

# The role of pitch range in focus marking

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## Prosodic marking of focus

It appears that a wide variety of prosodic resources are employed to mark material as focused:

- Pitch accent placement.
  - Accenting, post-focal deaccenting (e.g. English)
- Phrase boundary placement.
  - Boundary precedes/follows focus (e.g. Chichewa), post-focal dephrasing (e.g. Japanese, Korean)
- Pitch range.
  - Expansion of pitch range on focus, narrowing of post-focal pitch range (e.g. Mandarin).
- Duration.

## Prosodic marking of focus

- Languages typically use more than one of these strategies in marking focus.
- But there are apparently basic divisions between languages:
  - Pitch accent is central to focus marking in English, but many languages lack intonational pitch accents (e.g. Mandarin, Japanese).
  - Phrasing is reported to play a central role in focus marking in Japanese and Korean, but English does not systematically use phrasing for this purpose.

# Prosodic marking of focus

## Proposal:

- Pitch range is fundamental to focus-marking in typologically diverse languages including Mandarin, Japanese and English.
  - Expanded pitch range on focus, compressed pitch range after focus.
- Post-focal pitch range compression motivates/creates the appearance of post-focal deaccenting and dephrasing.
- These pitch range manipulations serve to increase the relative prominence of Focus compared to non-focal material.

# Focus

- Focus - “the informative part of an utterance”.
- ‘the information in the sentence that is assumed by the speaker not to be shared by him and the hearer’ (Jackendoff 1972).
- Diagnosed by:
  - Question-Answer congruence
    - (Who saw Bill?) [Mary]<sub>F</sub> saw Bill.
  - Correction
    - (Ted saw Bill.) No, [Mary]<sub>F</sub> saw Bill.
  - Association with a focus-sensitive particle
    - Only [Mary]<sub>F</sub> saw Bill.

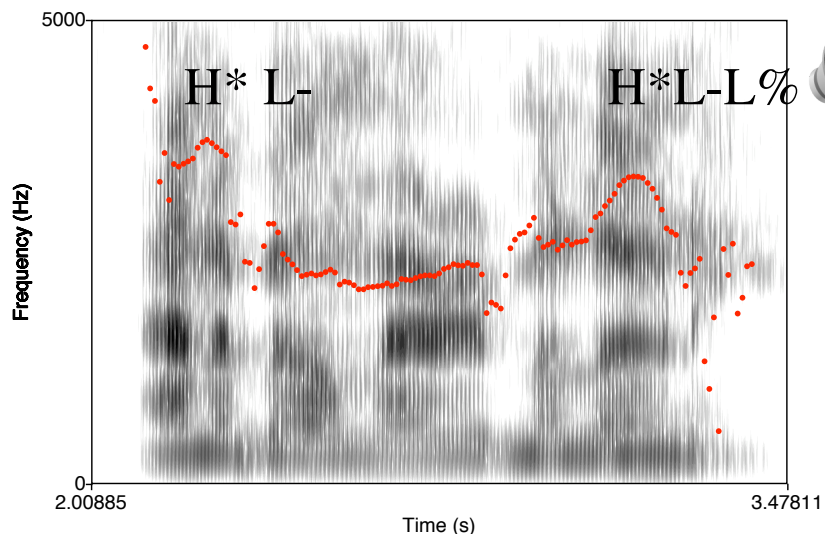
# Overview

- Examine Focus marking in three languages with different intonational phonologies:
  - English (Pitch accent)
  - Mandarin (Pitch range)
  - Japanese (Phrasing)
- Provide evidence for fundamental similarities across the three languages.

# Focus marking via pitch accent - English

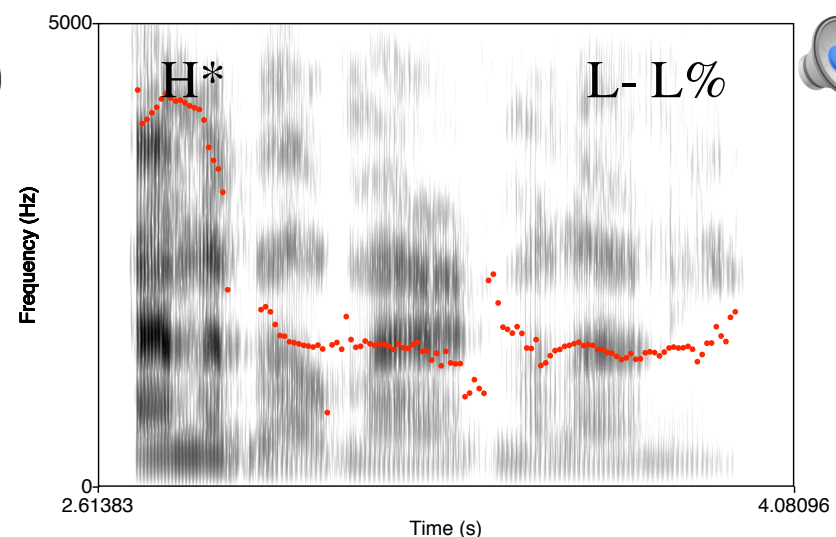
- Focus is canonically marked by a nuclear pitch accent on the primary stressed syllable (e.g. Ladd 1996:225, Cohan 2000).
- Nuclear accent = last accent in a phonological phrase.
- Placing a nuclear accent on a focus that occurs early in a phrase implies that all following words must be unaccented ('deaccented').

Broad focus: 'what happened'



Annabel married Maloney

Subject focus: 'who married Maloney?'



Annabel married Maloney

# Mandarin Chinese Intonation

- Many languages do not have intonational pitch accents.
  - How do they mark focus?
  - Are they fundamentally different from English?

## Mandarin Chinese

- Every syllable has a lexical tone (with the possible exception of ‘neutral tone’ syllables).
- Unsurprisingly, there are no pitch accents.
- It is not clear that there are boundary tones.
- Focus is marked using duration and pitch range.



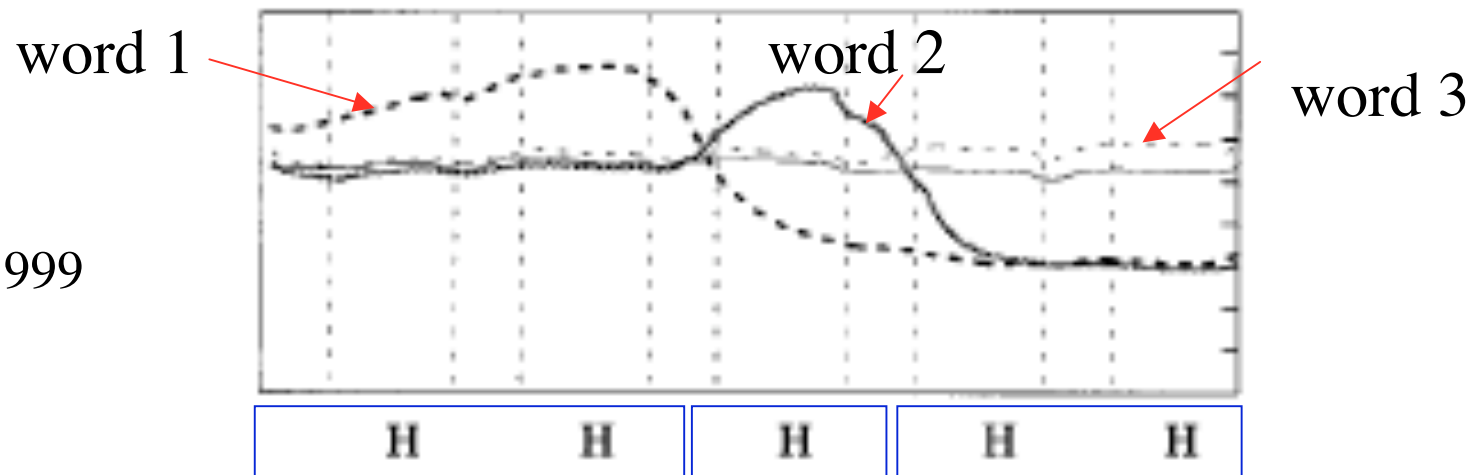
# Mandarin Chinese Intonation

- Xu (1999): elicited sentences with focus on different words by providing questions as context and underlining narrow focus item.
- E.g. target: māomī mō māomī ‘Kitty touches Kitty’
- Context questions:

