

INTONATION RESEARCH AND THE AUTOSEGMENTAL-METRICAL MODEL OF INTONATIONAL PHONOLOGY

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PART I

- Challenging features of intonation
- How they are addressed in different models
- How AM comes closer to addressing them

PART II

- **AM and phonetics**
- **Practical aspects of**
 - **doing research on intonation**
 - **using AM principles for intonation analysis**



Relevant publications

1. Arvaniti, A. To appear [expected: 2021]. The Autosegmental-Metrical model of intonational phonology. In S. Shattuck-Hufnagel & J. Barnes (eds), *Prosodic Theory and Practice*. The MIT Press. [[pdf of submission](#)]
2. Arvaniti, A. 2020. The phonetics of prosody. In M. Aronoff (Editor in Chief), *Oxford Research Encyclopedia of Linguistics*. Oxford: Oxford University Press. <https://oxfordre.com/linguistics/> [[pdf](#)]
3. Arvaniti, A. & Janet Fletcher. 2020. The Autosegmental-Metrical theory of intonational phonology. In C. Gussenhoven & A. Chen (eds), *The Oxford Handbook of Language Prosody*, pp. 78-95. Oxford University Press.
4. D'Imperio, M., B. Gili Fivela, M. Baltazani, B. Post & A. Vella. 2020. Southern Europe. In C. Gussenhoven & A. Chen (eds), *The Oxford Handbook of Language Prosody*, pp. 236-250. Oxford: Oxford University Press.

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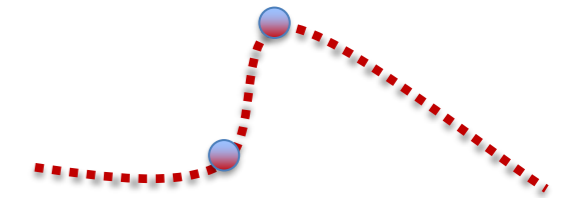
Intonation, tones and metrical structure

- Tones create melodies, many of which are very frequent; e.g. **H* L-L%** is the most common melody for English and Greek declaratives (what may be described as a fall)
- The autosegmental representation of melodies also includes information as to how the tones associate with the segmental string via the metrical structure: this is known as the **tune-text association**
- AM assumes the existence of a **metrical structure** that is independent of a language's melodies
- This structure provides the necessary information:
 - prominence relations among constituents (*heads*, informally *stresses*)
 - position of phrasal (and other constituent) boundaries
- Tones associate with the **heads** and **edges** of metrical constituents
- Whether tones associate with both heads and edges is language specific;
 - e.g. languages that do not have stress, such as Korean, only show tone associations with phrasal boundaries



Phonetic realization of tones in AM

- AM includes a theory of how its abstract representations are phonetically realized
- Phonological tones are realized as **tonal targets**, specific points in the F0 contour defined along two dimensions:
- **Scaling** = their F0 or pitch
- **Alignment** = their temporal position with respect to **segmental landmarks**
- Tonal targets often are local minima and maxima of F0
- This does not mean that all minima and maxima are tonal targets: the tonal targets depend on our phonological analysis
- **Segmental landmarks** are likely to be TBUs (tone bearing units): syllables, moras, vowels, sonorant consonants, depending on the language

