

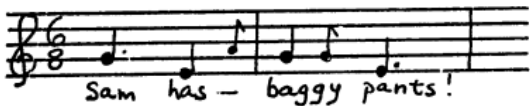
Intonation and meaning

EGG 2024 in Braşov

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Universität Konstanz

<https://deniz.fr/summers/egg2024/>



from Liberman (1975)

Yesterday:

Spoken utterances are associated with a **tune**, which is **structured and conveys meaning** (sentence type, focus, etc.)

Today:

- ✧ Pitch accents vs. edge tones
- ✧ Organization around a nucleus
- ✧ Towards a syntax to prosody mapping

Outline

Tunes and their component parts

- Initial evidence for component parts

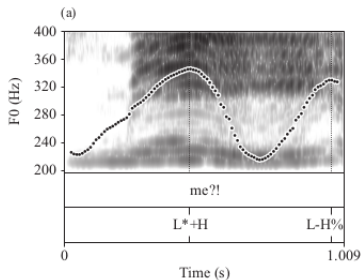
- Pitch accents

- Edge tones

The nucleus, pre- and post-nuclear material

Syntax to prosody

- Background on syntax and OT

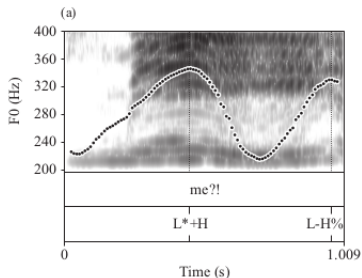


About these tunes, one question is...

H1 Do they *apply holistically to an entire utterance?*

Do they align start-to-end & scale with an utterance?

H2 Or do they decompose into component parts, which may align with different parts of an utterance?



About these tunes, one question is...

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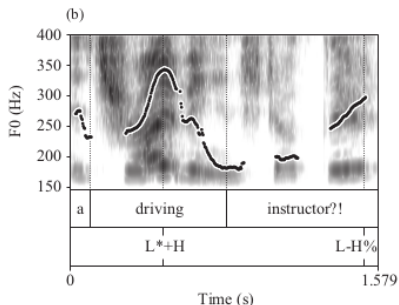
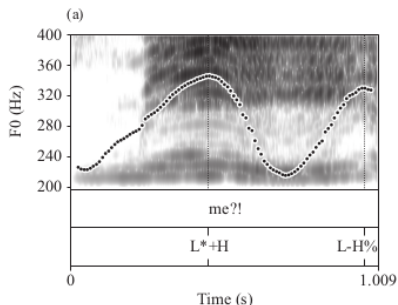
- ▶ **Pitch accents** mark stressed syllables H*, L*, ...
- ▶ **Edge tones** mark edges of prosodic constituents. H-, L%, ...

Points of anchor

figures from Aravaniti 2022

Take the same rise-fall-rise contour, and vary utterance length.

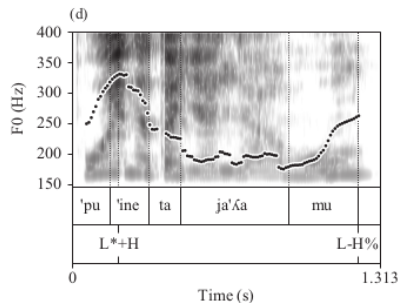
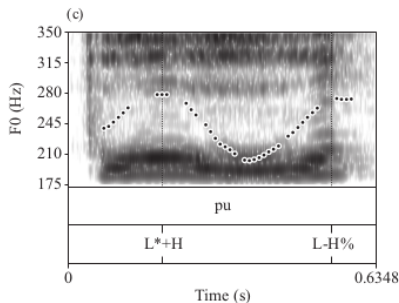
The contour doesn't stretch 'proportionally.'



