
Request (multiword)

%H L* L%

Request (one word)

Request
Question

1;05



(H) H+L* LH%

Neutral yes-no question

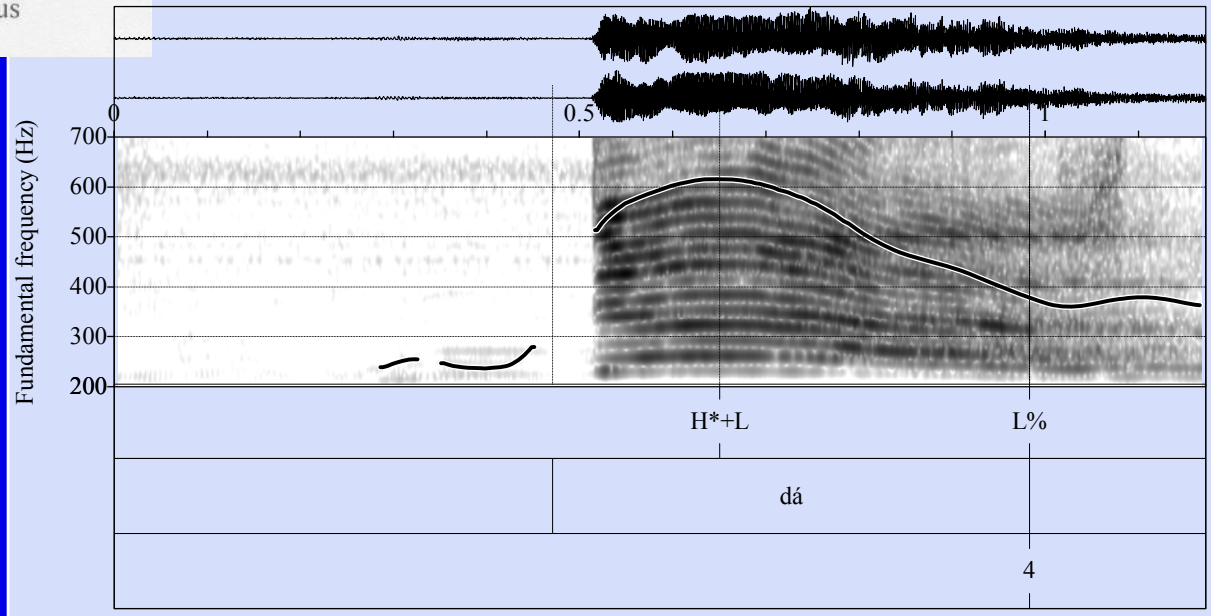
(H) H*+L L%
H*+L (L*) L%

Command (late focus)
Early focus

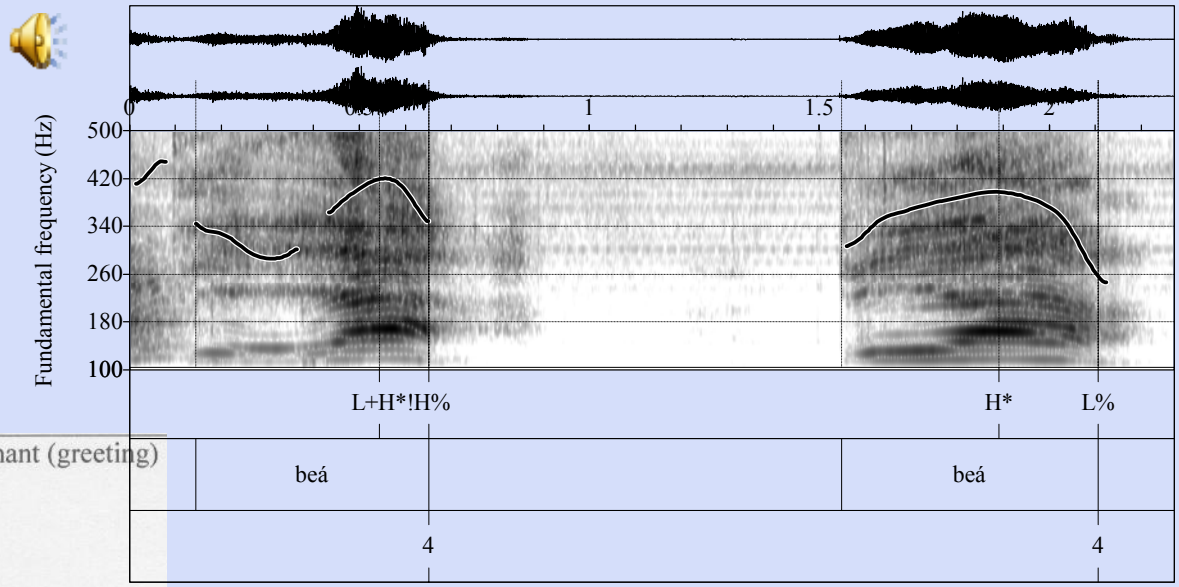
Command

1;05

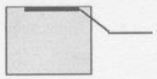
´da ‘give’



Call
Low call
1;07