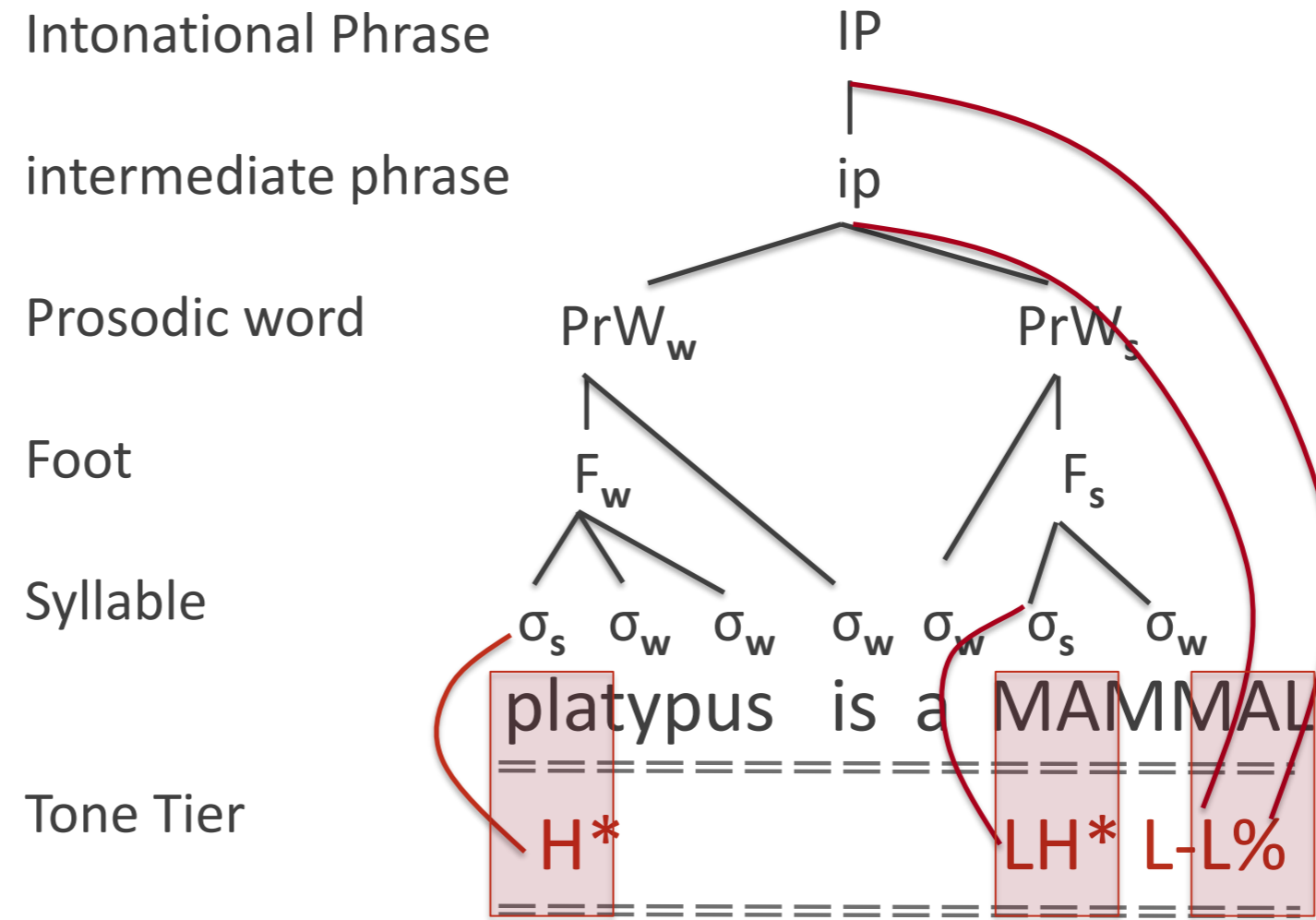
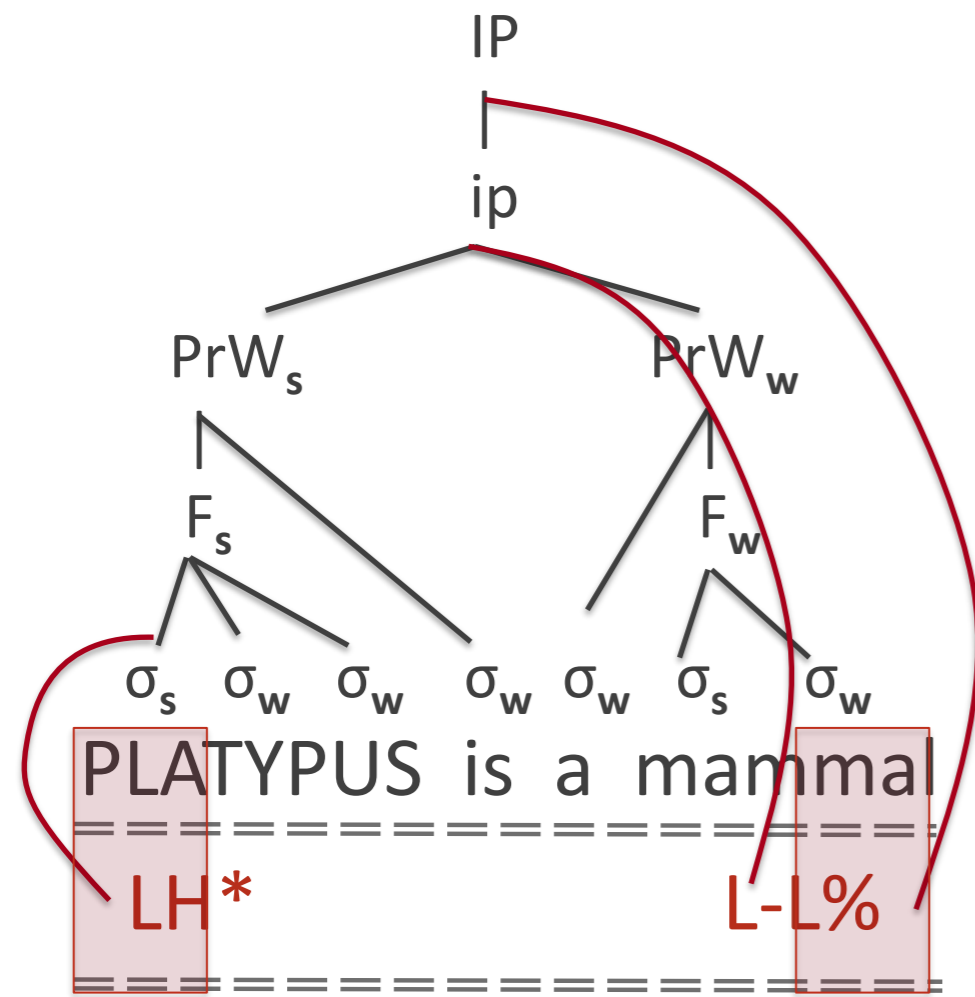