Points of anchor

figures from Aravaniti 2022

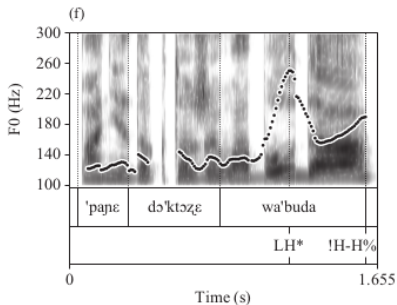
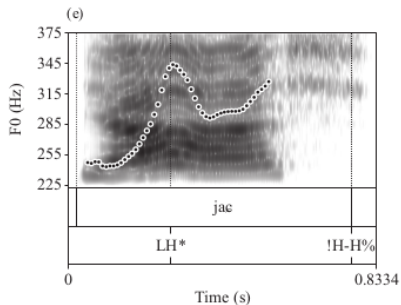
Greek 'where?' & 'where are my glasses?' in question intonation:



Points of anchor

figures from Aravaniti 2022

Polish 'Jaś' (name) & 'Mr. Dr. Wabuda' with a calling contour:



These contours are made up of two discrete events.

- ✧ One aligned with certain syllables, e.g., 'me' or 'dri-'
- ✧ The other aligned with the right edge of the utterance

This suggests that tunes don't apply holistically to utterances.

They decompose into component parts, which align with different parts of an utterance. Which parts?

Pitch accents are aligned with **stressed syllables**.

Stress

If we are confident that we have identified stress, we can move it around and see that pitch accents move around with it.

In (1), the syllables in **bold** are stressed, and marked with **H***.

- (1)
- a. geleceğin **Ankaralıları**
the future people of Ankara
 - b. geleceğin **Almanyalıları**
the future Germans
 - c. geleceğin **inananları**
the future believers

Switch to Praat.

Different languages have different pitch accent inventories.

✧ Per ToBI, Mainstream American English has:

L^* H^* $!H^*$ $L+H^*$ $L+!H^*$ $L^*+!H$ $H+!H^*$

✧ Per İpek (2015), Turkish has:

H^* $!H^*$ $\wedge H^*$

✧ Per GToBI, German has:

L^* H^* L^*+H $L+H^*$ H^*+L $H+!H^*$

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- ✧ Per GToBI, German has:

$L^* \quad H^* \quad L^*+H \quad L+H^* \quad H^*+L \quad H+!H^*$

- ✧ H and L are *local* maximums and minimums.

- ✧ There is no M, and rises or falls are not primitives.

(Ladd 2005, p. 62 et sq.)

- ✧ Pitch accents with + are *bitonal*:

- In $L+H^*$, an L *leads* an H^* .
- In L^*+H , an H *trails* an L^*

Diacritics to indicate relative height

Downstep and upstep

- ▶ !H

A downstepped H is perceptually lower than an immediately preceding H, but still distinct from a L.

- ▶ ^H

An upstepped H is perceptually higher than surrounding Hs

For more on downstep and upstep, consult chapter 2.6–2.7 of the MIT ToBI course, which the two following pitch tracks are taken from.

Downstep

Saving private Ryan 2: !H* surrounded by H*

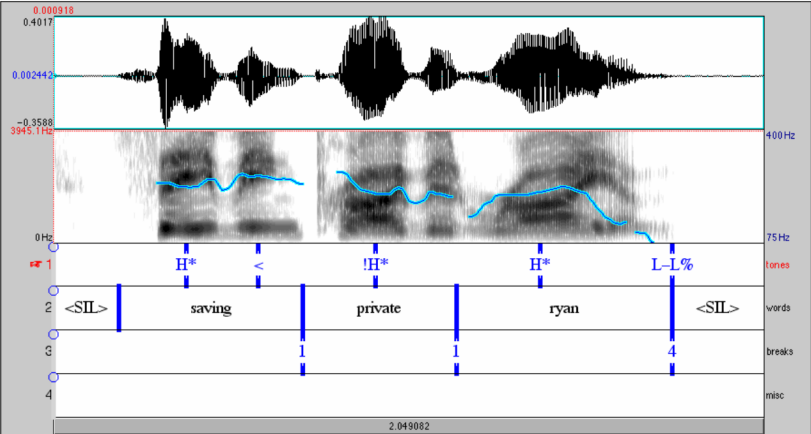


Figure 2.6.8 H* following !H* on *saving private ryan*

[<private_ryan2>](#)