be´a be´a ‘Mami, Mami’

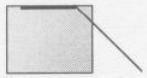


(L+)H* !H%



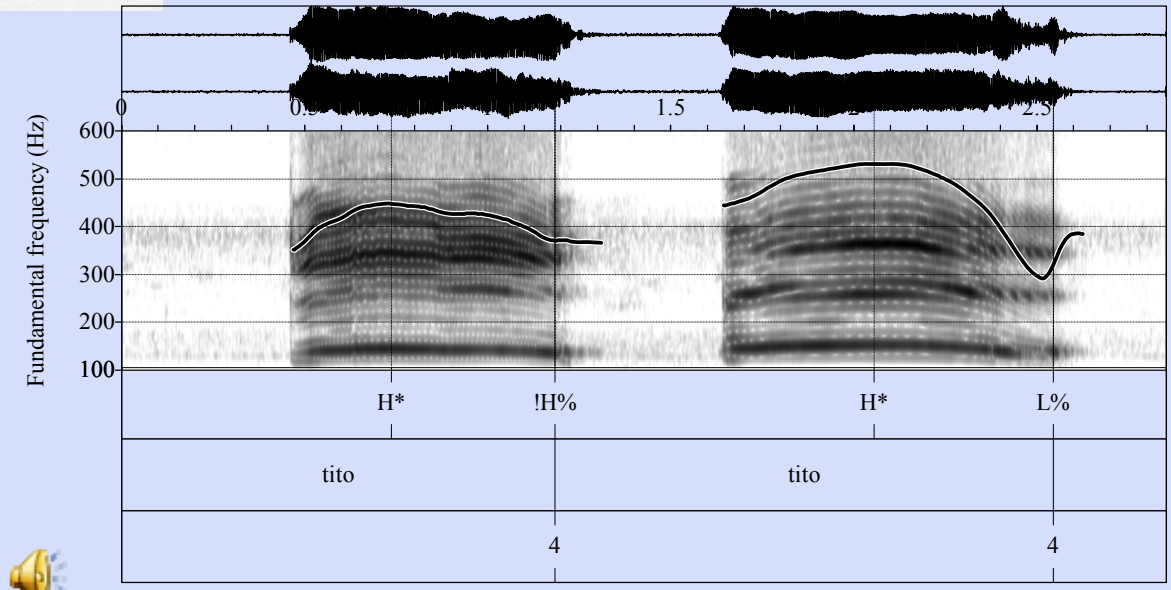
Vocative chant (greeting)

(L+)H* L%



Low vocative chant
(insisting call)

Call
Low call
1;08
´te: ´te: ‘Tito, Tito’



3. Results

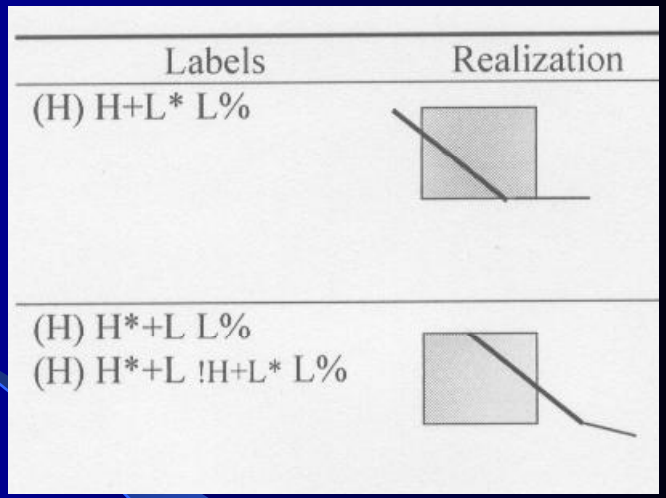
Decl	91
Focus	100
Req	21
Com	97
Calling	89
Low call	100
Int	14

