

What does '?' Sound Like?

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BU Linguistics Colloquium

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Roadmap

- ◆ First: Pitch in English (phonetics and phonology)
- ◆ Next: What questions sound like
- ◆ Then: An experiment to look deeper
- ◆ Last: Conclusions and Outlook

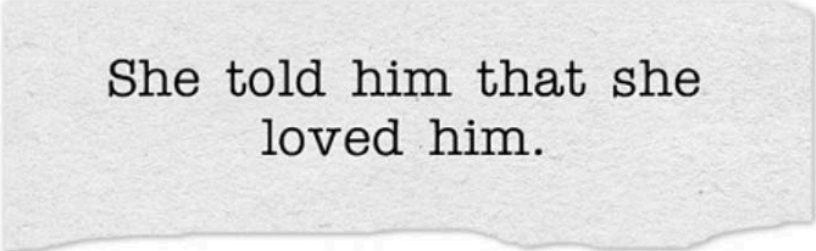
Pitch and Intonation

Variations in Pitch

- ◆ FACT: English is not a tone language
 - ▶ Does that mean we speak without pitch?
 - ▶ Literally impossible
- ◆ Pitch changes over the course of an utterance
 - ▶ Pitch is a perceptual phenomenon rooted in rate of vocal fold vibrations
- ◆ English systematically exploits pitch
 - ▶ It would be silly not to
 - ▶ But to what end?

Variations in Pitch

March 26th, 2014 at 4:30PM

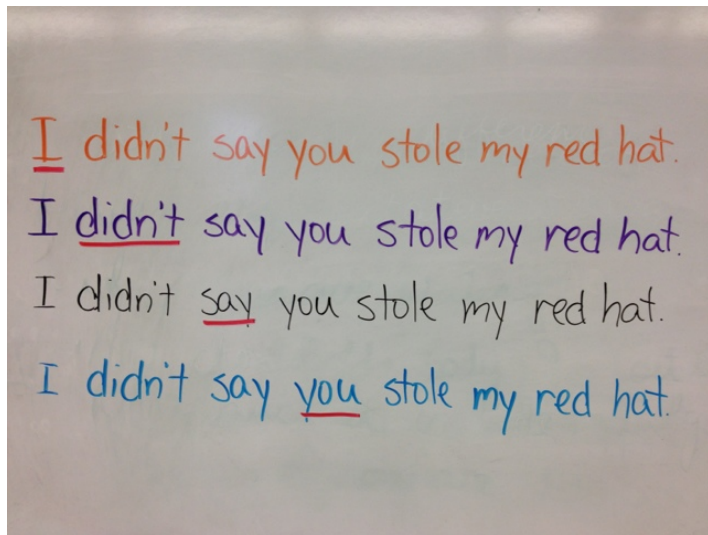


She told him that she
loved him.

Games with English: insert the word “only” anywhere into the above sentence and consider how the placement changes meaning.

<http://curlicuecal.tumblr.com/post/80818266551/games-with-english-insert-the-word-only>

Variations in Pitch



Variations in Pitch

Punctuation changes everything

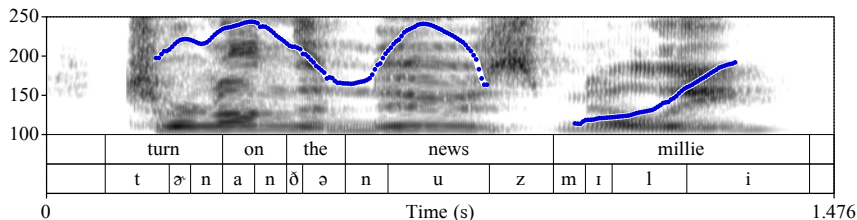


Variations in Pitch

- ◆ What is varying with the pitch?
 - ▶ Meaning
- ◆ So how is English **not** a tone language?
 - ▶ Tone languages use pitch to differentiate words (e.g., Thai, Navajo, Sandawe, ...)
 - Tone is a necessary part of the lexical entry for a word
- ◆ English is an **intonation** language
 - ▶ Variation in pitch affects meaning, *post-lexically*