Downstep

Saving private Ryan 3: H* followed by two !H*

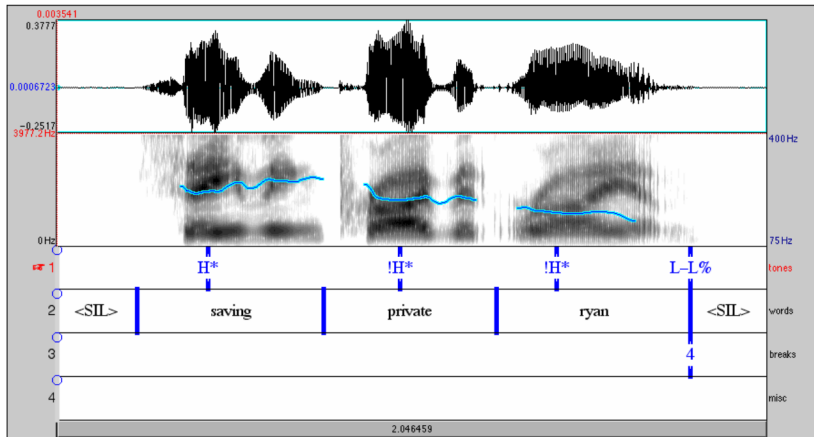


Figure 2.6.9 a sequence of !H* produced by the same speaker as the previous example.

[private_ryan3](#)

Upstep

- (2) a. Anamurlu.
The person from Anamur. H* on -na-
- b. Anamurlu mu?
The person from Anamur? ^H* on -na-

Stress hard

2.2.1 *The phonetic nature of stress*

Probably no topic in the general area of intonation and suprasegmentals has posed such a puzzle as stress. A great deal of experimental work going back many decades has sought to establish both physiological and acoustic correlates of stress as a phonetic phenomenon. Lehiste, writing in 1970, says that 'of the three suprasegmental features [quantity, tonal features, and stress], stress has for a long time been the most elusive one' (p. 106).

Ladd (2005: p. 49)

Stress

If a syllable bears a pitch accent, it is stressed.

If it doesn't bear a pitch accent, it may or may not be stressed.
(Not all stressed syllables are pitch accented.)

In (3), no pitch difference is realized on *permit*, but we perceive stress on one or the other syllable.

- (3) a. I TOLD you the permit had expired.
 b. I TOLD you they'd permit him to leave.

⇒ Stress is also realized by intensity and duration.

See Hayes (1995) for more stress.

Edge tones are aligned with the left or right edges of prosodic constituents.

The prosodic hierarchy

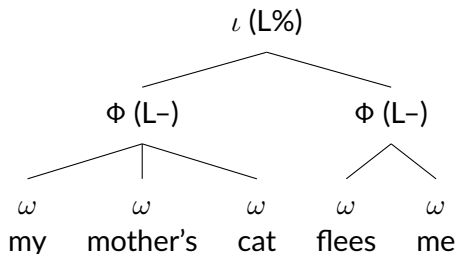
Utterances organize hierarchically into prosodic constituents:

υ	Utterance	(corresponds roughly to a paragraph or more)
ι-phrase	intonation phrase	(corresponds roughly to a clause)
Φ-phrase	prosodic phrase	(corresponds roughly to a syntactic phrase)
ω-word	prosodic word	(corresponds roughly to a grammatical word)
F	Foot	(metrical unit: trochee, iamb...)
σ	syllable	(strings of segments: CV, CVC, ...)
μ	Mora	(unit of syllable weight)

from Féry (2017)

- ✧ Some people make finer grained distinctions for some langs.
- ✧ prosodic \approx phonological \approx intermediate phrase

The prosodic hierarchy



At phrase boundaries, you might find:

- ▶ certain tones: here, L- and L%
- ▶ breaks: shorter for ips, longer for IPs

These trees are related to but distinct from (source) syntax trees.

- ✧ Some examples from English.
- ✧ Some examples from Turkish.

Exercise

In Turkish, pre-nuclear NPs often have an H at their right edge.

- (4) Dilara'nın arkadaşı^H yarın gelecek.
Dilara's friend tomorrow will come
Dilara's friend will come tomorrow.

Turkish words are also usually stressed on their final syllable.

How can we decide whether that H tone is a pitch accent or an edge tone?

