

Intonation and intonation units in Ahtna oral performance

Andrea L. Berez
Department of Linguistics
University of California, Santa Barbara

Today's Question:

What intonational features **distinguish between the genres** of Ahtna oral performance and expository discourse?

Or

Why does telling an Ahtna traditional tale sound different from chatting? [for one speaker]

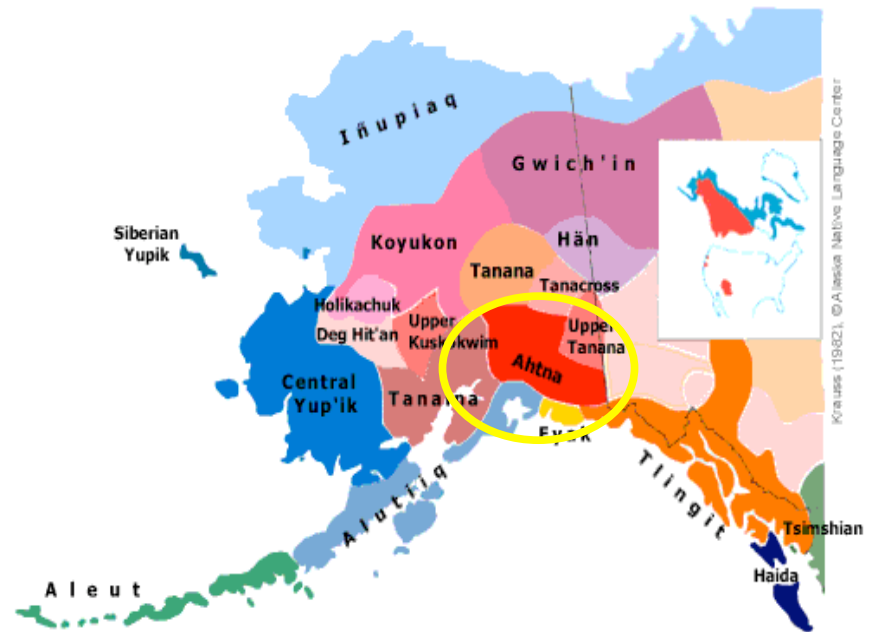
Introduction | Temporal Features | Pitch Features | Summary

Ahtna language
The data
Methodology



Ahtna (Athabaskan)

- Pop. ~2000
- 30-50 elderly speakers
 - All bilingual with English
- No phonemic tone
- Some work on prosody:
 - Tuttle (2002, 2003, 2008), Tuttle & Lovick (2007) on neighboring Dena'ina
 - Stress and intonation are distinct
 - Lower pitch in “phrase”-final syllables



The data



- Two excerpts from a single recording session by Martha Jackson in 1982 with Jim Kari in Fairbanks, Alaska.
- Respected elder, skilled storyteller, held position of *Kuy'aa* 'female chief'.
- “**Salmon Boy**” story: oral performance
 - Impressionistically: regular tempo, short spurts, little repair, regular intonation; sounds 'practiced.'
- “**Puberty Practices**” story: expository discourse
 - Impressionistically: longer units, irregular length and tempo, many false starts/repair; sounds 'off-the-cuff.'

Yenidaa nahwgholnic de 'adii.
'I will tell an old-time story now.'

Łuk'ae,
(2.4)

**'adii Bac'its'aadi konii yi gha
nahwgholnicde.**

*'I will tell the story of the salmon
that is called 'The One Who Is
Highly Regarded'.'*

(2.7)

Yenidaa,

łuk'ae,

(2.3)

koht'aenen,

(2.1)

koht'aene tsaa,

(0.6)

tsaa xu natedaasen.

*'Anciently the salmon man was
going back and forth to the cache.'*

(1.5)

'Udii nakeytel'aas tsaa,

(0.6)

tsaa t'aa ba' nalyaes.

*'All the time they were sending him
to the cache; he was bringing dry
fish from the cache.'*

(1.4)

Ba' nalyaes su.

'He was bringing dry fish.'