Intonation

- ◆ Intonation can be thought of as a sequence of lows and highs
 - ▶ This melody is independent of the text it is associated with
- ◆ The lows and highs can be thought of as ‘targets’
 - ▶ Where do we find those targets?
 - ▶ We can find evidence for them inflection points

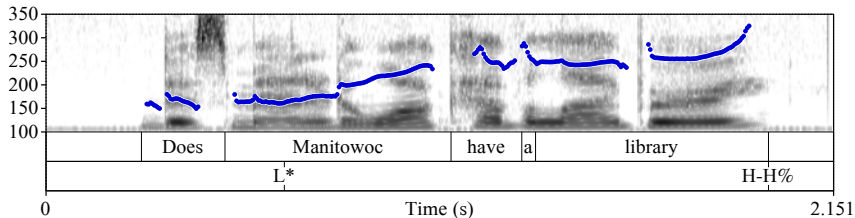


Intonation

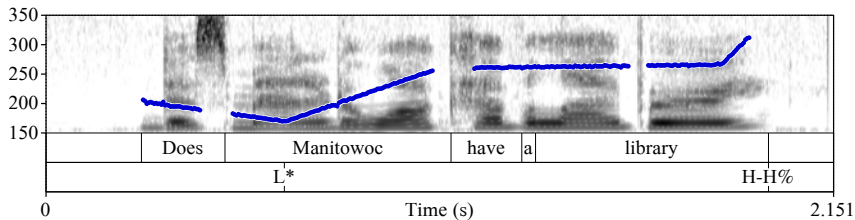
- ◆ How do these targets line up with the text?
 - ▶ Autosegmental-Metrical model (Pierrehumbert 1980, Beckman & Pierrehumbert 1986)
 - ▶ For American English: MAE_ToBI (Beckman & Hirschberg 1994, Beckman et al. 2006)
- ◆ There are different types of targets in MAE_ToBI
 - ▶ Alignment ***dependent on stressed syllables***
 - L*, H*, L+H*, L*+H, H+!H*
 - T* lines up with the stressed syllable
 - ▶ Alignment ***dependent on phrasing*** (and type of phrasing)
 - L-, H-
 - L-H%, H-H%, L-L%, H-L%
 - T- covers from preceding T* to end of intermediate phrase (ip)
 - T% occurs on the final syllable of the Intonational Phrase (IP)

Intonation of American English

- ◆ Listen to this:

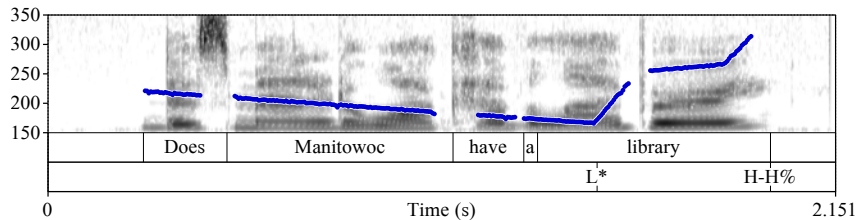
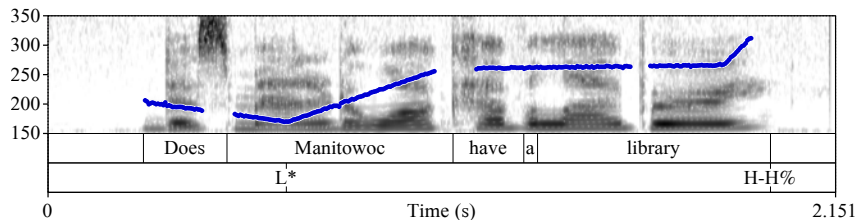


- ◆ Compare with this:



Intonation of American English

- ◆ Compare that with this:



Intonation of American English



System of Intonation

Valid Intonational Expressions

- ◆ Just like there are grammars governing valid combinations of words/morphemes (Morphosyntax), and valid combinations of consonants/vowels (Phonology)...
 - ▶ Phonology governs valid melodic sequences: “tonotactics”
 - ▶ Tonotactics depends governs both sequencing and structure
 - (cf. segmental phonotactics: */tla/, */atl/, ✓/at.la/)