Landmarks and intonational events

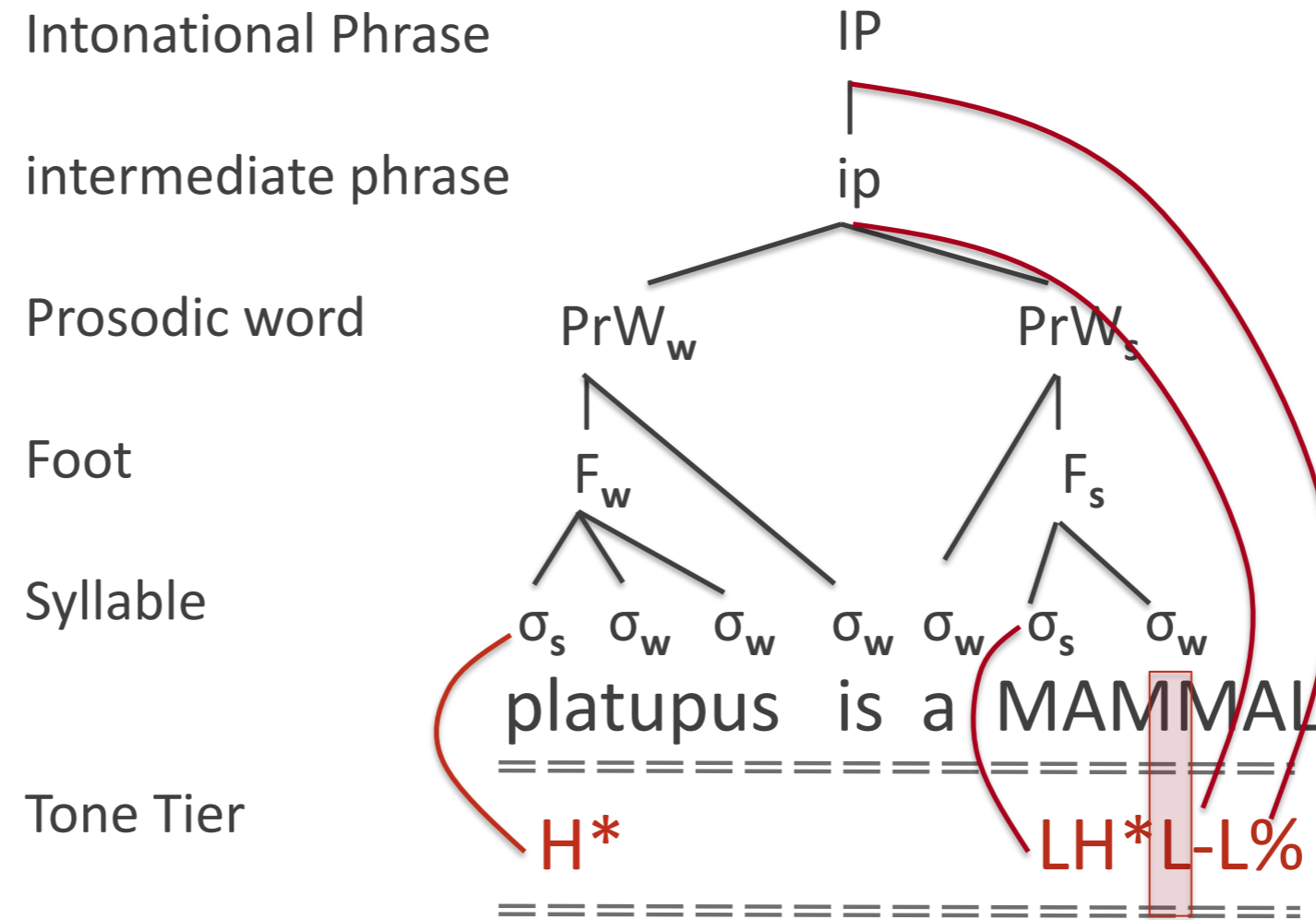
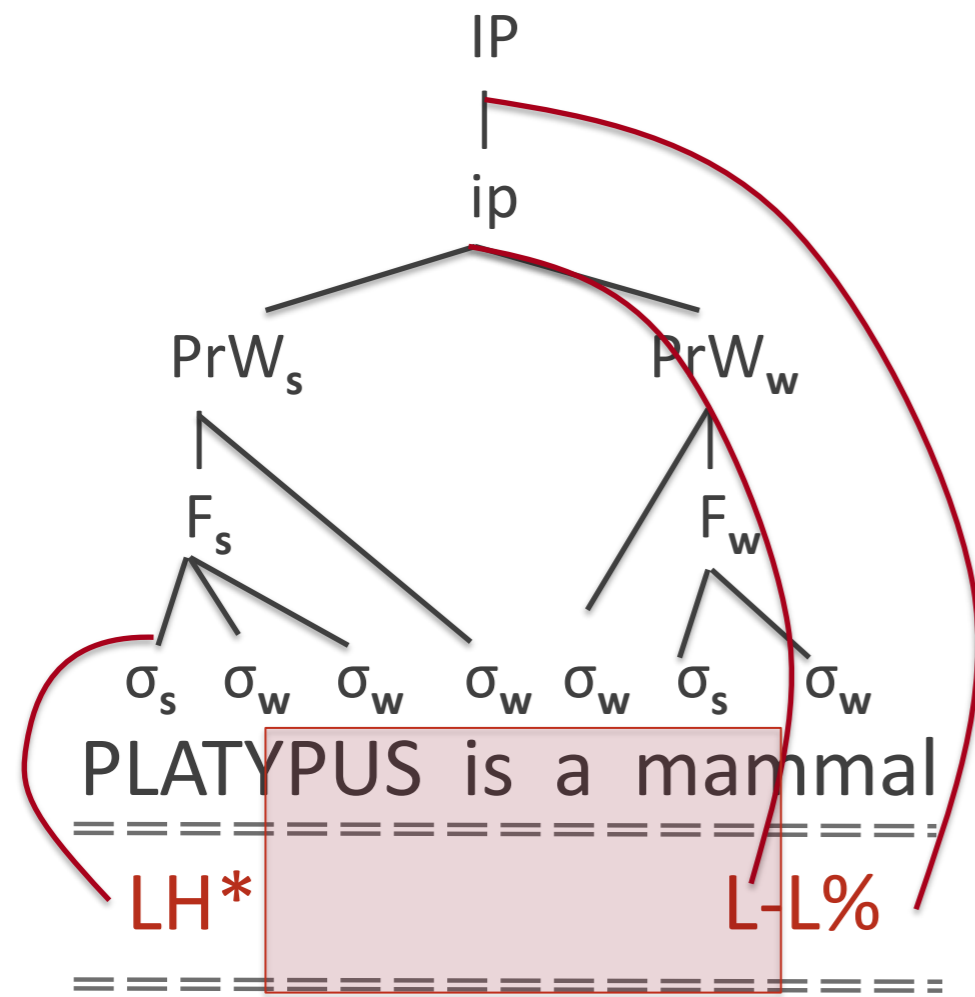
- Landmarks depend on the type of **intonational event**; roughly
 - pitch accents co-occur with accented syllables
 - the tones of pitch accents may occur before or after the accented syllable (one way to see this is to say that the duration of the pitch accent is longer than that of the syllable it is associated with)
 - boundary tones phonetically align with IP boundary-adjacent syllables (vowels or the final mora)
 - phrase accents behave phonetically like boundary tones (but aligning with ip boundaries)
 - phrase accents may also
 - spread
 - be realized on stressed syllables *without being pitch accents* (Grice et al., *Phonology*, 2000)