1. Māomī gānmá ne?	(What is kitty doing?)	‘neutral’ (VP)
2. Shéi mō māomī?	(Who is touching kitty?)	word1 (Subj)
3. Māomī zěnmō nòng māomī?	(What is kitty doing to kitty?)	word2 (V)
4. Māomī mō shénmō?	(What is kitty touching?)	word3 (Obj)

# Focus intonation in Mandarin Chinese

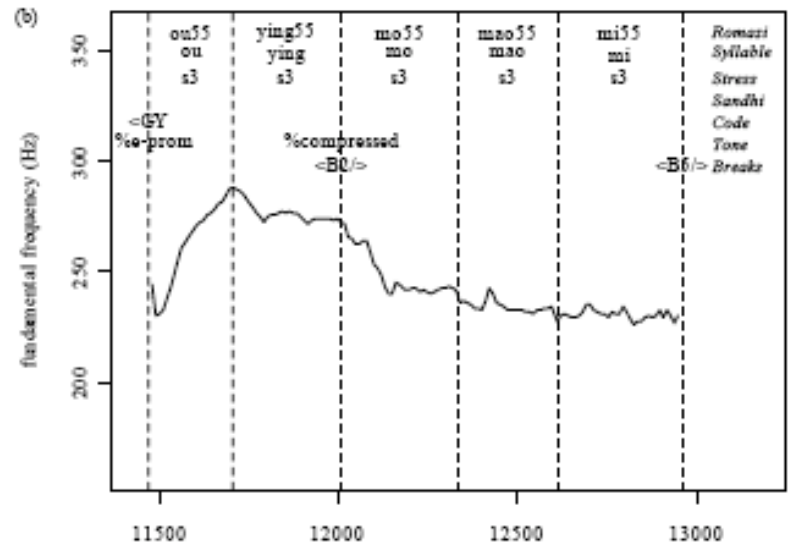
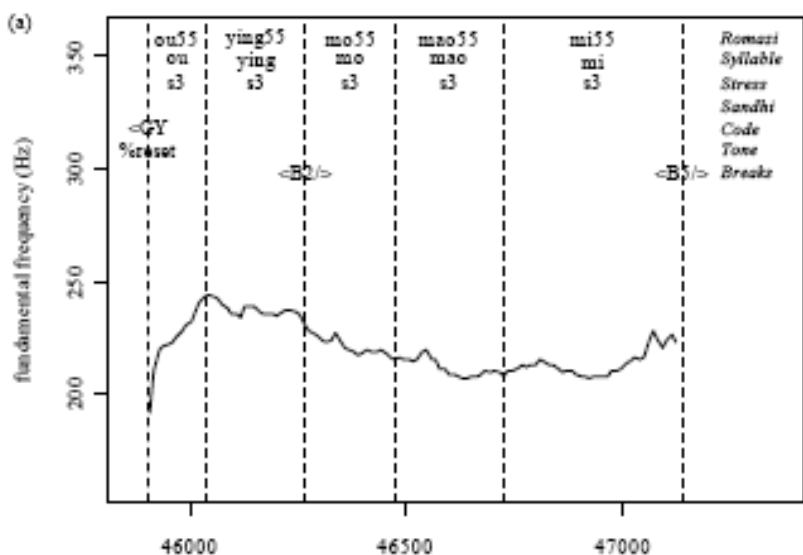
- Focus is implemented as variations in the local pitch range in which lexical tones are realized (Garding 1987, Jin 1996, Xu 1999, etc)
  - Focused words: expanded pitch range
  - Post-focus words: lowered, compressed pitch range
  - Pre-focus, final focus: ‘neutral’ pitch range



Xu 1999

Focus: ——— Neutral - - - - - Word 1 ····· Word 2 - · - · - Word 3

# Examples from Peng et al (2005):



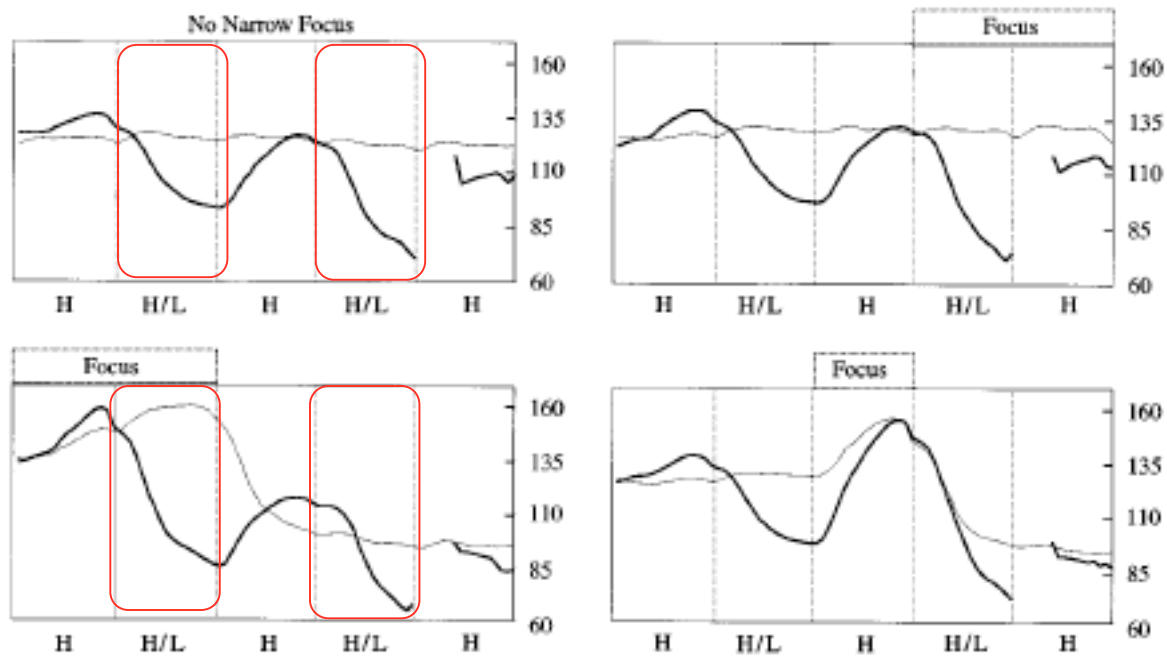
(a) Guoyu broad-focus utterance of *Ōu yīng mō māo mī* 'Ouying strokes kitty.'  
 (b) The same speaker's utterance of the sentence with narrow focus on *Ōu yīng*.



# Focus intonation in Mandarin Chinese

- Pitch range is expanded: H is higher, L is lower.
- Pitch range is compressed: H and L are closer in  $F_0$ .
  - Tone contrasts are preserved.