Tonotactics: Tone Combinations

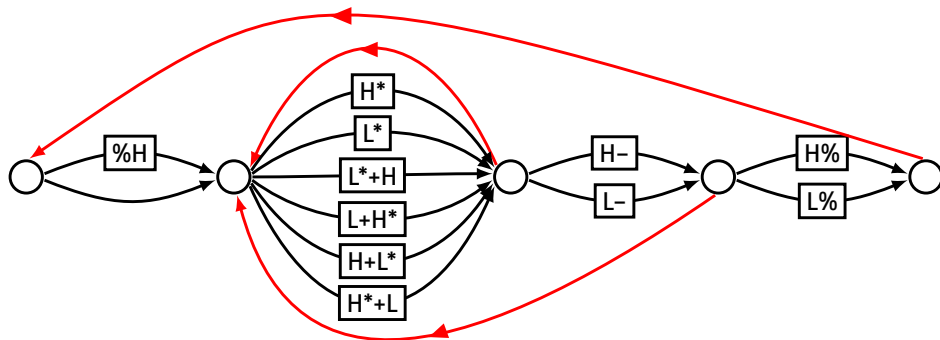
- ◆ Grammar of English intonation, modified from Beckman & Pierrehumbert 1986:

(Boundary Tone)

Pitch Accent(s)

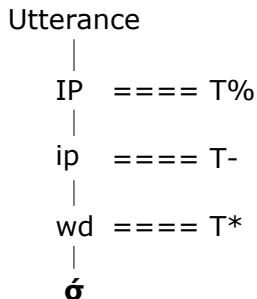
Phrase Accent

Boundary Tone



Tonotactics: Phrasing

◆ Minimal utterance:



- ▶ At least one IP, which requires at least one ip, which requires at least one stressed word, which requires at least one stressed syllable

More Intonational Phonology?

- ◆ Segmental phonology does more than govern phonotactics
 - ▶ Another aspect: allophones
 - Some variation in speech sounds is phonetic
 - ◇ /k/ → [k] vs. [k̚]
 - Other variation crosses otherwise critical phonological features
 - ◇ /t/ → [t] vs. [ɾ] vs. [ʔ]
- ◆ What kind of variation is there in the melodic intonational targets?
 - ▶ Is it all phonetic? Or are there 'allotones'?

Melodic Variation?

- ◆ What kind of variation is there in the melodic intonational targets?
- ◆ It is well established that there is 'low-level' phonetic variation
 - ▶ In part by nature: melodic targets are inherently *relative*
 - 'Syntagmatic'
 - ◇ What counts as high or low?
 - ◇ L* in one phrase may have a higher f0 than H* in another
 - cf. segmental phones
- ◆ Are there allotones?
 - ▶ Tacit assumption: L* is always realized as a single tone target in the (contextually defined) low range
 - ▶ We'll return to this

What does '?' Sound Like?

Question Intonation

- ◆ Question intonation... what is it?
 - ▶ “**We find most** (in some languages all) **of the suspensive intonations** used internally repeated at the end, **most often on yes no questions**. This is the intonation universal that has been most thoroughly studied.”

– Bolinger (1978:501)
 - ▶ How exactly this final high/rise is manifested differs crosslinguistically
 - Languages like Hungarian have a high on the penultimate syllable, with a fall on the final syllable (Ladd 2008)
- ◆ So final rise/high = question?
 - ▶ This is why many people characterize uptalk as sounding like a question
 - ▶ (But it's not quite the same: H-H% vs. L-H%, Ritchart and Arvaniti 2014)

Question Intonation

- ◆ Not all questions sound the same
 - ▶ Even a single question can sound very different in different contexts

the greatest need, for comparative purposes, is for fuller descriptions of how and when particular intonations of yes-no questions are used. The practice has been to lump all cases together, discriminating them only statistically: Language X may have a dozen ways of intoning a yes-no question, but it comes out having 'normally a terminal rise.' This is supposed to be true of ENGLISH, yet virtually anything can be done with a yes-no question:

And you be^{lieve} that? And you be_{lieve} that? And you be^{lieve} that?