Metrical structure and association to tones

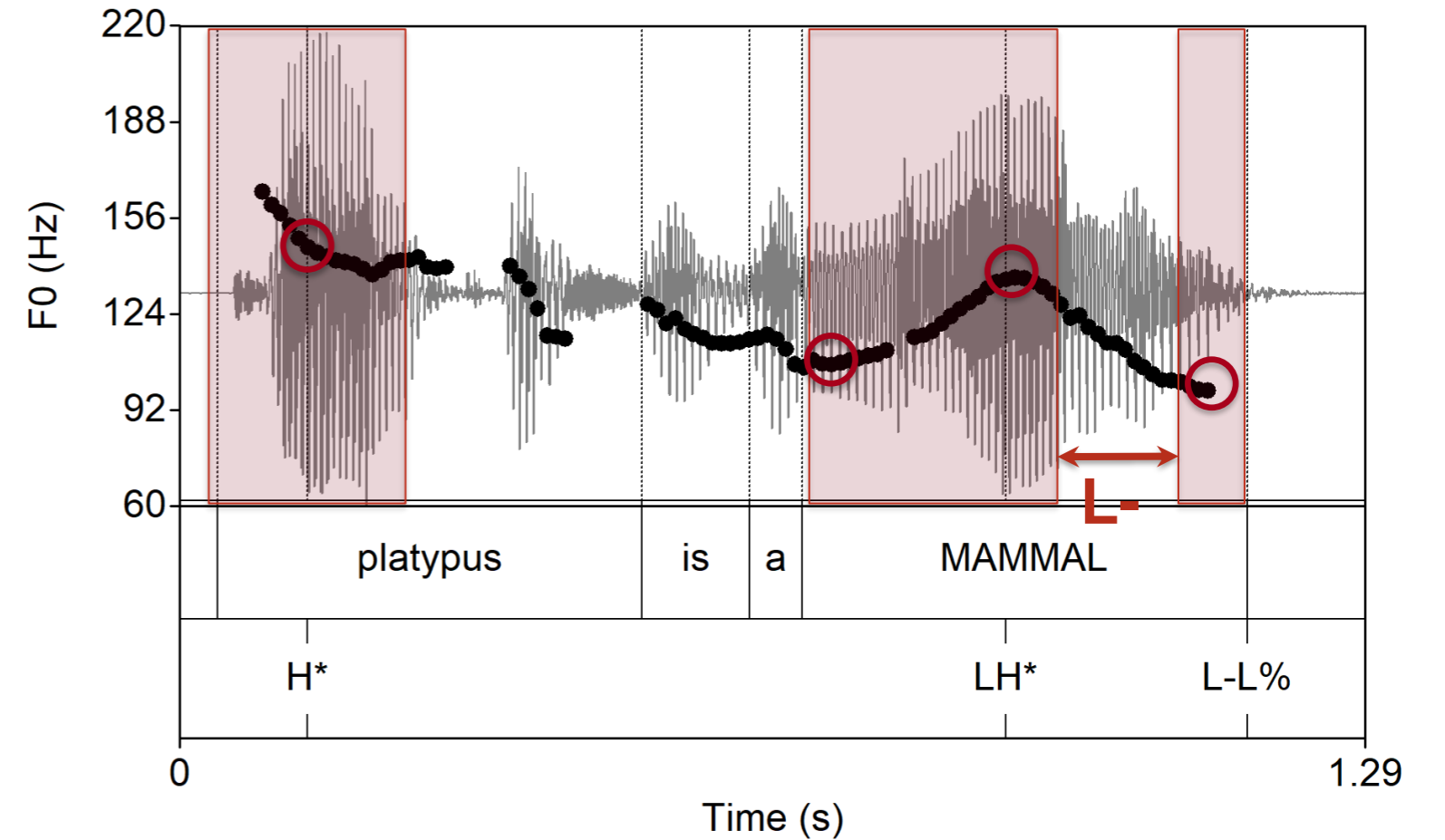
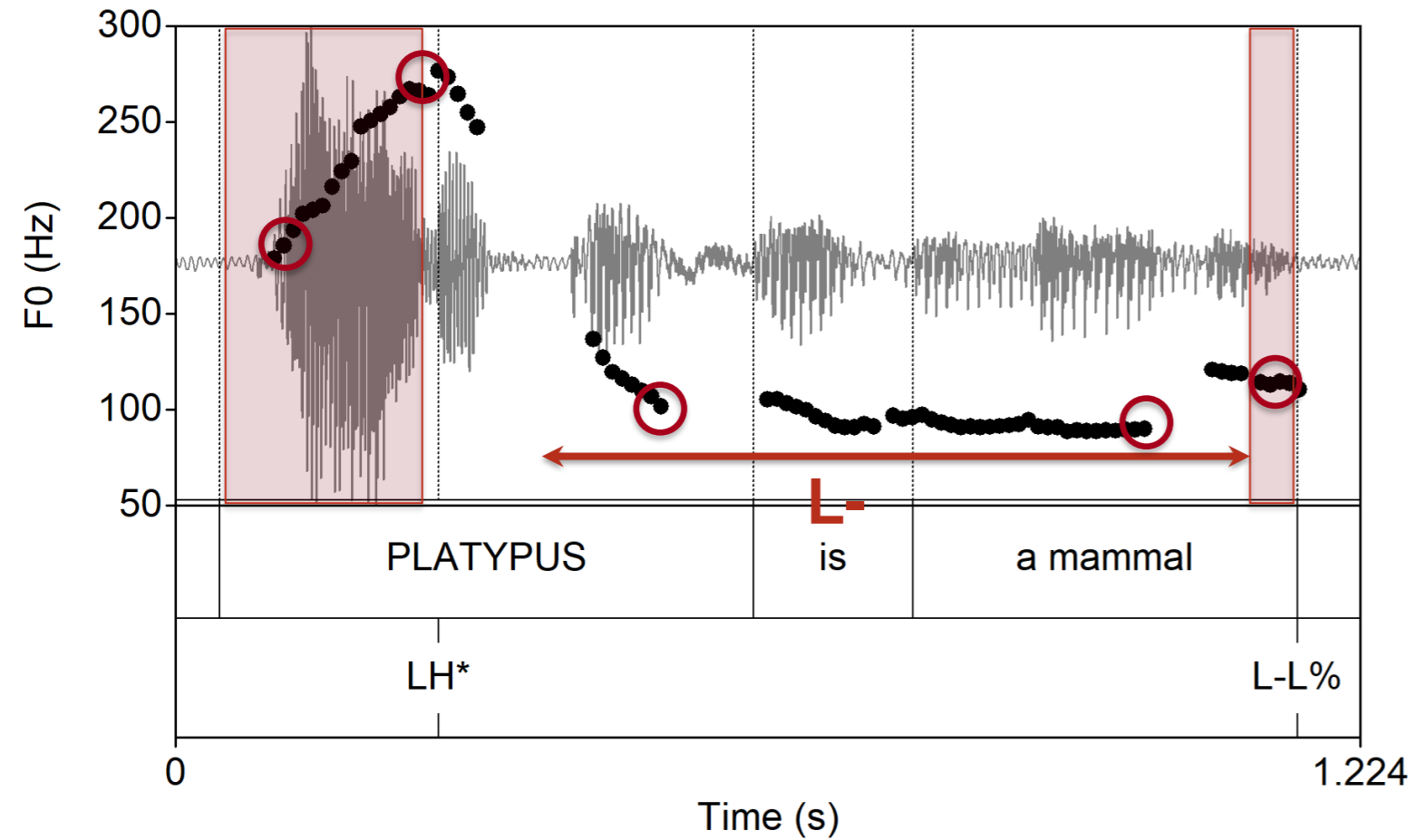


Metrical structure and association to tones



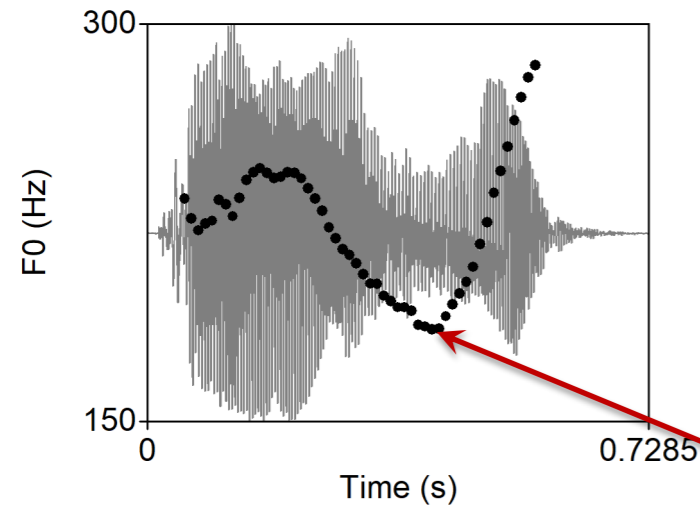
The stretches in red represent the **spreading** of the L- phrase accent
 Such spreading is frequently found for phrase accents; in Greek we know it applies to the L- of the tunes typically used with wh-questions