Exercise

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- (5) Dilara'nın sandal^{H*} yesi^{H-} yarın gelecek.
Dilara's chair tomorrow will come
Dilara's chair will come tomorrow.

Doing this kind of exercise well and at a larger scale will yield the *tonal inventory* of a given language.

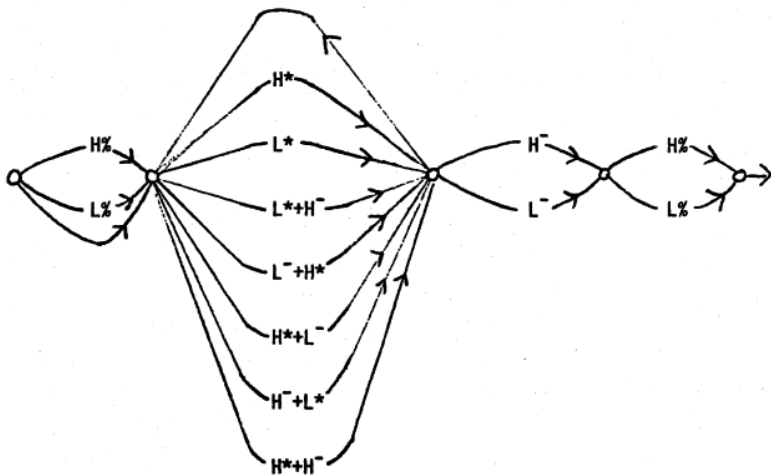
- ✧ What set of tones does the language make use of?
- ✧ What are these tones used to mark?

14) Boundary Tone

Pitch Accents

Phrase Accent

Boundary Tone



Pierrehumbert's (1980) grammar of well-formed tonal sequences in English (an FSA)
I think "phrase accent" used to mean "nuclear accent," but is now used for intermediate phrase boundaries.

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- Edge tones

The nucleus, pre- and post-nuclear material

Syntax to prosody

- Background on syntax and OT

There are up to three regions in a sentence

- | | | | |
|-----|----|------------------------|----------------|
| (6) | a. | The nucleus | always present |
| | b. | The pre-nuclear field | can be absent |
| | c. | The post-nuclear field | can be absent |

Pre-nuclear pitch accents might look different from nuclear ones.

The post-nuclear field hosts no pitch accents.

The nucleus

(7) YESTERday, BARBara WATERed her PLANTS.

- ✧ The linearly **last pitch accent** in a phrase is the nuclear accent in that phrase. The word that bears it is the **nucleus**.
- ✧ The nuclear accent is perceived as the most prominent accent in a sentence, even though it might not involve, e.g., the largest pitch excursion.
- ✧ The nucleus often bears informational prominence.

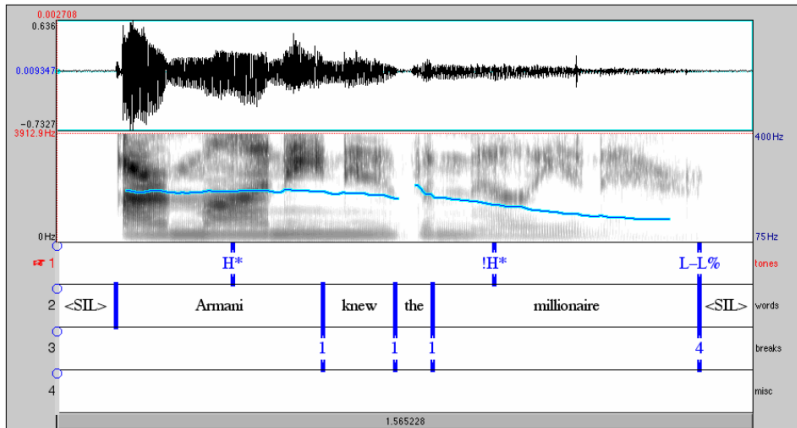


Figure 2.6.10b

[<armani3>](#)

A not very eventful Nuclear Pitch Accent.

Nuclear stress has a default position that is predictable.

On the basis of syntactic information.

- (8) a. Barbara hat gestern ihre **BLUMEN** gegossen.
b. Barbara **watered** her **PLANTS** yesterday.
- (9) a. die **Landung** auf dem **MOND**
b. the **landing** on the **MOON**

And semantic/pragmatic information.