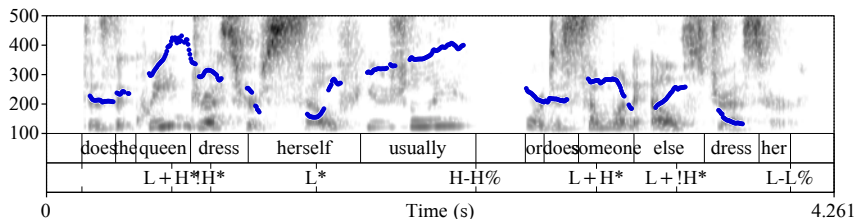
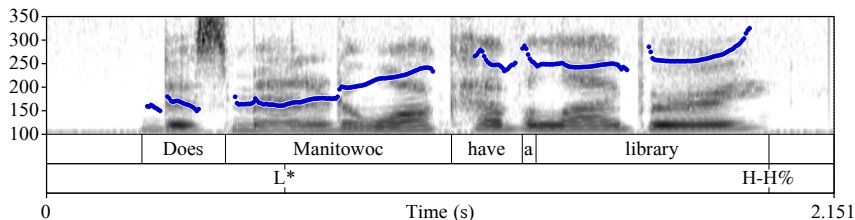
And you be_{lieve} that? And you be^{lieve} that? And you be_{lieve} that?

– Bolinger (1978:503)

Questions Rises?

- ◆ Let's focus on final edge tones: where do we find rises?

- ▶ Compare the following:



- ▶ Not all questions with subject-aux inversion are the same

Questions Rises?

- ◆ Let's focus on final edge tones: where do we find rises?
 - ▶ What do the following two sound like:
 - *(I can't see what's in your hand...)*
What are you reading?
 - *(Remind me what you said...)*
What are you reading?
 - *(I can't believe that !)*
You're reading what?
 - ▶ Not all questions with a wh-phrases are the same

Which Questions Have Final Rises?

- ◆ Whether there is a rise or not depends on what kinds of effect the speaker wants to have

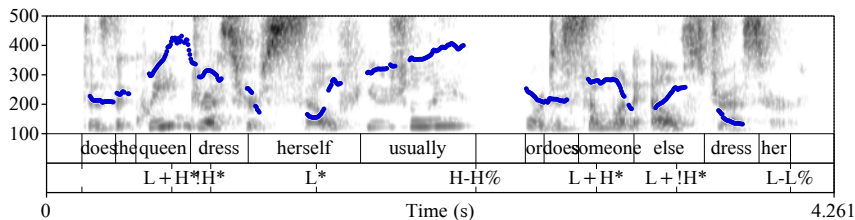
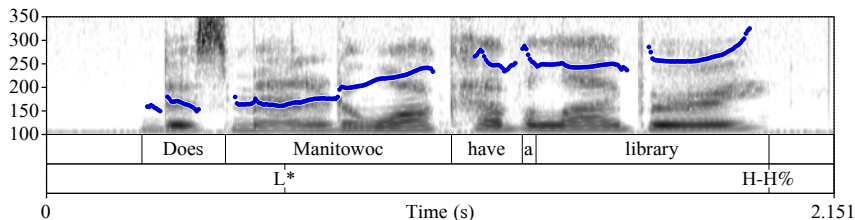
Doesn't Rise	Rises
WH (What did he see?)	Echo (He saw what?)
Alternative (Do you want some, or not?)	Polar (Do you want some?)
Rhetorical (So is there a better way?)	Tag (You want some, right/don't you?)
Assertions (There is a better way.?)	Requests (Can we have the bill please?)

- ▶ This is not the whole story!
 - There are some (fine grained) differences between these
 - How do we define the boundaries for these categories?
(These aren't necessarily the right categories)
 - Speech communities / Dialects vary here
 - Register differences?

Pitch Accents in Questions?