F0 and alignment



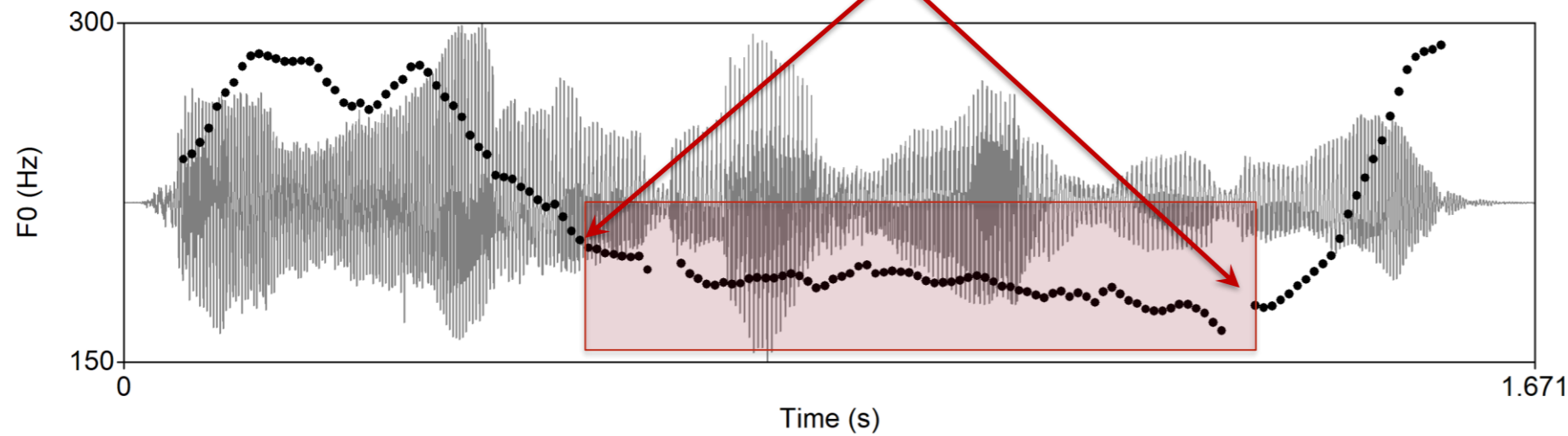
Red rectangles show the accented syllables and final sonorant consonant in *mammal*

This applies to Greek too: the case of wh-questions



Πού;

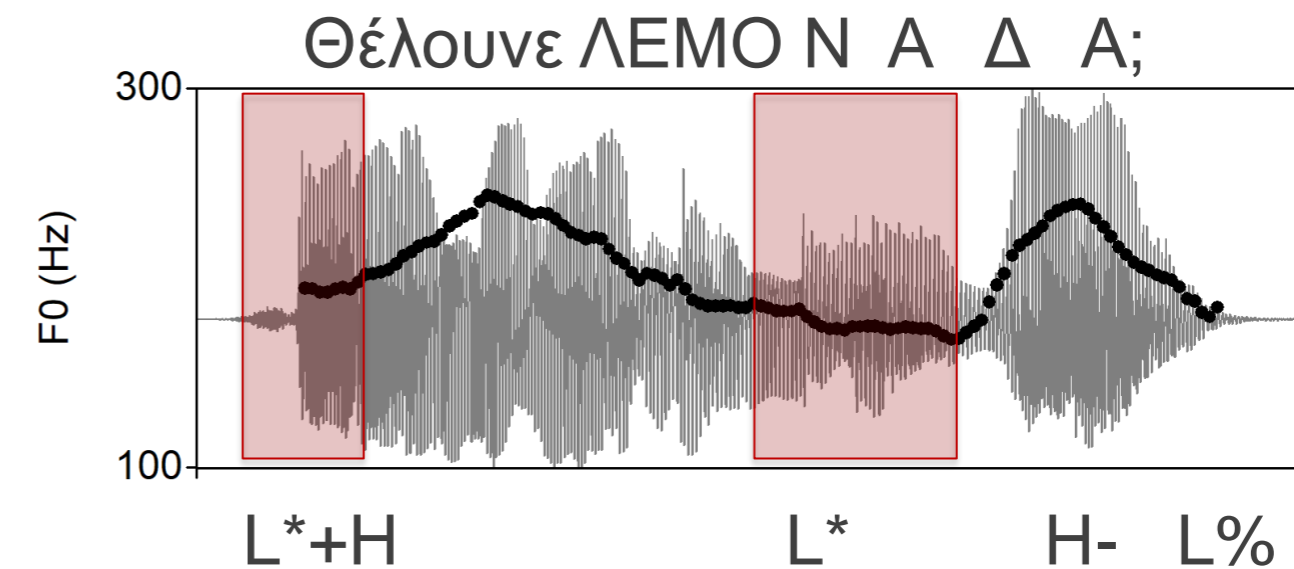
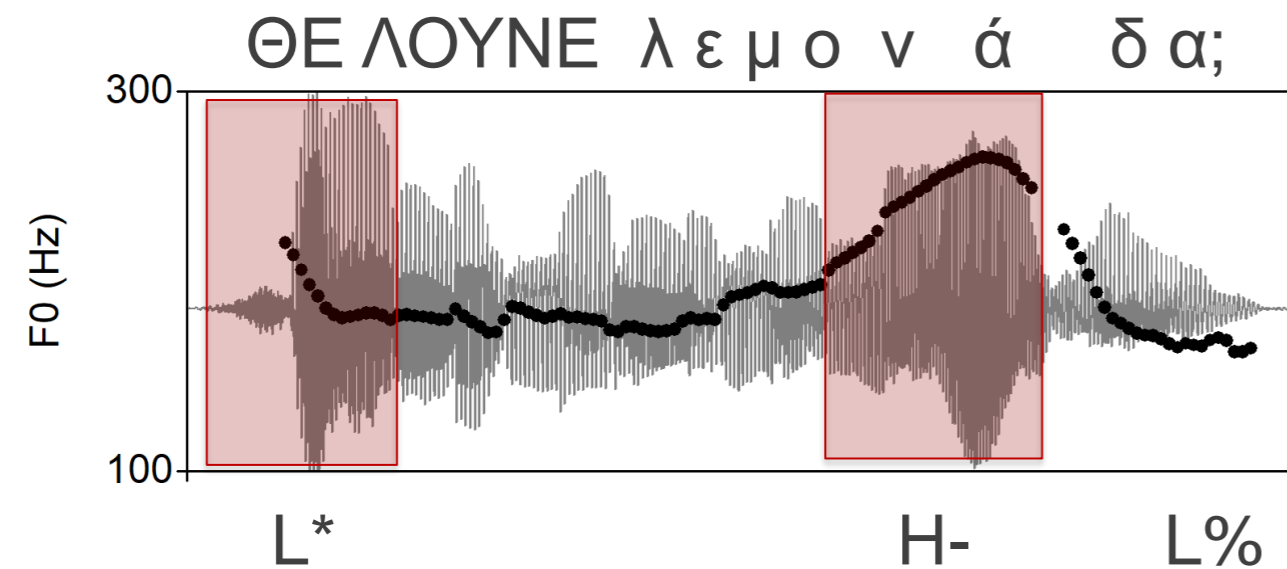
L^*+H $L-H\%$