(1.3)

Cu taaxu natesdyaayi lu,

(1.4)

hwt'ae,

(0.5)

uk'edighaetł' ukol.

*'He went there again for the third
time, there was no one, he was
gone.'*

*((Martha Jackson, Bac'its'aadi/The
Salmon Boy Story))*

Tsikał kugha Itsiis,

(0.2)

cu tsic'uudze' .. Itsiis.

'A hood was made for them, and a hat was made.'

(0.5)

Tsikał hwt'e' u'dghi'a'.

'The hood was called a 'head-kał.'

(1.3)

Dae' xu k'e,

uk'e hwt'ae',

(2.2)

delzaay' xu k'et,

(2.0)

hwt'e' delzaay' xu k'et delnen.

'In this way on her were rattles, rattling objects were placed on them.'

(0.7)

Kii'eł tiyaas ldu' ba'aaxe hwt'e'

delzaay xu' t'ae,

uke-,

(0.9)

kedahwdatnesi gha kiighisiin',

yin del-,

(0.7)

xuni'dat'aas dze'.

'As they went out with these to the outdoors, they fixed the rattles to be heard, they were put on them.'

(1.0)

Yuughe 'ele'e kanał'aen,

yuugh kanał'aeni yii c'a 'uyeh.

'They did not look about; for them to look about was a no-no.'

((Martha Jackson, *Tikeyaas de/ Puberty Practices*))

Methodology

- Three underlying assumptions:
 - Intonation emerges as units (**IUs**) that are salient to speakers and listeners.
 - The goal of studying IUs is to develop a model for the prosodic armature upon which speakers build discourse. Thus **IUs must not be conflated with syntactic or semantic units.**
 - While prosody is communicative in function and ultimately a perceptual matter, **quantitative analysis** and the **tools of laboratory phonetics** can help us understand the factors that contribute to our perception of the speech signal.

Methodology

- Divided data into 143 hypothetical IUs according to *Discourse Transcription 2 (DT2)* methods (i.e., Du Bois et al. 1992, 1993; Du Bois 2006, in prep). **IUs coded** for duration in ms., length in syllables, boundary intonation type.
- Using waveform + time-aligned spectrogram, **866 syllables coded** for (e.g.) rhyme duration, position in IU, phonemic length of nucleus, morpheme type, F0 in 10 ms. intervals over sonorous portion of rhyme ...
- **Pauses over 100 ms. coded** for position and duration.
- Statistical analysis of 30 000+ datapoints done with R 2.8.0 (R Development Core Team 2008).