- ◆ Prototypically, polar questions with a final rise have a **L* pitch accent** on the final stressed syllable

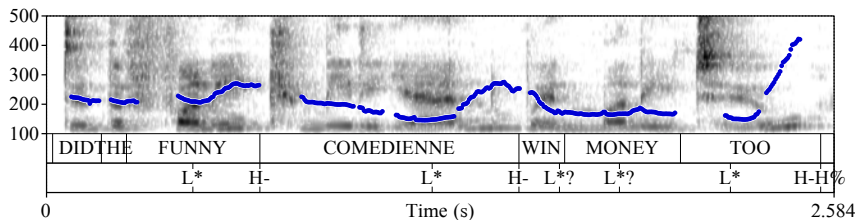
- ▶ Remember these?



Pitch Accents in Questions?

◆ In a previous pilot study, there were three types found:

▶ Gradual fall to L*



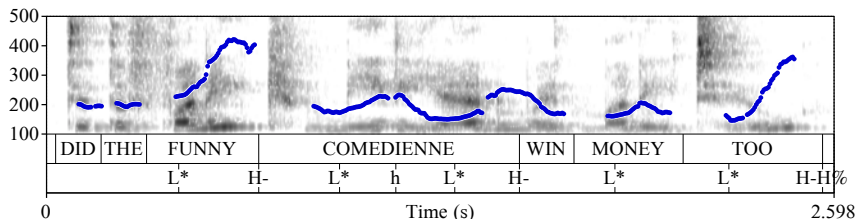
▶ Rise to high/mid (h/m) preceding the fall to L*

▶ Steady high/mid (-h/-m) preceding the L*

Pitch Accents in Questions?

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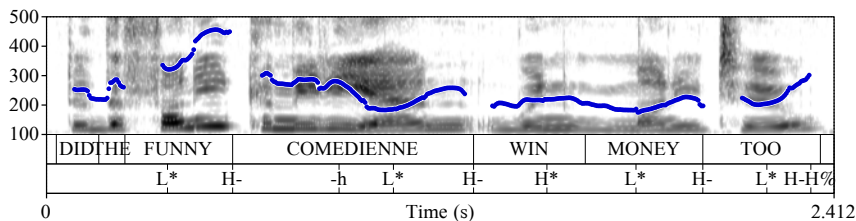


- ▶ Steady high/mid (-h/-m) preceding the L*

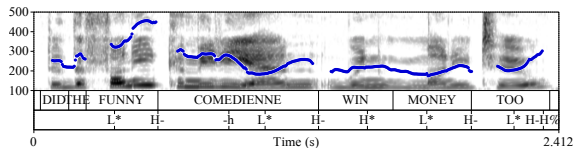
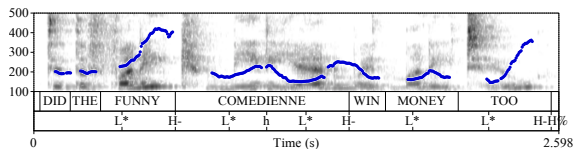
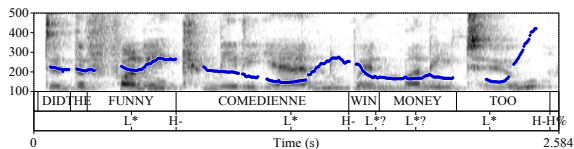
Pitch Accents in Questions?

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Pitch Accents in Questions?