- (10) a. JOHNSON died.
b. Truman DIED.

“Johnson’s health was not on people’s mind as Truman’s had been, and when his death came it was a surprise.”

(Schmerling 1976)

The default position of nuclear stress

This is the intonational contour(s) that people pronounce sentences with **out of the blue** or in **all new contexts**.

- (11) A What are some things that happened today?
B Ali had sushi at the crack of dawn.
Leo's bicycle got stolen at the grocery store.
And Jeremiah wrote a letter to his long lost lover.

- ✧ the Nuclear Pitch Accent falls on
- ✧ there is variability in the position of
 - pre-nuclear pitch accents,
 - breaks and boundary tones.

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- ✧ the Nuclear Pitch Accent falls on “dawn,” “store,” “lover.”
- ✧ there is variability in the position of
 - pre-nuclear pitch accents,
 - breaks and boundary tones.

It's not about the last word

(12) Ali hat im Morgengrauen Sushi gegessen.
Leos Fahrrad wurde beim Supermarkt gestohlen.
Und Jeremiah hat seinem Freund einen Brief
geschrieben.

(13) Ali had sushi yesterday.
Leo's bicycle got stolen somewhere.
And Jeremiah wrote a letter for me to post.

The specifics of today mostly concern English, German, Dutch-like languages.
What happens in OVS, OSV, VSO, VOS languages?

It's not about the last word

(12) Ali hat im Morgengrauen **Sushi** gegessen.
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The mind reader

Is syntax a good predictor of prosody?

Bolinger: No!

ACCENT IS PREDICTABLE (IF YOU'RE A MIND-READER)

DWIGHT BOLINGER

Harvard University

The Chomsky-Halle Nuclear Stress Rule and its modification by Bresnan, and to some extent the criticisms that have been leveled at it, have in common an attempt to account for accent in terms of syntax. Instead, accent should be viewed as independent, directly reflecting the speaker's intent and only indirectly the syntax. Accented words are points of information focus.

Definitely give a listen to his "Power to the Utterance."
(For historical, stylistic and methodological lessons.)

The mind reader

Is syntax a good predictor of prosody?

“Predictable if you’re a mind reader \approx if you know speaker’s intent

- ▶ *That*, and not syntax is a (main) predictor of prosody.
- ▶ We’re not mind readers, so we can’t predict prosody.”

It looks like Bolinger’s warning was against a certain, too mechanistic approach to the syntax/prosody relationship.

His warning is certainly well heard (Büring 2016: pp. 5–6).

But not enough to be discouraging.

Syntax might not be enough

The same sentence (\Rightarrow the same syntactic structure) is associated with different natural intonation patterns.

- (14)
- a. mariAnna made a MARmelade.
 - b. marianna made a MARmelade.

Syntax might not be enough

There are words that don't like being accented out of the blue.

- (14) What happened today?
- a. Marianna MADE something.
 - b. #Marianna made SOMETHing.
- (15) What happened today?
- a. #Marianna MADE a marmelade.
 - b. Marianna made a MARmelade.

Open class vs. functional vocabulary?

Syntax might not be enough

More damning:

Sentences with (apparently) the same syntactic structure but with different *content* words with different accent patterns.

- (14) a. The end of the chapter is reserved for various problems to COMPUTERIZE.
- b. The end of the chapter is reserved for various PROBLEMS to solve.

Emphasis? Predictability?

Syntax might not be enough

More examples from Bolinger:

- (14) a. I have a point to emphasize.
b. I have a point to make.
- (15) a. I can't finish in an hour—there are simply too many topics to elucidate.
b. I can't finish in an hour—there are simply too many topics to cover.
- (16) a. Those are crawling things.
b. Those are crawling insects.
- (17) a. lessons to learn
b. passages to memorize

Syntax might not be enough

The bottom line:

- ▶ If two (even subtly) different intonation patterns are possible for a sentence without any change of meaning, our theories should **predict free variation**.
- ▶ If there are **other factors** than syntax that affect intonation patterns with regularity, our theories should **incorporate them**.

(Taking into account focus and givenness marking *in addition* to syntax, for example, goes a long way.)