- Choice of tonal events (% correct shape)
- Main deviant patterns

AS/CDS: Decl: H+L* L% Req: H L* L% Com: H*L L%
Call: (L)H* !H Int: H+L* LH%

	1;00	1;01	1;02	1;03	1;04	1;05	1;06	1;07	1;08	1;09	1;10	1;11	2;02
dec		lev	lev										
req	LH	call	call	call	LH	call		H*L	call	call			
com			HL*										
call		L*H ^L	^H+ L*								H%		
int		LH*	L*H	L*H		L*H	H*L						

3. Results



- Alignment

An alignment based distinction:

nuclear accent of neutral / focused decl

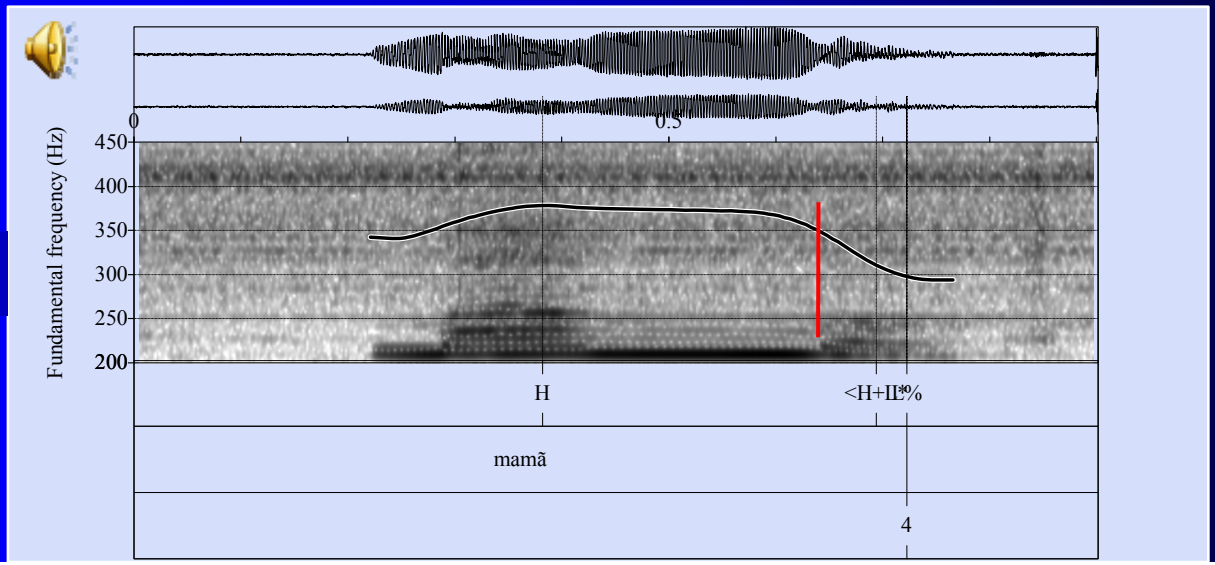
- H+L*: Alignment of the leading peak is not consistently adult-like until **1;09**: main pattern is <H+L* (L also tends to align later than in Adult EP)
- H*+L: Alignment of H* is adult-like much earlier – 1;02