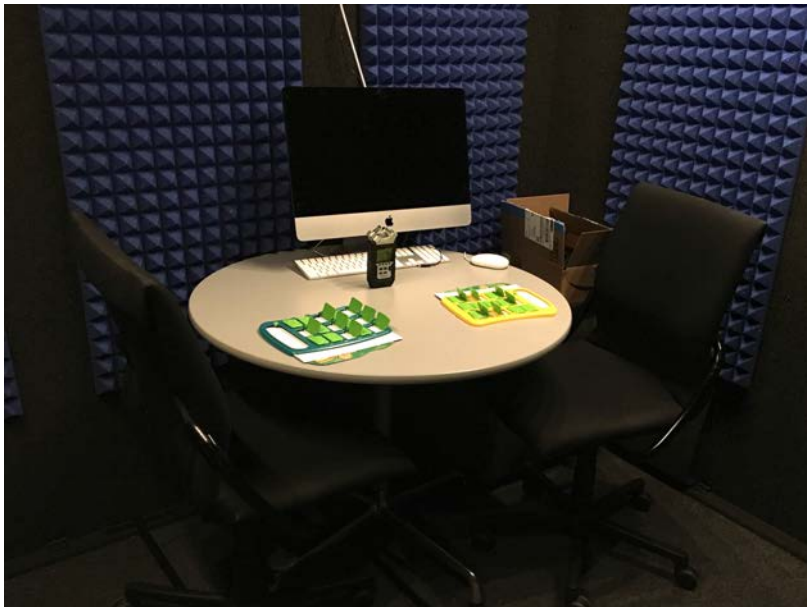
Pilot Study

- ◆ Why would this happen?
 - ▶ To make the following low tone more salient?
 - (Like initial strengthening or dissimilation for segments?)
- ◆ How often does this happen?

Gradual fall to L*	20/66
Rise-fall / Steep fall to L*	32/66
Ambiguous	14/66
- ◆ Open question then: Why so many Rise-falls/Steep falls in this data?
 - ▶ Effect of context, which encouraged extra emphasis?
 - ▶ To test that...

Experiment: Guess Who

Experimental Setup



Experimental Setup

- ◆ Task: Play the game!
 - ▶ At 3 levels of emotional engagement
- ◆ Benefits:
 - ▶ The context is controlled
 - ▶ Naturalistic speech
 - ▶ Lots of polar questions get asked, by nature

Experimental Data

- ◆ Participants are anonymized
 - ▶ Demographic information (e.g., age, gender, sex, hometown, etc.) preserved
- ◆ Recordings are annotated
 - ▶ ToBI labelling
 - ▶ Position during the round
 - ▶ Question type: Aboutness
 - "Opponent's menu items"
 - "Guess at answer"
 - "Non-game-related"
 - "Previously asked questions"
 - "Game rules"
 - ▶ Question type: Function
 - ▶ Question type: Form

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- ◆ Recordings are annotated
 - ▶ ToBI labelling
 - ▶ Position during the round
 - ▶ Question type: Aboutness
 - ▶ Question type: Function
 - "Information-seeking" "Confirmatory"
 - "Rhetorical" "Echo question"
 - "Other"
 - ▶ Question type: Form

Experimental Data

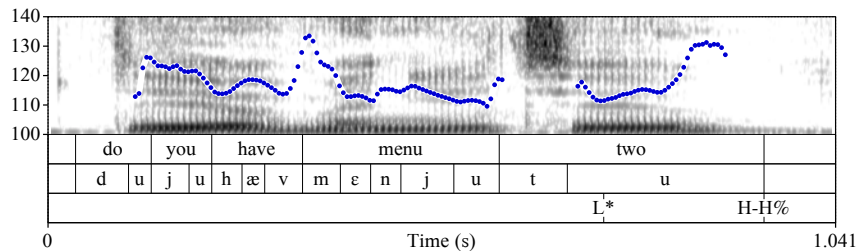
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 - ▶ Question type: Aboutness
 - ▶ Question type: Function
 - ▶ Question type: Form
 - "Polar Question" "WH Question"
 - "Alternative Question" "Tag Question"
 - "Other"

Findings: Pitch Accent

- ◆ Disclaimer: It's very early in the process yet
- ◆ We've found variation!
- ◆ Melody around final stressed syllable
 - ▶ Gradual fall (L^*), steep fall ($-hL^*$), and rise-fall (hL^*)
 - As predicted based on pilot data
 - ▶ Examples...