Xu 1999



- Focus is also marked by duration: Word is longer when narrowly focused, compared to neutral/non-focused realizations.

## Focus marking via phrasing? - Japanese

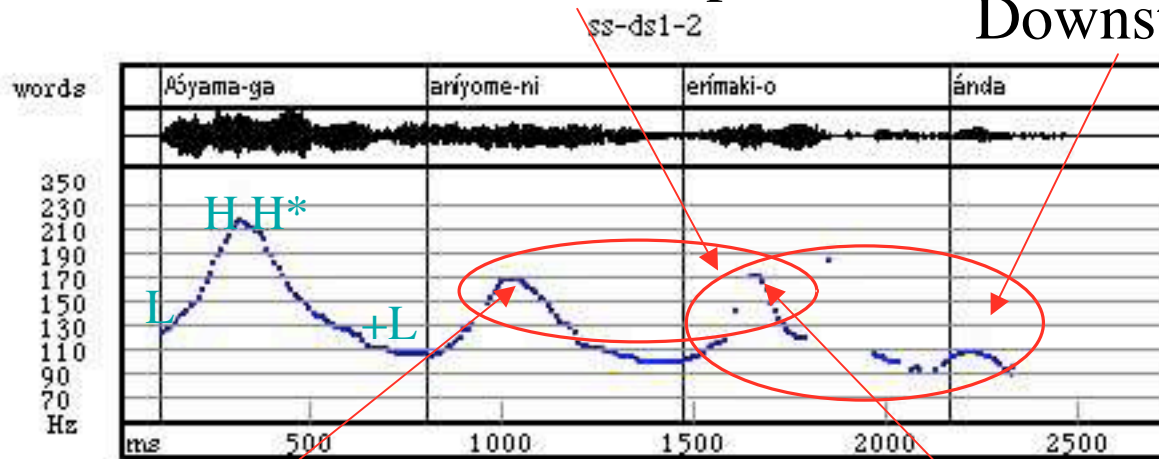
- Japanese has lexical pitch accent, but no intonational pitch accent.
- It has been proposed that phrasing plays a central role in focus marking.
- Two levels of phrasing, Major and Minor (Selkirk & Tateishi 1991) (or iP and AP (Pierrehumbert & Beckman 1988)).
- MiP is marked by initial LH- rise.
  - Followed by H\*L fall in lexically accented words.
- MaP is the domain of downstep for H\*L accents: pitch range is reduced after H\*.

Ishihara  
(2003)

(7a) *No focalization*

No downstep

Downstep

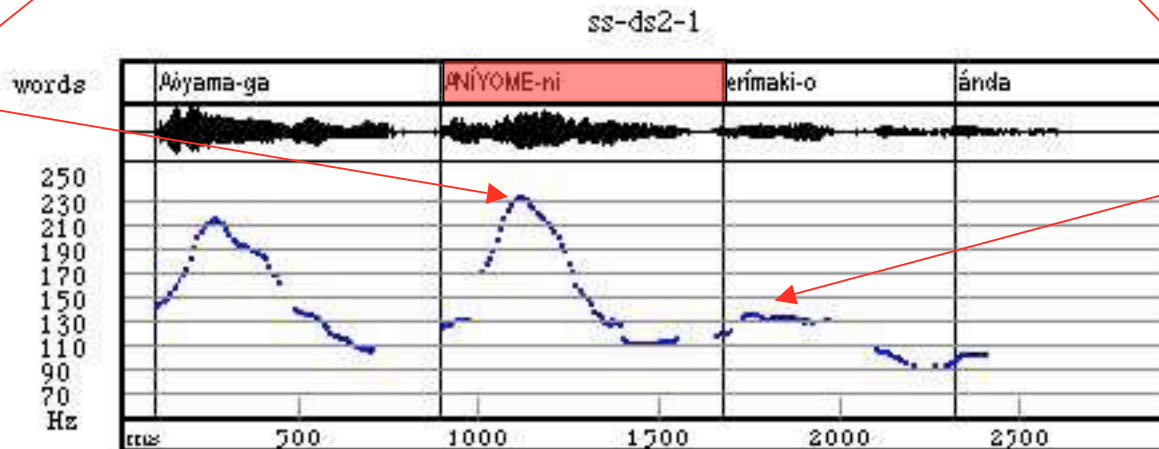


[MaP ] [MaP ] [MaP ]

(7b) *Focalization on ariyome-ni 'sister-in-law-DAT'*

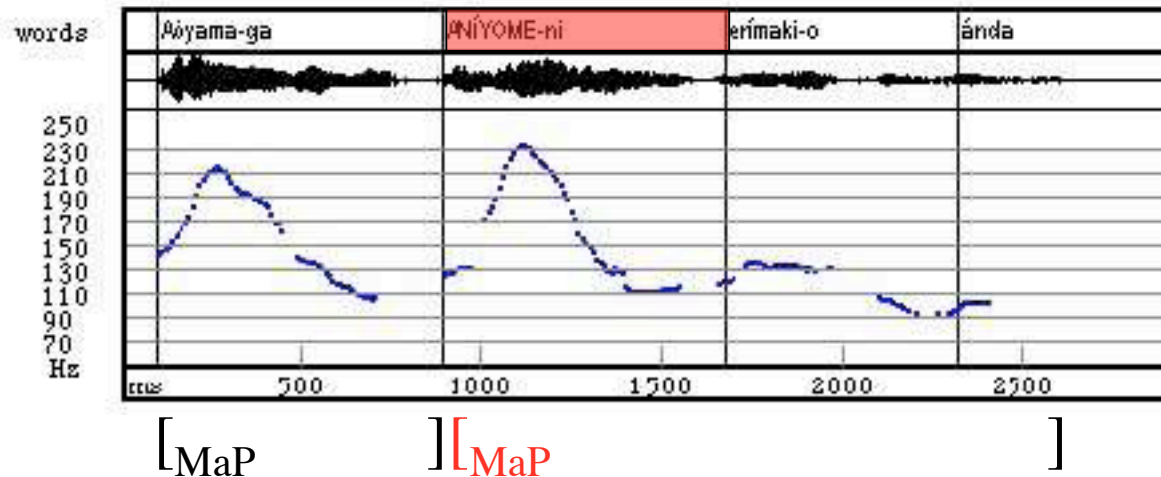
H raised on  
Focus

H lowered  
after focus



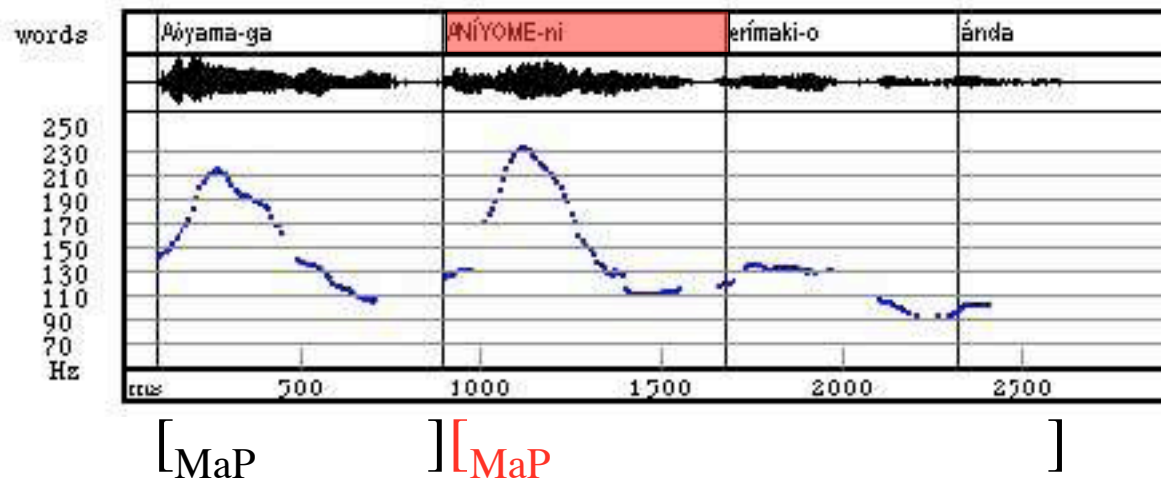
# Analysis of focus marking via phrasing

- Raising of focus has been attributed to preceding MaP boundary, blocking downstep (e.g. Pierrehumbert & Beckman 1988, Nagahara 1994).