Decl

1;05

´m6´m6~

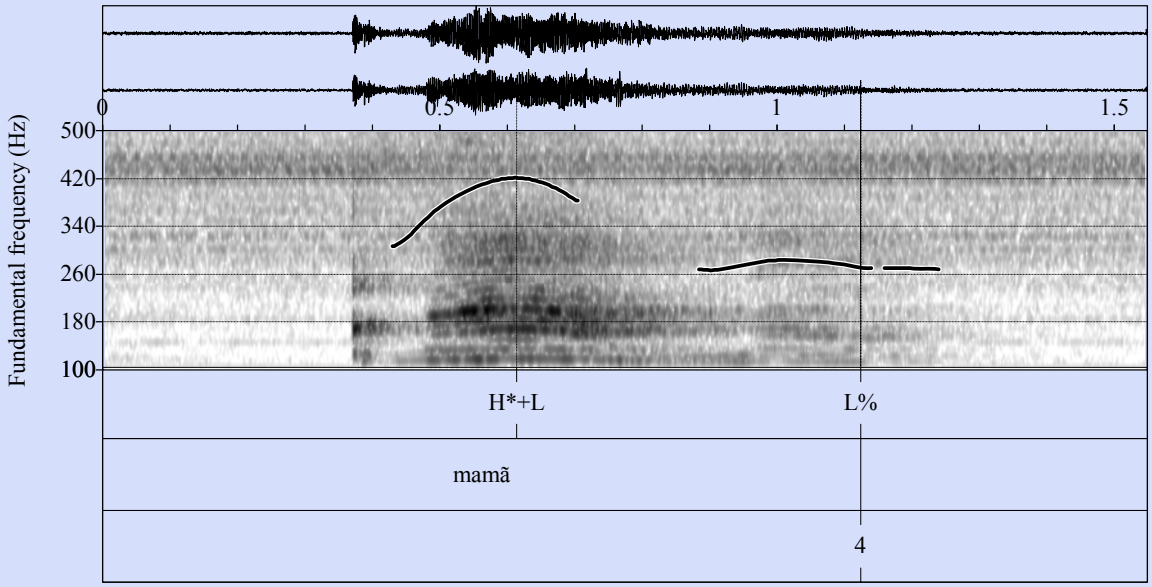
'mum'



Foc

1;06

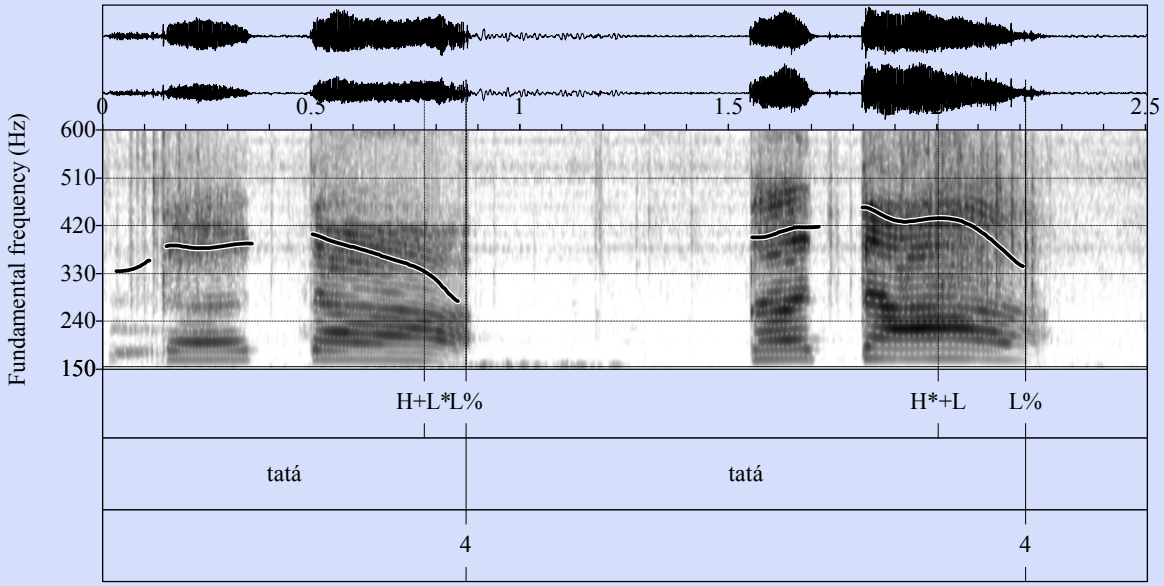
´m6m6 ‘mum’



Decl
Foc

1;09

ta´ta ta´ta ‘Tata. Tata’