Πού ζούνε οι λαγόγυροι;



Phrase accents with stress-seeking behaviour



The Greek polar question tunes illustrate the stress-seeking of phrase accents and are also myth-busting
They show that:

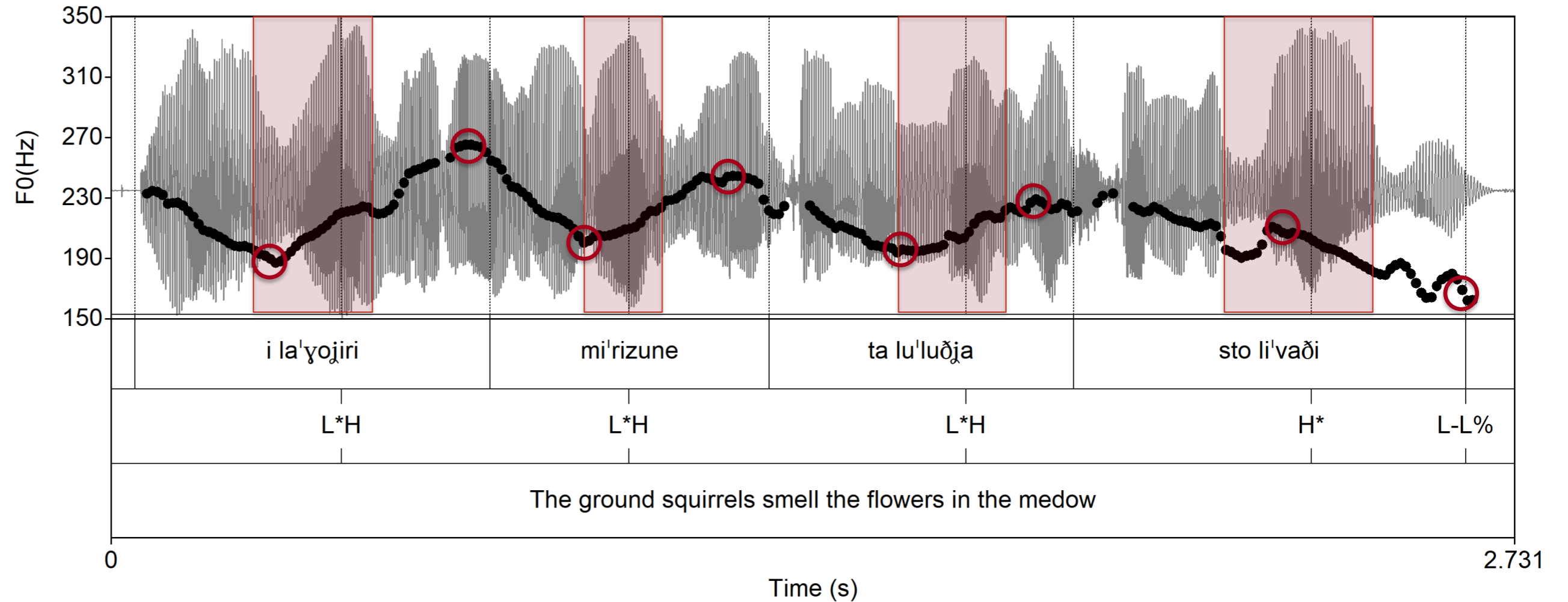
- Words do not have to have high pitch to be in focus
- High pitch does not make a word prosodically prominent
- Questions do not have to end in a pitch rise

AM and underspecification

- In AM, since tones do not exhaustively represent the course of F0, we can say that representations are **underspecified**
- This applies at the phonetic level as well: no specifications for F0 are filled in for parts of the segmental tier that are not associated with tones
- There are several consequences of underspecification
 - the F0 of specific stretches may vary from instantiation to instantiation of a tune
 - this is because for segmental material not associate with tones F0 is **derived by interpolation or tone spreading**



Phonetic consequences of phonological underspecification: some syllables are not specified for tone



Red rectangles show the accented syllables

Tonal crowding

- The flip side of underspecification is that in many instances there may be more tones than TBUs
- This is known as **tonal crowding**
- Languages have a variety of ways of dealing with tonal crowding
 - Undershooting (compressing) tones
 - Lengthening the segmental material to fit the tones
 - Deleting or truncating tones (curtailing the tone's excursion)
 - Using, by preference, a different melody when there is tonal crowding
- No language of those investigated uses one of these methods exclusively (contra Grabe's *hypothesis*)