DT2 Methodology

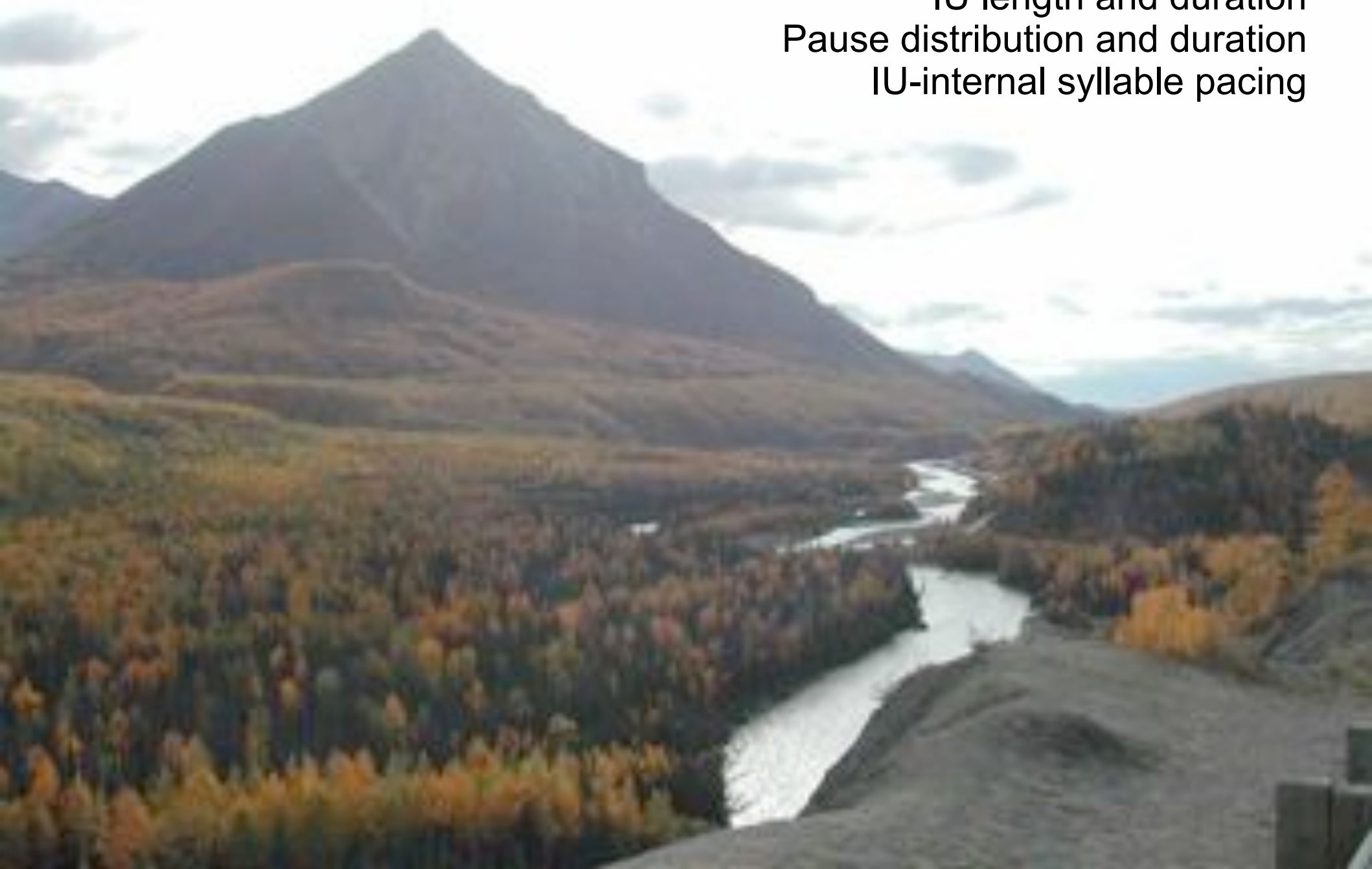
- Strength of method in **identifying and transcribing units** (albeit emergent) rather than, i.e., to give exhaustive description of pitch/tune (like ToBI).
- “The claim is that speakers attend to the recognition and interpretation of unit boundaries **as a partly distinct process** from the recognition and interpretation of distinctive tunes” (Du Bois in prep:2).
 - Reflected in **boundary cues** and **cue loci** (ask later)
 - Individual cues have measurable phonetic properties, but are perceptually taken together in diagnosing IUs
- Mixed opinions of value of training in hearing IU cues (e.g., Englebretson 2000).

DT2 IU Cues (after Du Bois 2006)