## Analysis of focus marking via phrasing

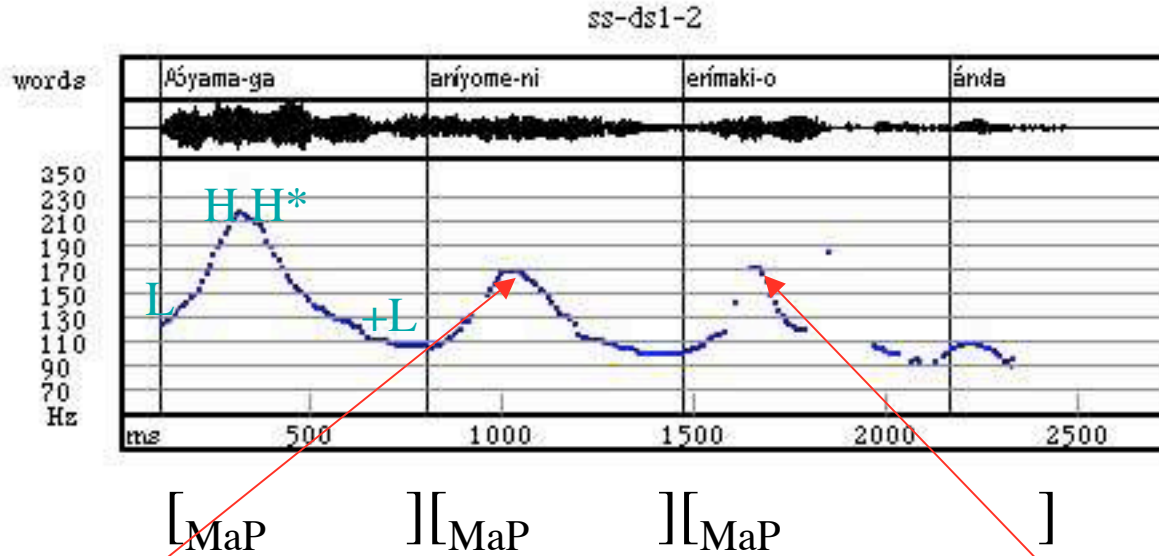
- Post-focal lowering has been analyzed in terms of post-focal dephrasing - material following Focus is incorporated into same MaP (e.g. Nagahara 1994, cf. P&B 1988, Sugahara 2003).
  - Results in downstep of post-focal material since MaP is the domain of downstep.





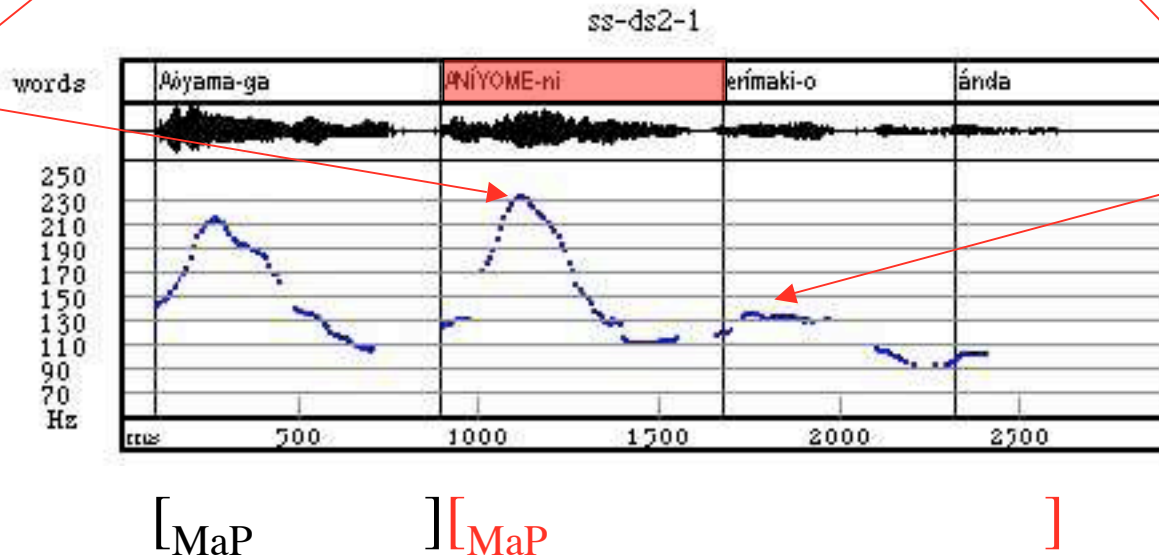
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Ishihara  
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(7b) *Focalization on ariyome-ni 'sister-in-law-DAT'*

H raised on  
Focus



H lowered  
after focus

## Focus-marking via pitch range

- Alternative analysis: Focus is marked by increasing pitch range on Focus and compressing and lowering pitch range after Focus.
  - Just like Mandarin.
- Evidence:
  - Pitch range effects are required even if phrasing effects are assumed (phrasing is not sufficient) (Ishihara 2003, Sugahara 2003).
  - Durational evidence shows that there are phrase boundaries in the post-focal domain (Sugahara 2005).

## Expansion of pitch range on Focus

- Insertion of a MaP boundary preceding Focus is not sufficient to account for observed expansion of pitch range on Focus.
- MaP boundary can only block downstep, but Focus raising is observed in environments where downstep is not expected:
  - Utterance-initial position: Focused initial word has higher F0 than matched unfocused word (P&B 1988:4.1)
  - MaP boundary expected due to syntax (Ishihara 2003) (above).
- Expansion of pitch range on Focus is independent of any phrasing effects of focus.