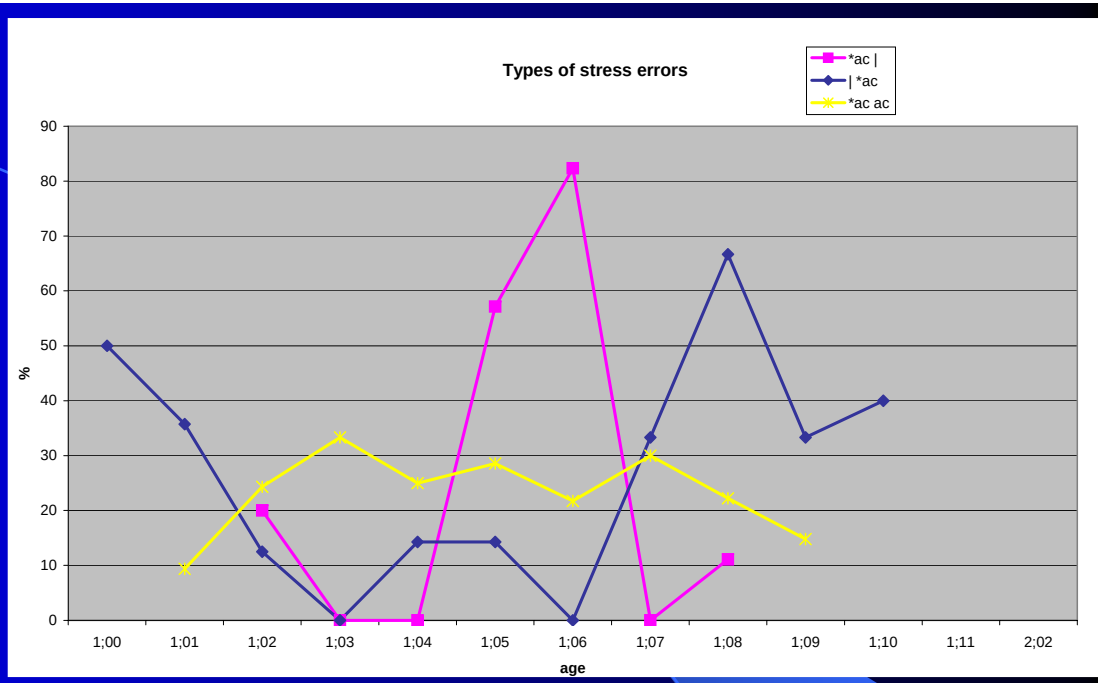
3. Results

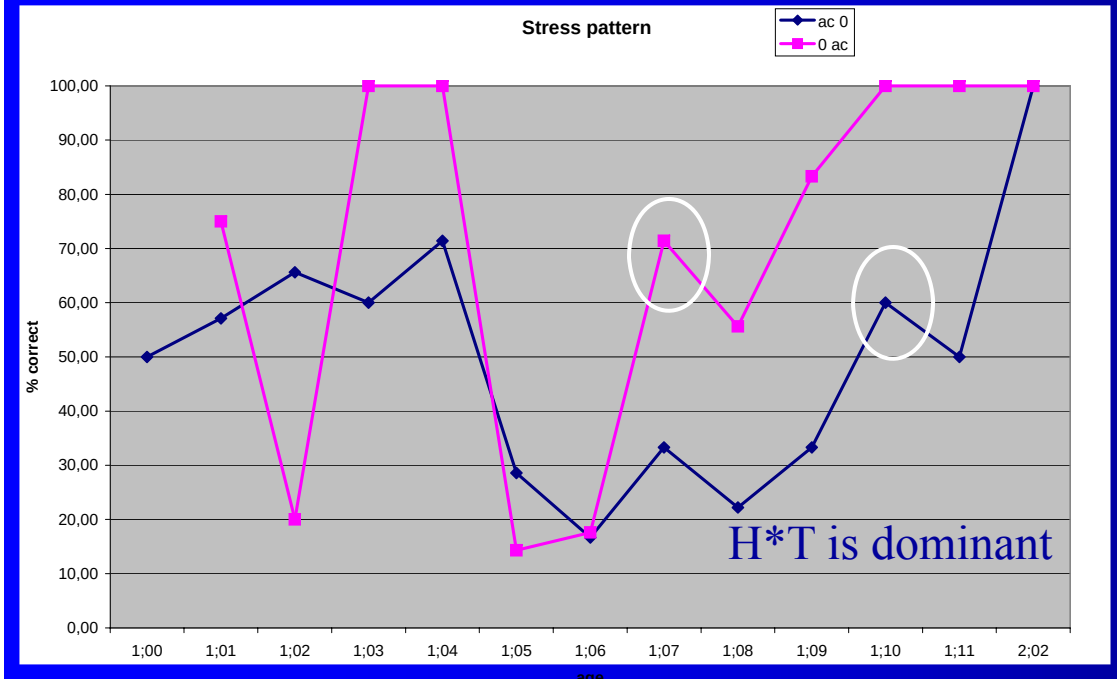
- Accent and Stress

Stress patterns in disyllables:

Initially: level stress and stress shift

Final stress becames stable first





Level stress: with different pitch accents & both final and penult

´m6´m6~ (1;05) m6´m6~ 'mum'
´pa´pa (1;06) ´bOl6 'ball'

R Stress shift: with diff accents, including H+L* and H*+L

pa´pa (1;08) ´bOl6 'ball'

L Stress shift: with H*+L

´m6m6 (1;06) m6´m6~ 'mum'

3. Results

- Accent and Stress

Our findings strongly suggest an interplay between accent and stress in acquisition