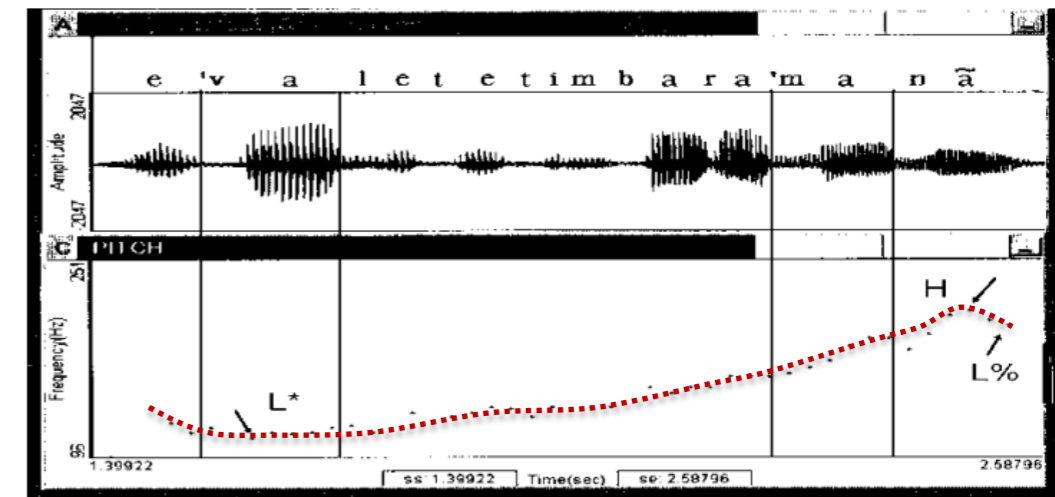
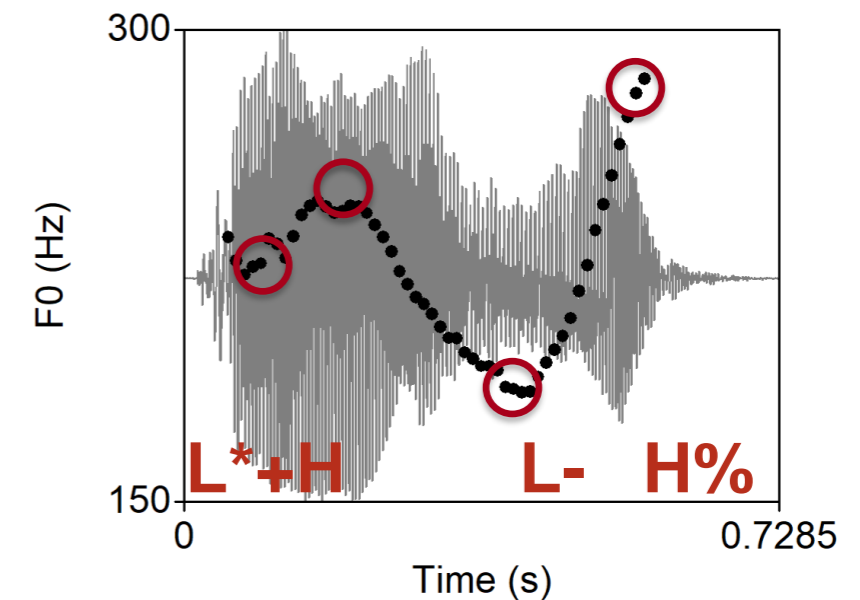
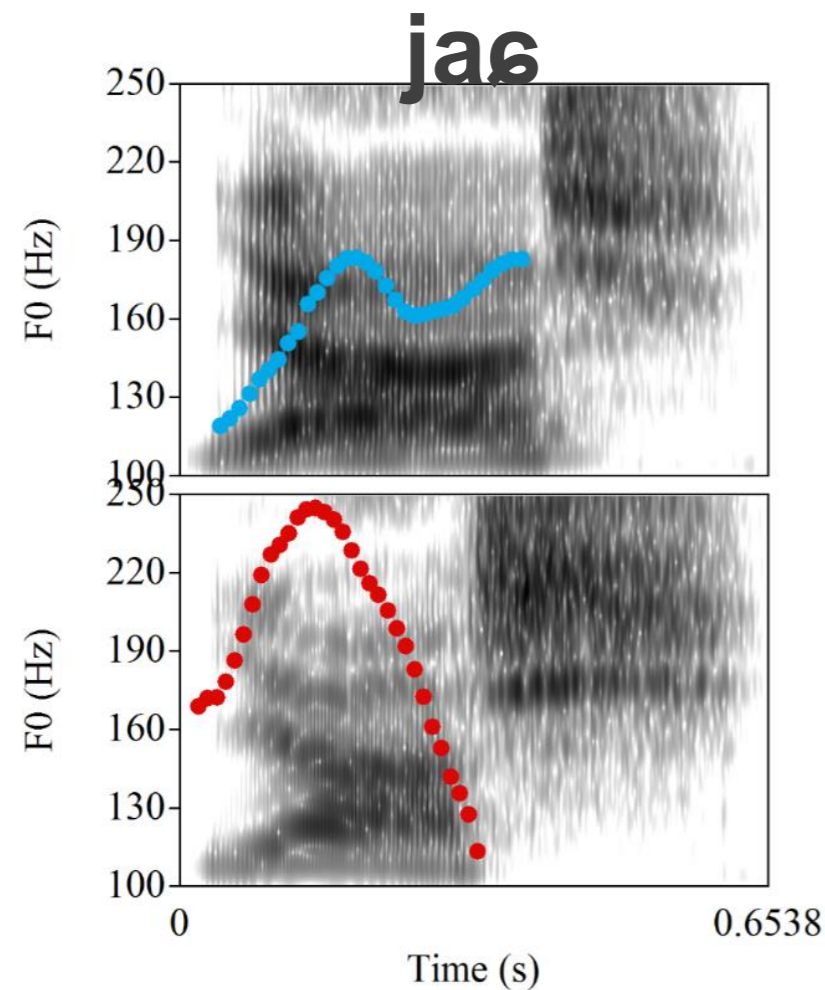


Figure 5: Waveform and *F0* contour of the test sentence [e'v a l e t e t i m b a r a ' m a n ā] 'Put-past-pl. the-safety-pin' "Did you PUT the safety-pin?" by speaker KR. The vertical lines delimit the two stressed syllables of the utterance.