But that default can be overridden, e.g., because of focus, givenness, etc.

- (14) a. BARBARA watered her plants yesterday.
- b. Barbara WATERED her plants yesterday.
- c. ...

The pre- and post-nuclear fields

Material that linearly...

- ▶ ...precedes the nucleus is 'pre-nuclear.'
- ▶ ...follows the nucleus is 'post-nuclear.'

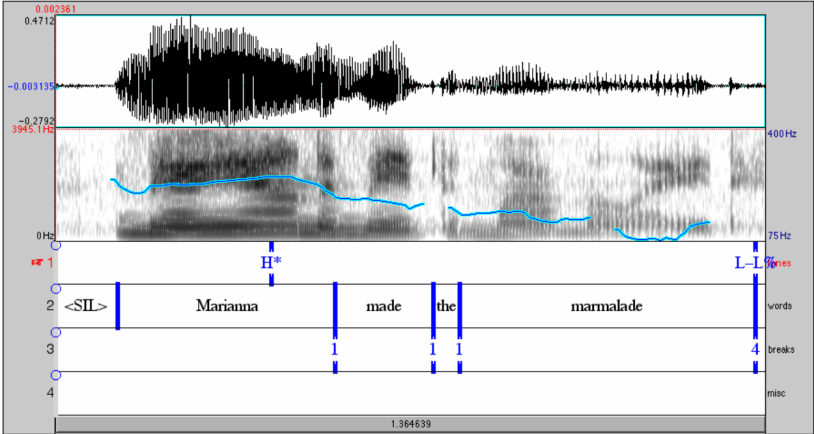
Material in the pre-nuclear field is accented and phrased regularly.

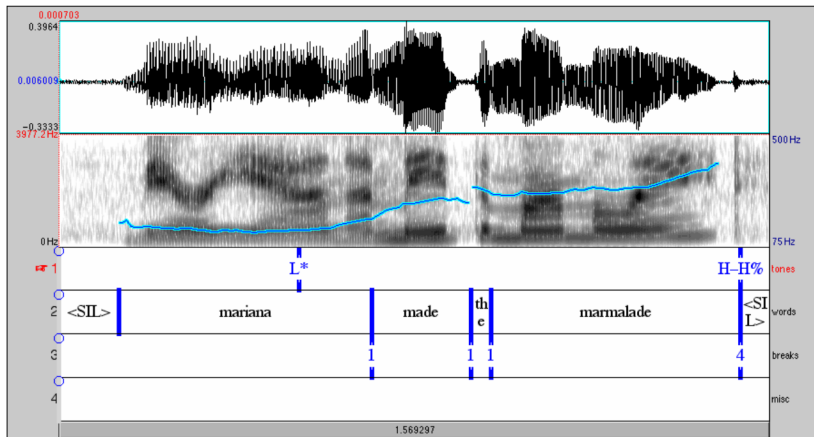
Material in the post-nuclear field is...

- ▶ deaccented,
- ▶ phrased with the nucleus. (though see Ladd 2005: 143–147)

Figure 2.3.2 A single H* in an intonational phrase with the same words as Figure 2.3.1

<[marmalade2.wav](#)>





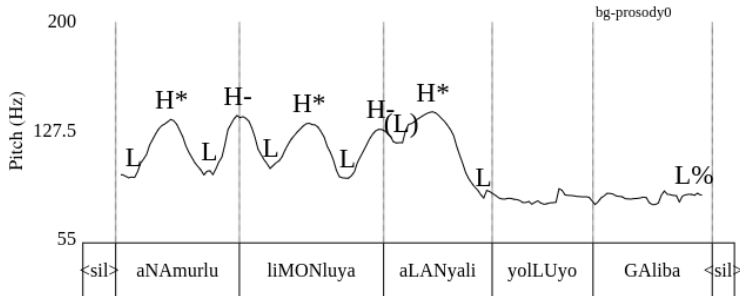
(6) (What's going on?)

a. anámurlu limónluya alányali yollúyor gáliba
 (()_Φ ()_Φ ()_Φ)_I

Anamur.DEM Limonlu.DAT Alanya.DEM send ADV

The person from Anamur is sending people from Alanya to Limonlu, I think.

b. Pitch track for 6a



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Regularities

There are obvious regularities in how we intone things.