Input

Stress patterns in EP: Penult 76%; Final 22%+ Monosyl 22% Frota et al. 2006

Phrasal prominence is final

Main phonetic correlate for word stress: duration Delgado Martins 2002

Stress is not cued by tone: pitch accent distribution is sparse (only 17% of IP-internal word stresses are pitch accented Vigário & Frota 2003)

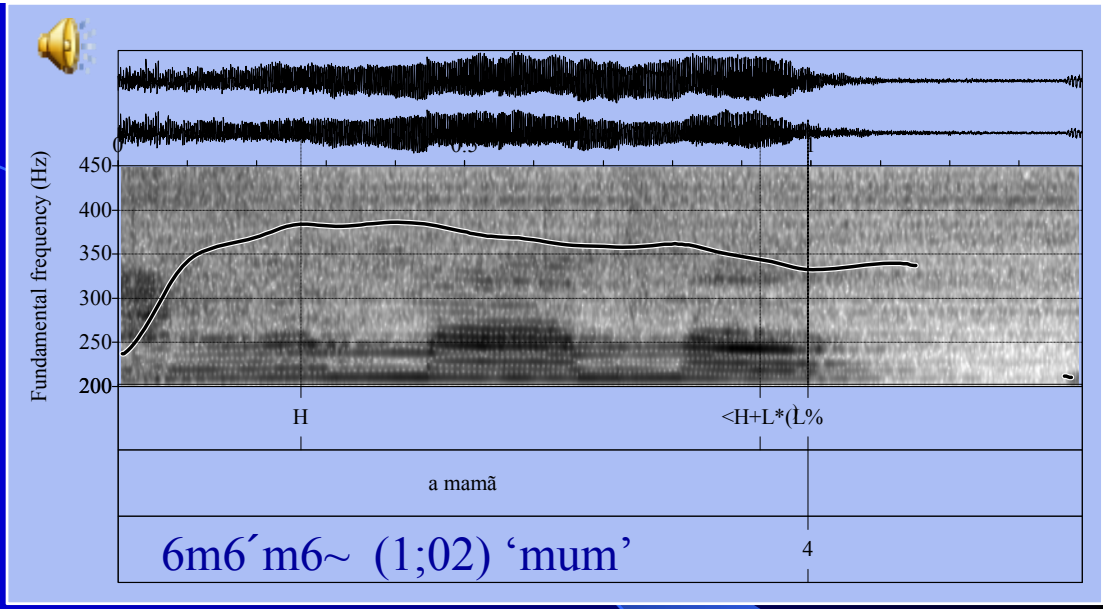
HL* is the most common nuclear accent

Assuming *Heads must bear a H tone* (≈initial bias), along the lines of de Lacy 2002, 2007, Yip 2007) + properties of EP