## Expansion of pitch range on Focus

- There is evidence that Focus is not always preceded by MaP boundary because an accented Focus can undergo downstep.
- Accented final Focus is lower when preceded by accented words than when preceded by unaccented words (Shinya 1999).
  - Downstep (triggered by preceding accent) applies to Focus.
  - Implies that there is no MaP boundary between Focus and preceding word since MaP boundary blocks downstep.

a. *Downstep case (with a sequence of* **downstep** *)*

[[[[ Aómori-no ] áni-no ] mégane-no ] iróFOC ] desu  
Aomori-GEN brother-GEN glasses-GEN color COP

‘(It is) the COLOR of Aomori’s brother’s glasses.’

b. *No downstep case (with a sequence of unaccented words)*

[[[[ Oomori-no ] ane-no ] yunomi-no ] iróFOC ] desu  
Oomori-GEN sister-GEN tea.cup-GEN color COP

‘(It is) the COLOR of Oomori’s sister’s tea cup.’

lower f0 than

## Expansion of pitch range on Focus

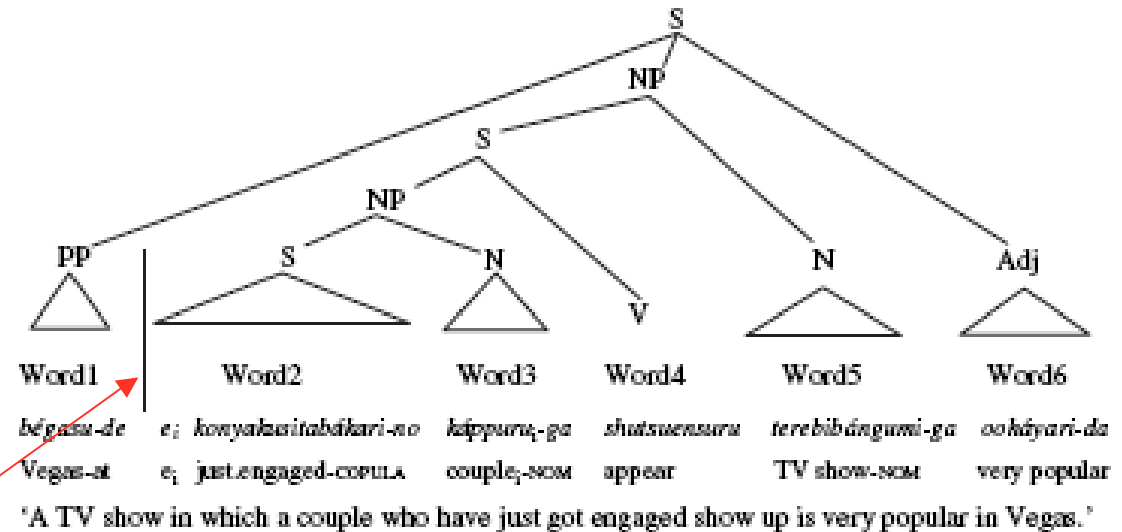
- There is evidence that Focus is not always preceded by MaP boundary because an accented Focus can undergo downstep.
- Accented final Focus is lower when preceded by accented words than when preceded by unaccented words (Shinya 1999).
  - Downstep (triggered by preceding accent) applies to Focus.
  - Implies that there is no MaP boundary between Focus and preceding word since MaP boundary blocks downstep.
- Focus on an accented word in downstep context is still higher than non-focused word in the same context.
  - Focus /unaccented\_ > Focus /accented\_ > Non-Focus /accented\_
  - Expansion of pitch range on Focus accounts for this difference.
  - i.e. Focus is not always preceded by a MaP boundary, but raising of f0 on Focus H\* always applies.
- Similar results reported by Poser (1984), Kubozono (2006).

## Phrasing in the post-focal domain

- Post-focal dephrasing ties post-focal Pitch Range Compression (PRC) to absence of phrasing in the post-focal domain.
- Sugahara (2005) provides evidence from final lengthening that there are (large) phrase boundaries within the post-focal domain.
  - Post-focal PRC is independent of dephrasing.

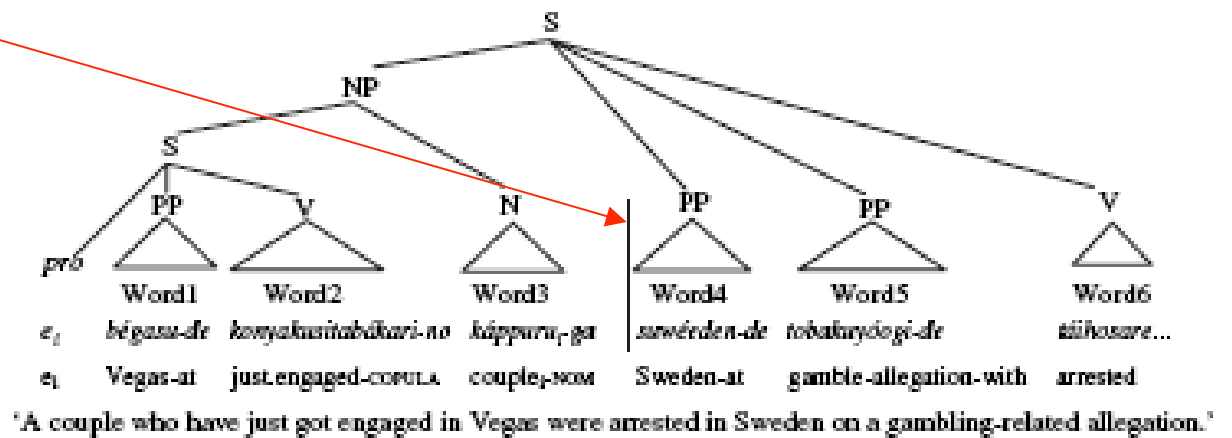
- Compared segmentally-matched sentences that differ in syntactic structure, and thus in expected phrasing.

(7) < Vegas Set: Structure I > <sup>4</sup>



MaP or IP boundary

(8) < Vegas Set: Structure II >



## Sugahara (2005)

- In broad focus, expect big differences in durations of ends of words 1 and 3, due to presence/absence of final lengthening.
- With narrow Focus on Word1, if there is post-focal dephrasing, durations of words 1 and 3 should be similar in the two structures.

Structure I:	Word1 <i>béga.su-de</i> Vegas-at	Word2 <i>konyakusitabákar i-no</i> just.engaged-COPULA	Word3 <i>káppuru-ga</i> couple-NOM	Word4 <i>shut.suensuru</i> appear
Structure II:	Word1 <i>béga.su-de</i> Vegas-at	Word2 <i>konyakusitabákar i-no</i> just.engaged-COPULA	Word3 <i>káppuru-ga</i> couple-NOM	Word4 <i>suwéeden-de</i> Sweden-at

- Elicited two focus conditions:
  - NN - All New: ‘out of the blue’
  - FG - First word Focused, following material Given.
    - Elicited as a correction.
    - ‘Is it true that the couple that just got engaged in **Hayama**...?’



# Sugahara (2005) - Results

Structure I:	Word1 <i>béga.su-de</i> Vegas-at	Word2 <i>konyakusitabákar i-no</i> just.engaged-COPULA	Word3 <i>káppuru-ga</i> couple-NOM	Word4 <i>shutsuensuru</i> appear
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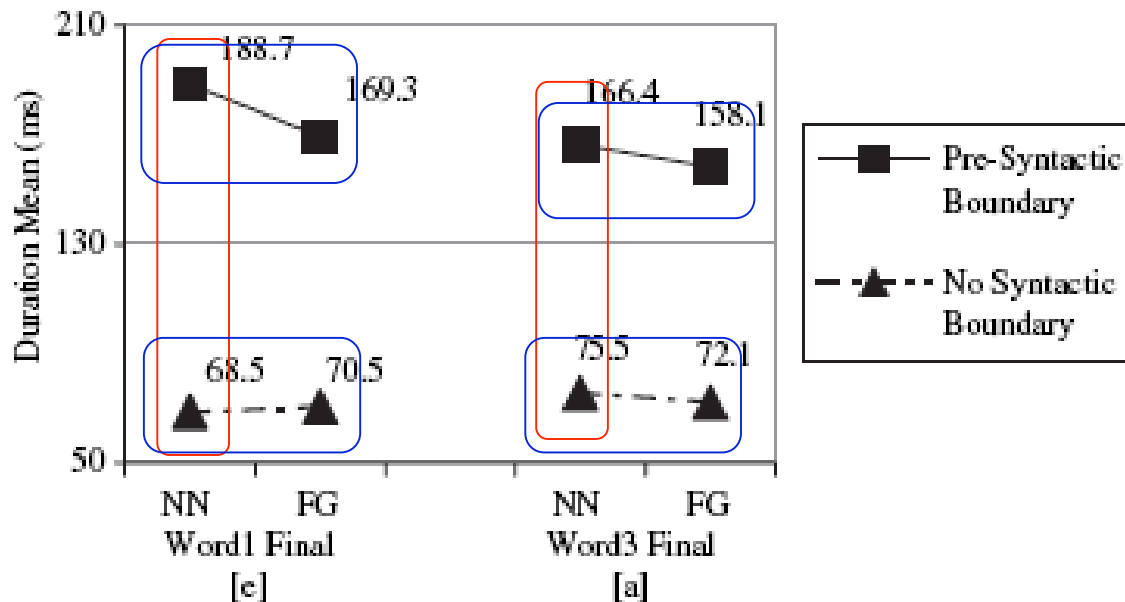