Questions:

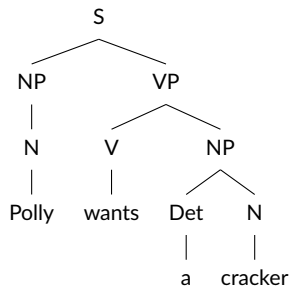
Can we predict what intonational contour arbitrary sentences will have (in a given language)?

- a. If not, why not?
- b. If yes, what does that take?

A fruitful enterprise has been to say **yes**, and to take **syntax as the main predictor**.

⇒ Bennett & Elfner (2019) The Syntax-Prosody Interface.

Refresher on syntax



[[Polly]_{NP} [wants [a cracker]_{NP}]_{VP}]_S

Refresher on Optimality Theory (OT)

We often observe changes happening to the same item.

- (15)
- a. çek-ecek 'it will pull'
 - b. çak-acak 'it will strike'
 - c. The future suffix: {-ecek, -acak}

Then, we posit an underlying and various surface forms:

- (16)
- a. Underlying: -acak
 - b. Surface: {-acak, -ecek}

We now want to talk about the relationship between the two...

Refresher on Optimality Theory (OT)

One way of analyzing the Turkish situation is to say that the language has a **constraint**.

(17) BACKNESS HARMONY

All vowels in a suffix match in backness with the last one in the root.

In general, in the language, the vowels...

- a, ɪ, o, u are followed by -acak back vowels
- e, i, ö, ü are followed by -ecek front vowels

and words must do as best as they can to obey the constraint.

Refresher on Optimality Theory (OT)

One way of analyzing the Turkish situation is to say that the language has a **constraint**.

(17) BACKNESS HARMONY

All vowels in a suffix match in backness with the last one in the root.

So when we want to say “it will strike/hammer” we have four logically possible options.

(18) a. çak-acak ‘it will strike’

b. çak-ecek

(19) a. çek-acak

b. çek-ecek ‘it will pull’

Refresher on Optimality Theory (OT)

One way of analyzing the Turkish situation is to say that the language has a **constraint**.

(17) BACKNESS HARMONY

All vowels in a suffix match in backness with the last one in the root.

But only two are acceptable:

(18) a. çak-acak 'it will strike'

b. *çak-ecek

(19) a. *çek-acak

b. çek-ecek 'it will pull'

The reason is: the starred forms violate BACKNESS HARMONY.

Refresher on Optimality Theory (OT)

In the general case, languages have many constraints that enforce different things, with some, more important to satisfy than others.

- (20) FAITHFULNESS TO INPUT:
Every segment in a surface form is the same as the corresponding segment in the underlying form.

The form in (21) satisfies this constraint.

- (21) çak-acak “it will strike”


The form in (22) violates it twice.


- (22) çek-ecek ‘it will pull’

So, shouldn't it be ungrammatical?

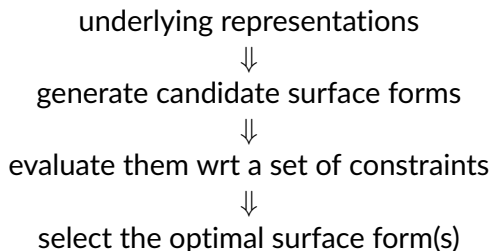
Refresher on Optimality Theory (OT)

Constraints are ranked, and are violable.

/çek-acak/	BACKNESS HARMONY	FAITHFULNESS TO INPUT
çek-acak	*!*	
 çek-ecek		**

- ▶ In Turkish, it is more important to change a vowel to satisfy harmony, than to be faithful to the input.
- ▶ And even though the winning candidate is not perfect, it is better than its competitor wrt these constraints.
- ▶ Symbols:
 - ▶  designates the winner
 - ▶ Asterisks (*) count violation marks
 - ▶ The ! marks the point at which a candidate loses.

Refresher on Optimality Theory (OT)



We want to apply all of this to prosody:

Given an input form (syntax + other things), predict an output form (intonational structure).

For more on OT, see:

⇒ John McCarthy (2008)

Doing Optimality Theory: Applying Theory to Data