May account for (i) why stress is not straightforward, (ii) tendency to have H*T with penult stress or L stress shift, (iii) initial **later alignment** of leading H in HL* (no L stress shift with HL*)

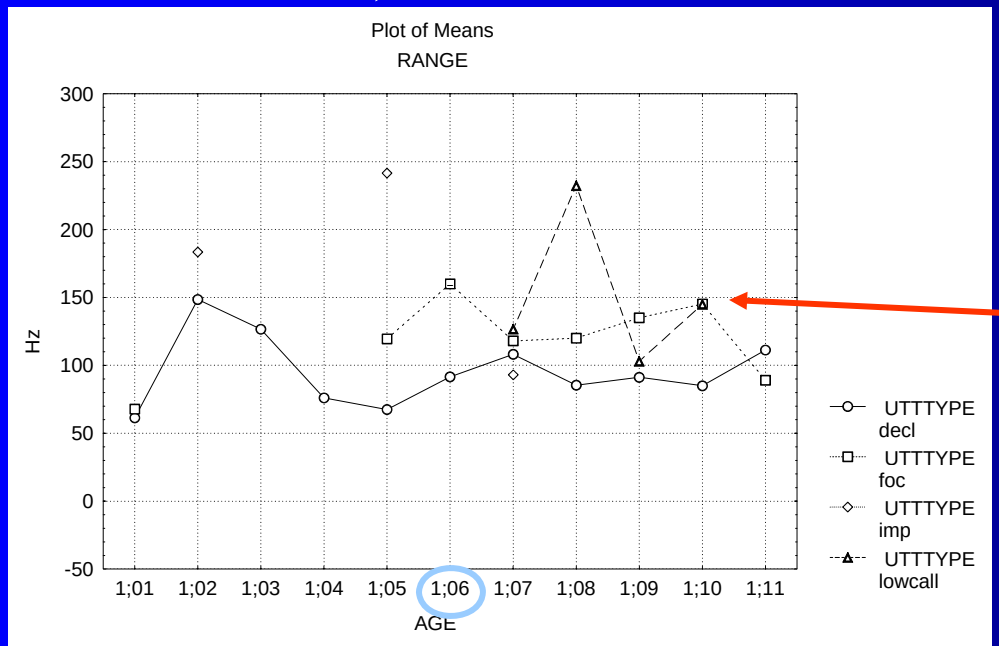
3. Results

- Scaling



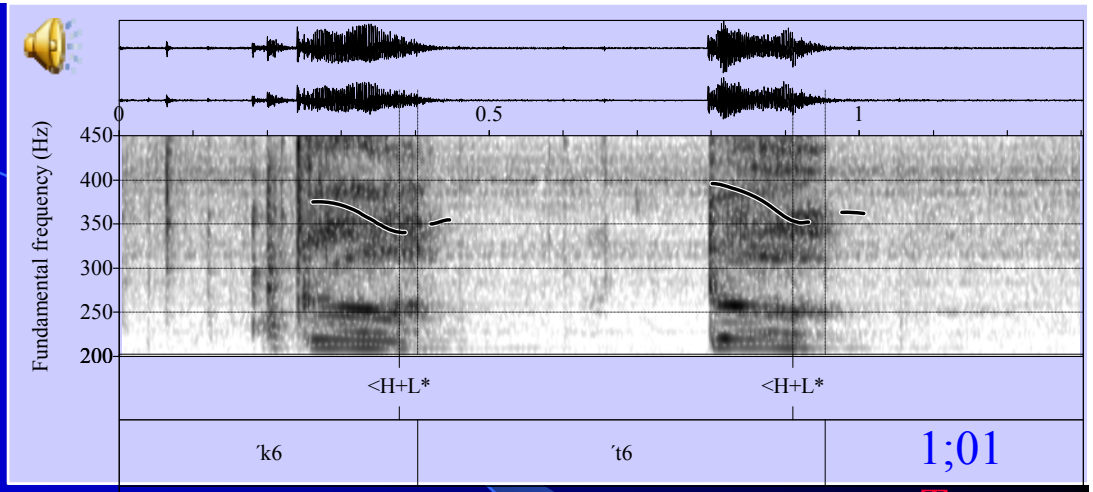
Pitch scaling properties are not mastered from the beginning.