Figure 4. Final vowel duration means of < Vegas Set > averaged over the four speakers

- Large final-lengthening effects
- No effect of Focus.
- Final-lengthening is found post-focally
- No post-focal dephrasing.
- Same results with another pair of sentences.

## Sugahara (2005) - Results

- PRC was observed - Post-focal PRC can operate across phrase boundary.
- The magnitude of the lengthening (~100 ms) is too great to be attributed to a small constituent boundary (e.g. MiP) - Sugahara argues that it indicates IP boundaries.
  - Post-focal PRC can leave prosodic phrasing intact.
  - So PRC cannot be explained in terms of dephrasing - it is independent of it.
- Similar phenomena are observed in English and French.

### Interim summary:

- Pitch-range plays a central role in marking Focus in Japanese (cf. Ishihara 2003, Venditti et al forthcoming), just as in Mandarin.
- ‘Dephrasing’ appears to be a side-effect of PRC - f0 cues to phrasing are weakened/lost but durational cues remain.

## Focus marking in Seoul Korean

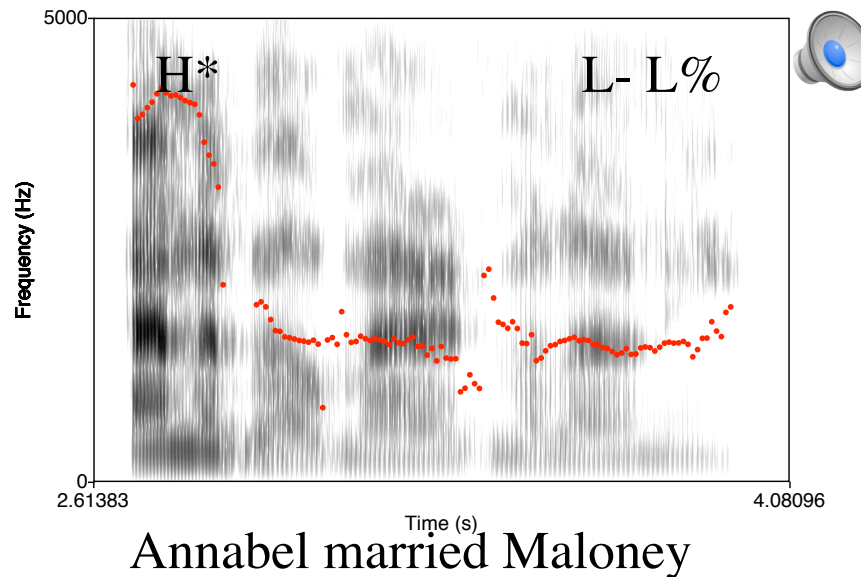
- Seoul Korean has neither pitch accents nor lexical tone.

Focus marking (Jun 2002, Jun & Lee 1998):

- AP boundary preceding Focus.
- Focus word lengthened, realized with expanded pitch range.
- Dephrasing: all words up to the end of the IP included in the AP with focus, or
- Pitch range compression - if post-focus string is long, AP boundary may be retained, but post-focal AP has reduced pitch range.
- Similar to Japanese?

# Phrasing in the post-focal domain - English

- Focus is canonically marked by a nuclear accent - the final accent in an Intermediate Phrase.
- So Focus early in a phrase results in a long stretch without pitch accents - ‘postnuclear deaccenting’.
- This deaccenting is more accurately characterized as post-focal PRC:
  - Phrasing is possible within the post-focal domain (cf. Japanese).
  - Reduced post-focal pitch accents are possible.



## Phrasing in the post-focal domain - English

- Given the Pierrehumbert/ToBI model of English intonation, post-focal deaccenting also implies post-focal dephrasing.
  - Every iP must contain a pitch accent.
- Phrasing is possible in the post-focal domain (Norcliffe & Jaeger 2005), suggesting that PRC is independent of phrasing.

## Phrasing in the post-focal domain - English

- Evidence comes from disambiguation of verb-preposition vs. verb-particle ambiguities.
- Price et al (1991) showed that readers reliably disambiguate these ambiguities through prosodic phrasing.

- V+Preposition:

A. Heartless violence lead to a bloody victory.

B. The Vikings won] over their enemies

stronger weaker

- V+Particle:

A. Gentle persuasion lead to a friendly settlement.

B. The Vikings won over] their enemies.

weaker stronger

## Norcliffe & Jaeger (2005)

- Elicited the ambiguous sentences with early narrow focus in a correction context (4 speakers).
- The two syntactic structures were differentiated by duration patterns even when they occurred in the post-nuclear stretch:

Verb+Prep:

No, [the VIKINGS won][over their enemies]      V rime is longer by 18 ms

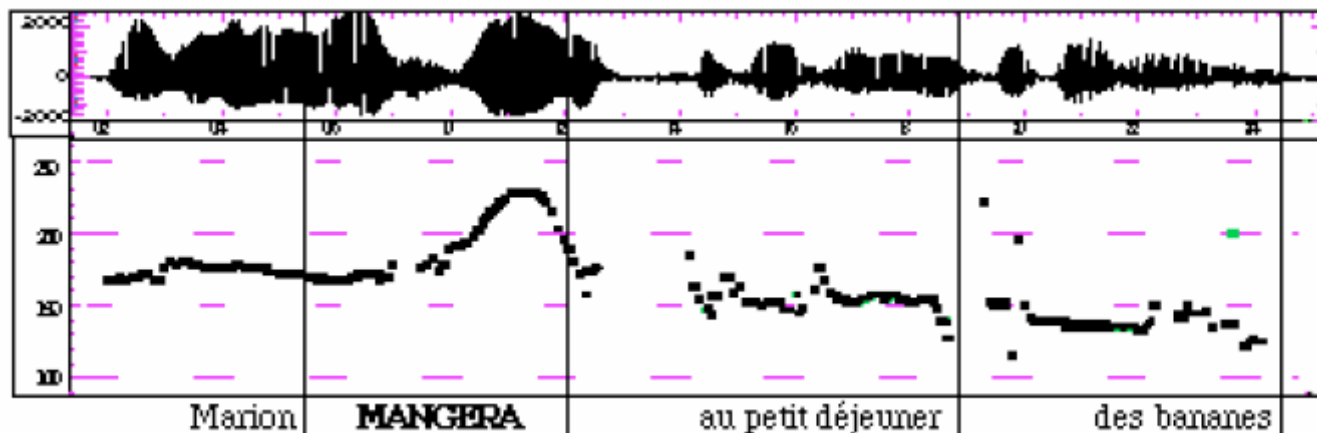
Verb+Part:

No, [the VIKINGS won over][their enemies]      Prt. rime is longer by 25 ms

- Indicates that there is a phrase boundary in the middle of the post-nuclear stretch.
- Suggests post-focal deaccenting is fundamentally post-focal PRC, which leaves phrasing intact although without boundary tones.