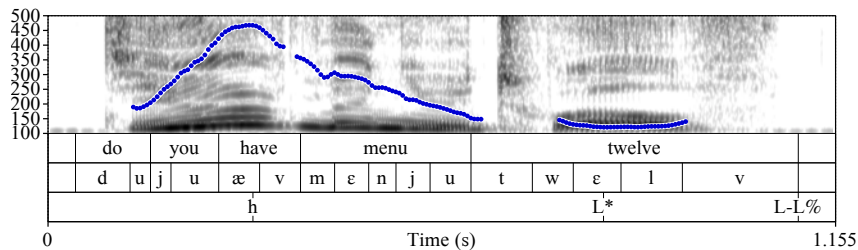
Findings: Pitch Accent

◆ Standard gradual fall to L*:



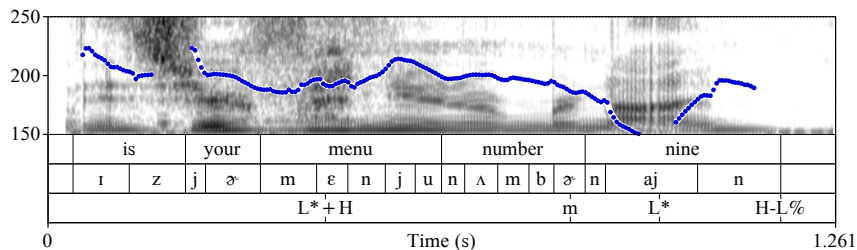
Findings: Pitch Accent

- ◆ Extra 'high' target before L*: (Same speaker!)



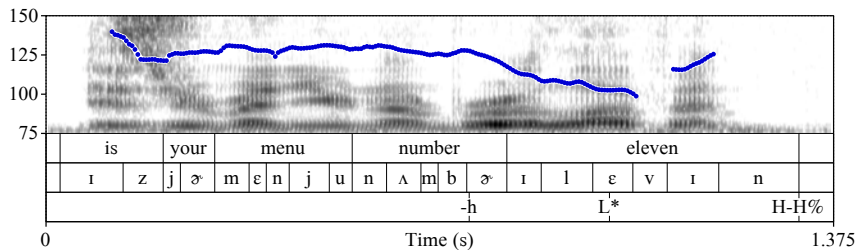
Findings: Pitch Accent

- ◆ Extra 'mid' target just before L*:



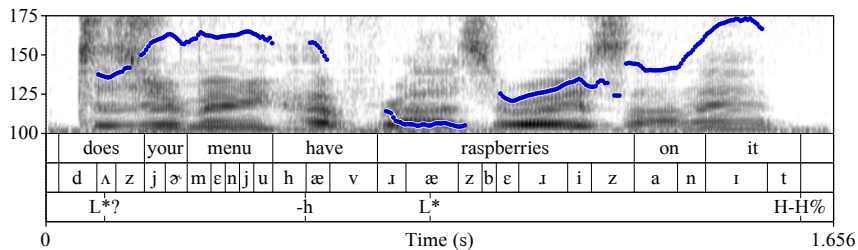
Findings: Pitch Accent

◆ High cover tone before L*:



Findings: Pitch Accent

◆ High cover tone before L*:

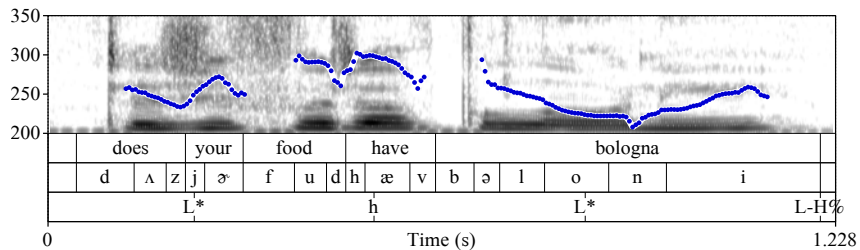


Findings: Edge Tones

- ◆ We've found variation!
- ◆ Also melody at final phrase edge tone
 - ▶ Final rise (H-H%), steady high (H-L%), slight rise (L-H%), even final fall (L-L%)
 - ▶ Examples...