Scaling seems to become stable before alignment (at least for declaratives - around **1;06**).



Other aspects of use of accent range approach adult-like status: wider range in the focus accent (optional feature in Adult EP, frequent in the some speakers)

3. Results



- Phrasing

Initial stage: disyllabic targets, if uttered with 2 syllables, tend to be produced with one pitch accent per syllable (usually falling accent)

88.4% of such cases occur until **1;04**;

44% of words uttered with 2 syllables show 2 pitch accents (n=38/87)

End of this stage coincides with the onset of disyllabic words: word size > 1.5 at 1;04

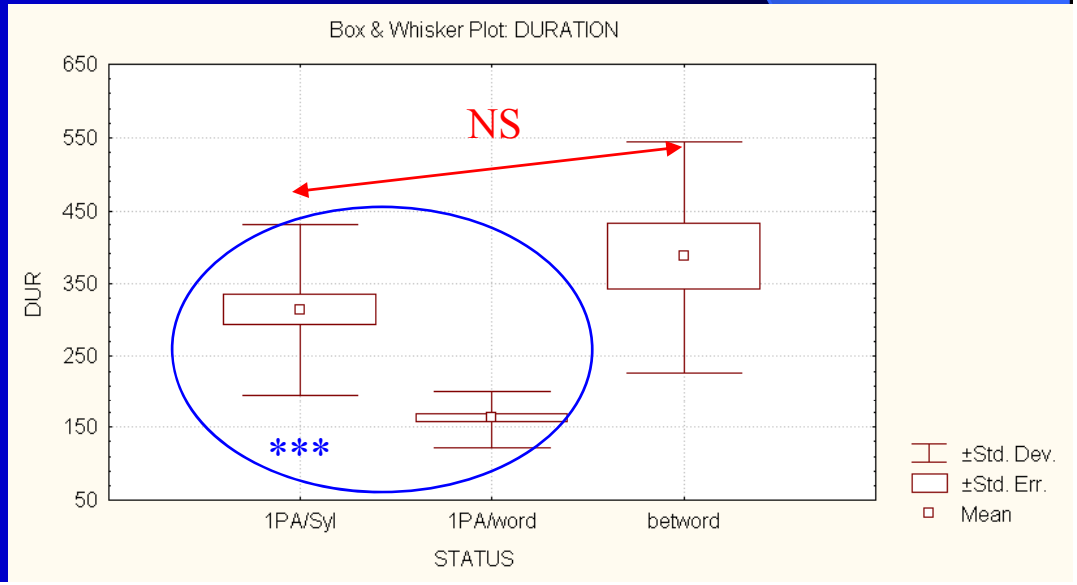
Other properties:

level stress predominates (64%)

longer **duration** of C2 in C1VC2V (similar to C2 between words)

e.g. Demuth & McCullough 2008

Suggests: syllable≈PW≈phrase>> PW≈phrase



4. Summary

- Choice of tonal events (for the range of contours produced) is mostly correct as early as at 1;05; coincides with (i) use of a variety of utterance types, (ii) word size > 1.5
- Inventory of pitch accents and boundary tones is adult-like at 1;09 (=Catalan); coincides with lexicon size > 20)
- No early mastery of tone-text alignment (≠Catalan, =Dutch): initially <H+L*. At **1;09** alignment similar to AEP. Initially, level stress and stress shift. After **1;09**, stress patterns stable. Interplay between pitch accent and stress.
- Scaling not mastered from the beginning. It seems to become stable before alignment (≠Cat), for Decl. at 1;06. But there are aspects of scaling not mastered until later (!H in calls).
- Evidence (tonal, duration) for the construction of prosodic phrasing

5. Conclusions

- Intonational development largely independent of the onset of the two-word stage (for L: 2;02). [similar to Catalan, but unlike in English or Dutch]:
  - Adult-like inventory of intonation contours
  - Appropriate use of distinct tunes for specific pragmatic meanings (e.g. Decl, Foc, Com, Req)
  - Development in the production of alignment and scaling patterns (1;09)
- Evidence that intonational development is correlated with increase in vocabulary size [as suggested for Dutch]

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Thank you

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