## Phrasing in the post-focal domain

- Similar phenomenon in French (Jun & Fougeron 2000):
  - Pitch accent language
  - Narrow focus is generally realized with post-focal deaccenting: post-focal stretch is an  $f_0$  plateau.
  - Final lengthening indicates that the post-focal domain is divided into APs as in corresponding ‘neutral’ sentences.



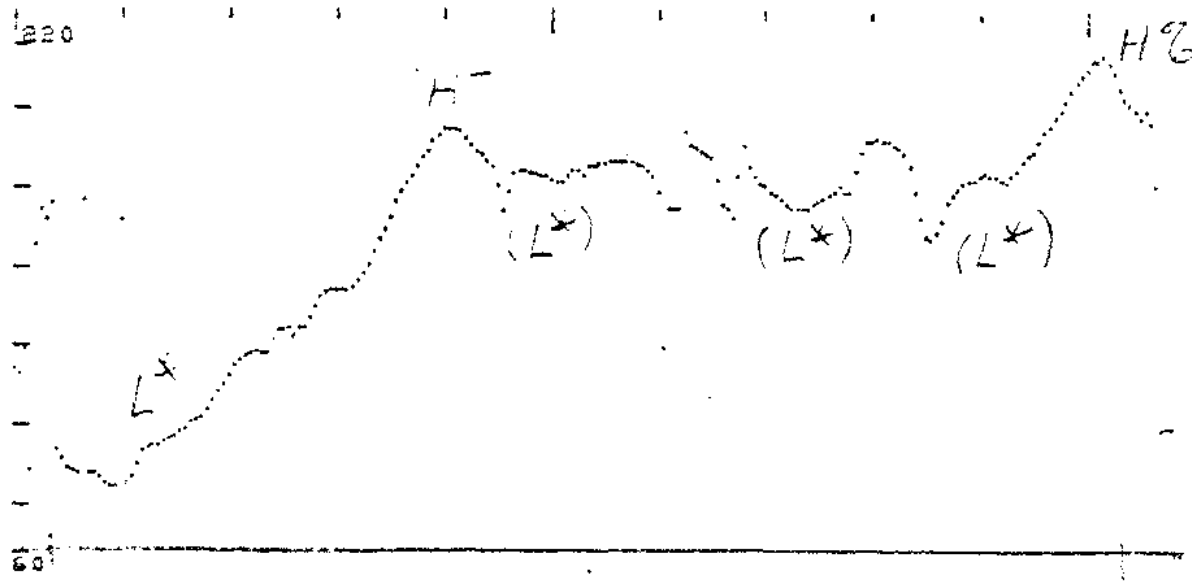


## Accents in the post-focal domain

- Evidence that post-focal PRC causes deaccenting (not vice versa) comes from the existence of reduced accents in the post-focal domain.
- Reduced post-focal accents a regular part of focus intonation in a number of languages: Palermo Italian (Grice 1995), Neapolitan Italian (D'Imperio 2000), European Portuguese (Frota 2000), cf. Ladd (1996:212ff.)
- They can also occur in English:
- In Norcliffe & Jaeger's study 27% of utterances contained reduced post-focal accents.
  - Duration differences were still significant when these utterances were excluded.
- Pierrehumbert (1980) observed post-focal 'echo accents'

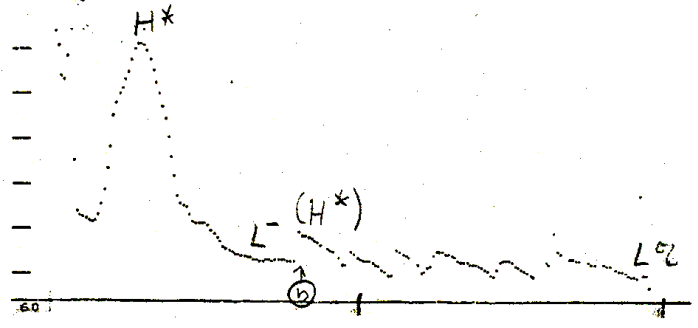
# Accents in the post-focal domain - English

5.8) M4L



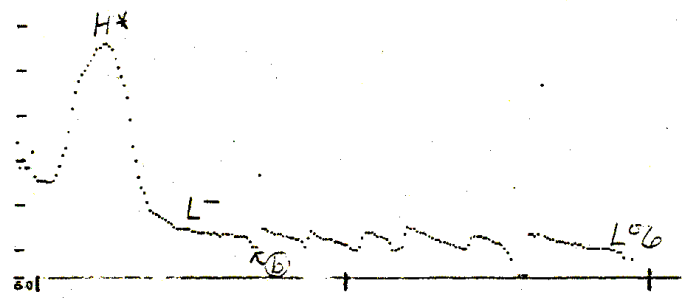
The Uruguayan bulldozer driver's union  
 L\*                      H- (L\*)                      (L\*)                      (L\*) H

5.9) M4L



The Uruguayan bulldozer drivers' union.  
 H\* L (H\*) L

5.10) M4L



The Uruguayan bulldozer drivers' union.  
 H\* L L%

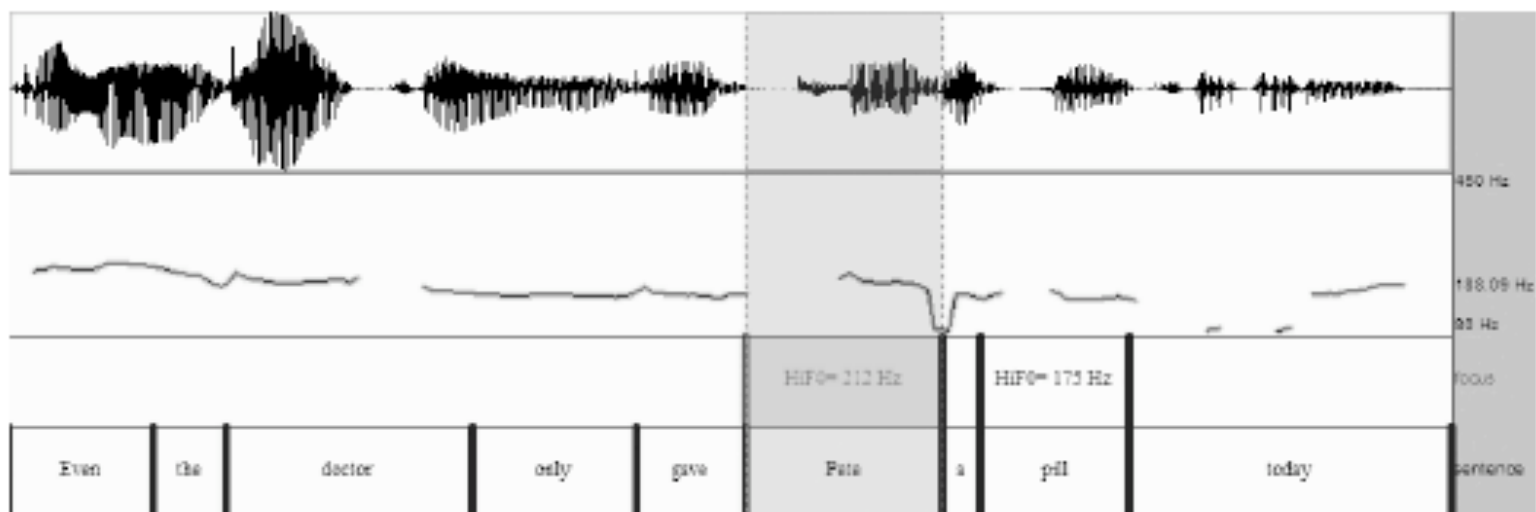
## Accents in the post-focal domain - English

Beaver et al (2007) provide evidence that phrasal prominence distinctions are possible in post-nuclear position, although marked more consistently by duration and intensity rather than  $f_0$ .