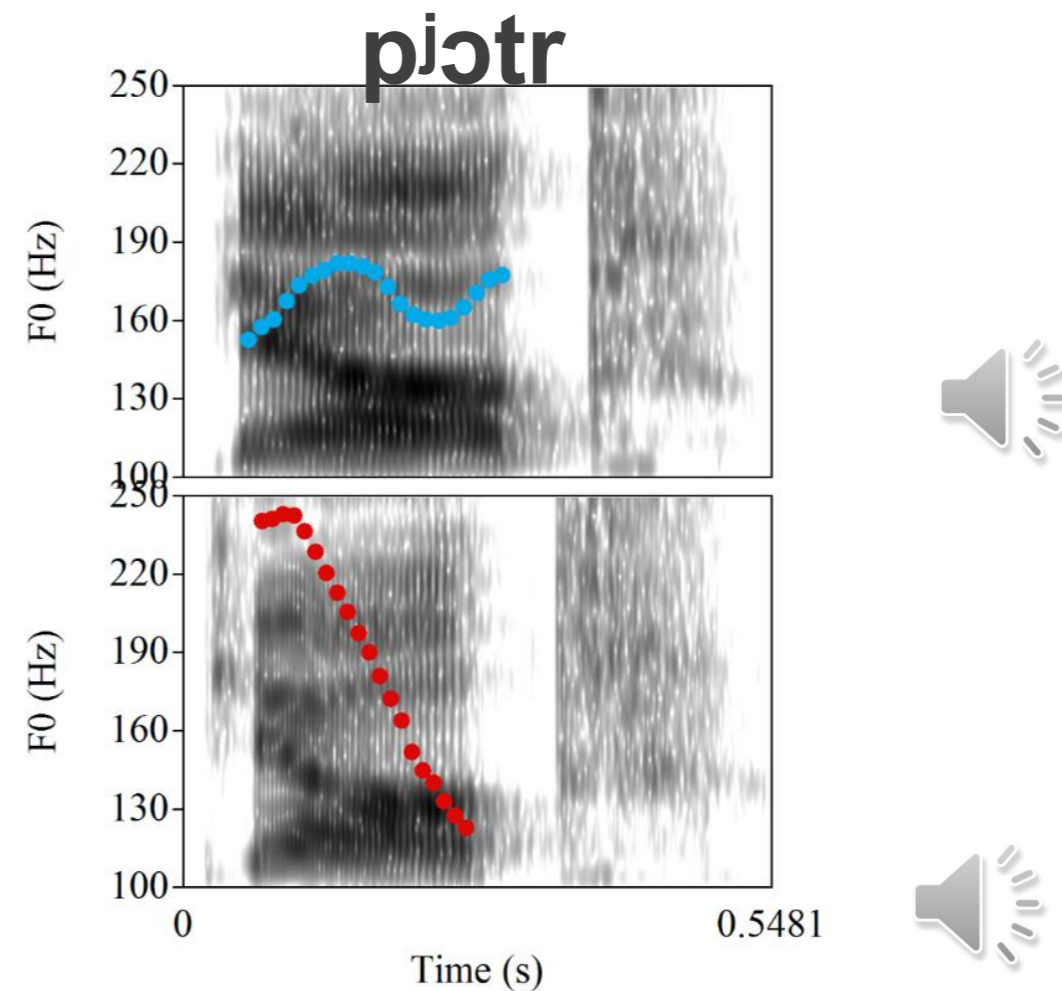
Tonal crowding: Polish calling melodies



Routine call
LH* !H-H%



Urgent call
H* L-L%

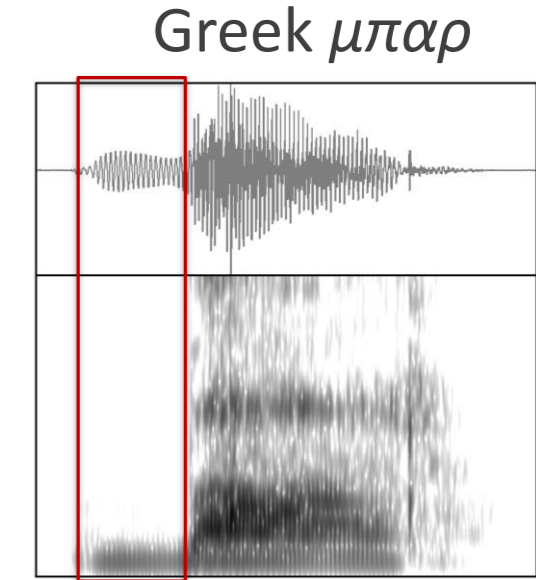
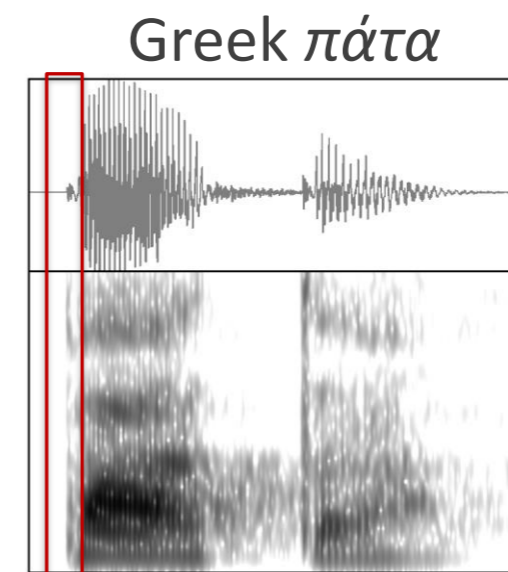


The L tone is indispensable in the routine call tune

The L is truncated under extreme tonal crowding in the urgent call, suggesting it is an optional element

What to watch out for when starting a new analysis i

- Phonetically, intonation is neither invariable (as some AM analyses suggest), nor more variable and less systematic than segmentals
- If in doubt, think of what you would do if dealing with segments
- No two languages need have the same intonational units
- No two languages need have the same phonological representation for similar pitch contours: superficially similar pitch contours may be differently organized in two languages
 - cf. [p] – a voiceless unaspirated bilabial plosive – is phonologically classified as /p/ in Greek, but as /b/ in English



What to watch out for when starting a new analysis ii

- The same phonological representation in different languages need not result in identical phonetics
 - cf. the phoneme /s/ is not phonetically realized in the same way in Spanish, English, and Greek
- Languages will show dialectal and contextual variation; these may include
 - lack of a particular contrast
 - neutralization between two tonal categories in some contexts
 - different phonetics for the same phonological category
 - different melodies
 - different meanings for similar melodies
- Contrasts in the system (intonational elements) should be posited on the basis of meaning
- The connection between meaning and intonation is arbitrary and many-to-many (so it has to be investigated, not assumed)



Phonological representations, phonetic transparency, and meaning

- Phonological representations of intonation need not always be phonetically transparent
 - the representation of a rising pitch accent need not necessarily involve both a L and H tone
 - different representations are needed if, in the language under analysis, a rising accent conveys different meaning than simply high F0; cf. H* , LH* , L*H in English
 - if such distinctions are not part of the system, the simpler representation should be preferred
 - Consider: we use /p/, /t/, /k/ in English to phonologically represent the language's voiceless stops, even though we know that their most likely phonetic realization is [p^h], [t^h], [k^h] respectively
- Representations need to capture what is contrastive (no symbolic representations for context-dependent variation; Browman & Goldstein, 1992; Ladd, 2014)
- Criteria for positing phonological categories should include
 - phonetic evidence (cf. Arvaniti, 2016; Arvaniti et al., 2017)
 - phonological considerations (cf. Gussenhoven, 2016)
 - meaning (cf. Prieto & Borràs-Comes, 2018; González et al., 2017), though not loosely applied functional categories or paralinguistic notions used in lieu of pragmatic meaning distinctions



ON TO PRAAT

- Pitch menu
- Viewing range vs. analysis range (pitch settings and advanced pitch settings)
- Pitch halving and pitch doubling
- Drawing method: default or speckles?
- Micro-prosodic variation: segmental effects; exhalation
- Draw visible pitch contour
- Extract visible pitch contour vs. analyse periodicity > to pitch
- Editing a contour
- Manipulate