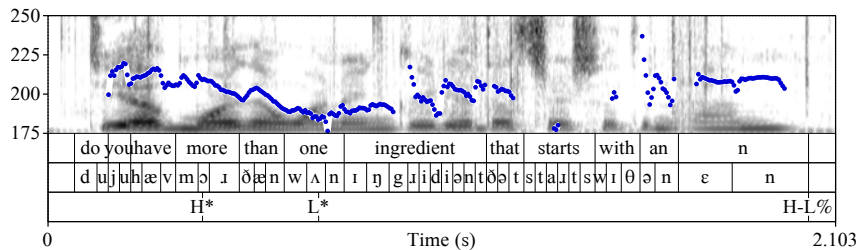
Findings: Edge Tones

◆ L-H%:



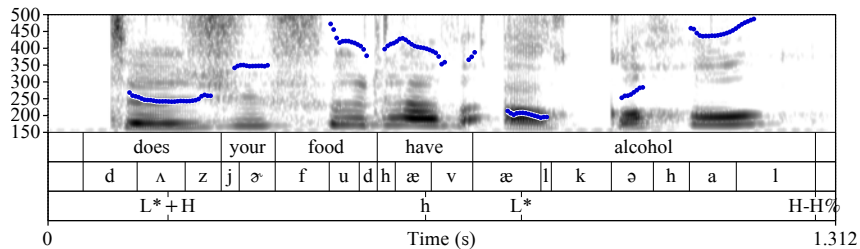
Findings: Edge Tones

◆ H-L%:



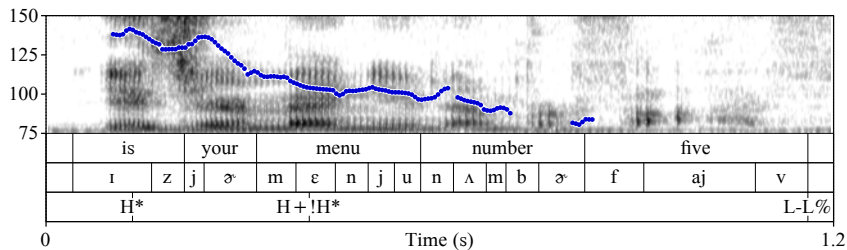
Findings: Edge Tones

◆ H-H%



Findings: Edge Tones

◆ L-L%



Early Analysis: Variation

- ◆ Not enough data to be certain yet, but impressionistically...
 - ▶ Speaker matters
 - One speaker consistently did a fall on his questions
 - ◇ (e.g., this)
 - To do: look for demographic correlations
 - ▶ Speaker attitude mattered
 - When a speaker was confident, the question form might have been a polar question, but it involved L-L%
 - ◇ (this vs this)
 - To do: look for correlations with when in the round the question was asked

Early Analysis: Variation

- ◆ Not enough data to be certain yet, but impressionistically...
 - ▶ Question aboutness mattered
 - One speaker seemed to prefer L-H% and H-L% for questions that were guesses at answers
 - To do: run statistics!
 - ▶ Level of emotional engagement mattered
 - H-H% became less common when speakers were told to pretend to be bored
 - ◇ (this vs this; this vs this)
 - Much smaller pitch ranges when bored
 - To do: run statistics!

Conclusions and Outlook

Conclusions and Outlook

- ◆ **‘?’ doesn’t sound just one way**
 - ▶ There is lots of intonational variation
 - ▶ Even within categories like ‘polar question’
 - ▶ We found variation in pitch accents as well as edge tones
- ◆ Big questions:
 - ▶ Which forms are allophones of one another?
 - ▶ Which forms are linguistically contrastive?
- ◆ To explore these phonological questions, we need to know what kind of phonetic variation there is
 - ▶ We need conventions for labelling / describing phonetic variation in intonation
 - ▶ Something like an intonational equivalent of the IPA?
 - cf. IPrA (Hualde & Prieto 2016) / IViE (Grabe et al. 1998)

Thank You!

The linguistics programs at UCLA, BU, Swarthmore, and Princeton

You, the audience

My research assistant Z.L. Zhou

The audience of Speech Prosody 2016

Colleagues who participated in my pilot study

Intonational collaborators and mentors