- Studied ‘Second Occurrence Focus’ sentences:
  - a. Both Sid and his accomplices should have been named in this morning’s court session.
  - b. But the defendant only named Sid in court today.
  - c. Even the state prosecutor only named Sid in court today.
  - a. Defense and Prosecution had agreed to implicate Sid both in court and on television.
  - b. Still, the defense attorney only named Sid in court today.
  - c. Even the state prosecutor only named Sid in court today.
- SOF word is longer and more intense than matched non-focused word.
- Minimal  $f_0$  effects (minimum  $f_0$  is slightly lower in SOF in d.obj position)

## Accents in the post-focal domain - English

- Occasionally a pitch accent is observable (and audible) on SOF:



*Figure 7.* Sample with a pitch accented second occurrence focus.

- Optional, reduced post-focal accents are also observed in Catalan (Estabas Vilaplana 2003).

# Focus marking

- In spite of the differences between the intonational systems of English, Japanese and Mandarin, focus marking is similar in all of them.
- Focus is marked by relative prominence.
  - Pitch movement, duration, loudness.
- Increase prominence of Focus, decrease prominence of post-focal material.
  - Within the limits imposed by the phonology of the language (e.g. availability of pitch accents, need to preserve lexical F0 contrasts, restriction of tones to phrase edge etc).
  - What about pre-focal material?

# Focus marking

- Prominence is fundamentally gradient
  - Post-focal pitch movements can be reduced rather than completely flattened.
- Dephrasing per se is not used to mark focus.
  - phrasing is ‘chunking’ of the signal.
  - prominence marks the status of these chunks.
  - Just because post-focal phrases are non prominent does not mean they cease to be relevant units of the utterance.
  - phrasing is effected via PRC - e.g. initial LH in Japanese and Korean AP/MiP may be suppressed.
    - Possibly dephrasing may occur to eliminate pitch movement.
- It is important to represent prominence/pitch range in phonological analysis and transcription of prosody.

End



# References

- Beaver D.I. Beaver, B.Z. Clark, E. Flemming, T.F. Jaeger and M.K. Wolters (2007). When semantics meets phonetics: Acoustical studies of second occurrence focus. *Language* 83.2, 251-282.
- Cohan, J. (2000) *The Realization and Function of Focus in Spoken English*. Ph.D. thesis, University of Texas at Austin.
- D'Imperio, M. (2001). Focus and tonal structure in Neapolitan Italian. *Speech Communication* 33, 339-356.
- Estabas Vilaplana, E. (2003). Tonal structure of post-focal L in English and Catalan. *Atlantis* 25, 39-53.
- Frota, S. (2000). *Prosody and Focus in European Portuguese: Phonological Phrasing and Intonation*. Garland, New York.
- Garding, E. (1987). Speech act and tonal pattern in Standard Chinese. *Phonetica* 44, 13-29.
- Grice Martine (1995), *The intonation of interrogation in Palermo Italian*, Tübingen, Niemeyer.
- Ishihara, S. (2003). *Intonation and interface conditions*. PhD dissertation, MIT.
- Jin, S. (1996) *An Acoustic Study of Sentence Stress in Mandarin Chinese*. Ph.D. dissertation, The Ohio State University.
- Jun, Sun-Ah & Cécile Fougeron (2000) [A Phonological Model of French Intonation](#) ", in *Intonation: Analysis, Modeling and Technology*, ed. by Antonis Botinis . Kluwer Academic Publishers. pp.209-242.
- Jun, Sun-Ah & Hyuck-Joon Lee (1998) [Phonetic and Phonological markers of Contrastive Focus in Korean](#), in *Proceedings of the 5th International Conference on Spoken Language Processing* , Vol. 4, p. 1295-1298, Sydney, Australia.
- Jun, Sun-Ah (2002) [Syntax over Focus](#). *Proceedings of International Conference on Spoken Language Processing (ICSLP)* . John H.L. Hansen & Bryan Pellom (eds.), pp.2281-2284, Denver, Colorado.
- Kubozono, H. (2006) [Focus and intonation in Japanese: does focus trigger pitch reset?](#) In Ishihara, S. et. al. (eds.) *Working Papers of the SFB632: Interdisciplinary Studies on Information Structure (ISIS)* 9. Potsdam: Universitätsverlag Potsdam, 1-27.
- Ladd, D. R.: 1996, *Intonational Phonology*. Cambridge University Press.
- Nagahara, H. (1994) *Phonological phrasing in Japanese prosody*. PhD dissertation, UCLA.

# References

- Norcliffe, E. & Jaeger, T.F. 2005. Accent-free Prosodic Phrases? Accents and Phrasing in the Post-Nuclear Domain. *Proceedings of Interspeech 2005*.
- Peng, S., Chan, M. K. M., Tseng, C., Huang, T., Lee, O. J., and Beckman, M. E. (2005). Towards a Pan-Mandarin prosodic annotation system. In S.-A. Jun, ed., *Prosodic Models and Transcription: Towards Prosodic Typology*. Oxford University Press.
- Pierrehumbert, J.E. & M.E. Beckman (1988) *Japanese tone structure*. MIT Press, Cambridge.
- Pierrehumbert, Janet (1980) *The Phonology and Phonetics of English Intonation*. PhD dissertation, MIT.
- Poser, W. (1984) *The phonetics and phonology of tone and intonation in Japanese*. PhD dissertation, MIT.
- Price, P.J., S. Ostendorf, S. Shattuck-Hufnagel & C. Fong (1991). The use of prosody in syntactic disambiguation. *JASA* 90(6), 2956-70.
- Selkirk, E. & K. Tateishi (1991) Syntax and downstep in Japanese. C. Georgopoulos & R. Ishihara (eds.) *Interdisciplinary approaches to language: essays in honor of S-Y Kuroda*. Kluwer, Dordrecht.
- Shinya, T. (1999) Eigo to nihongo ni okeru fookasuni yoru daunsteppu no sosi to tyoon-undoo no tyoogo [The blocking of downstep by focus and articulatory overlap in English and Japanese]. *Proceedings of Sophia Linguistics Society*, vol. 14, 35-51.
- Sugahara, M. (2003) *Downtrends and post-FOCUS intonation in Tokyo Japanese*. PhD dissertation, University of Massachusetts, Amherst
- Sugahara, M. (2005) Post-focus prosodic phrase boundaries in Tokyo Japanese: Asymmetric behavior of an F0 cue and domain-final lengthening. *Studia Linguistica* 59, 144-173.
- Venditti, Jennifer J., Kikuo Maekawa and Mary E. Beckman. (in press) Prominence marking in the Japanese intonation system. In S. Miyagawa and M. Saito (eds.) *Handbook of Japanese Linguistics*. Oxford University Press.
- Xu, Yi (1999). Effects of tone and focus on f0 contour formation. *Journal of Phonetics* 27, 55-105.