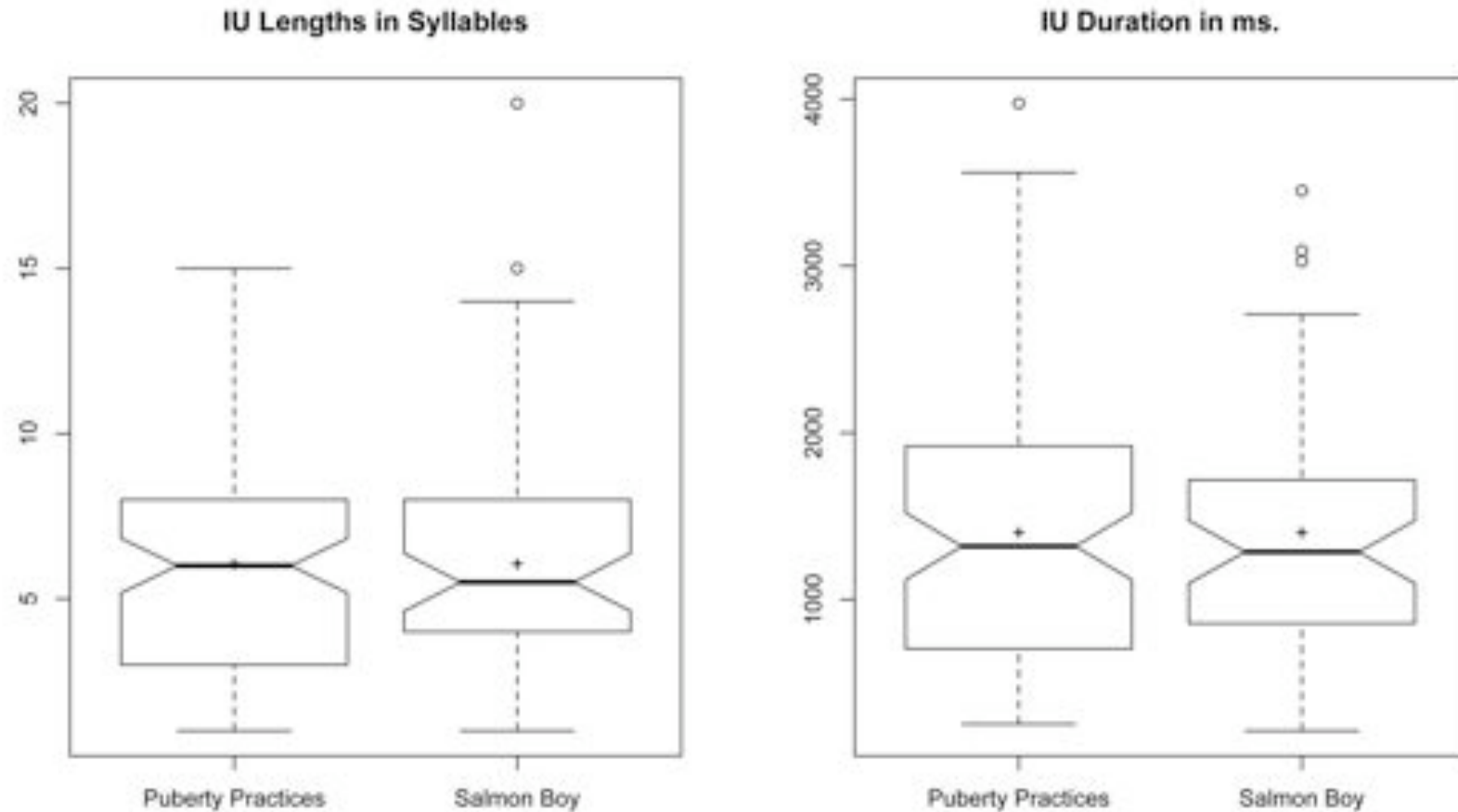
Cue	Locus	Definition
Lag	Boundary	Tempo lag or prosodic (nonlexical) lengthening
Rush	Boundary	Rapid tempo in unstressed syllables
Boundary Tone	Boundary	Boundary (non-)continuity tone
Pitch Reset	Boundary	Noticeable pitch change resulting in return to baseline
Pause	Boundary	Absence of speech
Breath	Boundary	Audible inhalation
Tune	Unit	Coherent intonation contour perceived as a holistic gestalt for the IU
Isotony	Unit	Repeated intonation contour across sequence of IUs
Accent Count	Unit	IU size in primary accents
Register	Unit	Overall shift in pitch or amplitude

Introduction | Temporal Features | Pitch Features | Summary

IU length and duration
Pause distribution and duration
IU-internal syllable pacing



IU length (σ), duration (ms.) by genre



- *U*-tests show no significant difference for either variable. $p=0.9115$
- **► Neither IU length nor duration marks a difference in genre.**

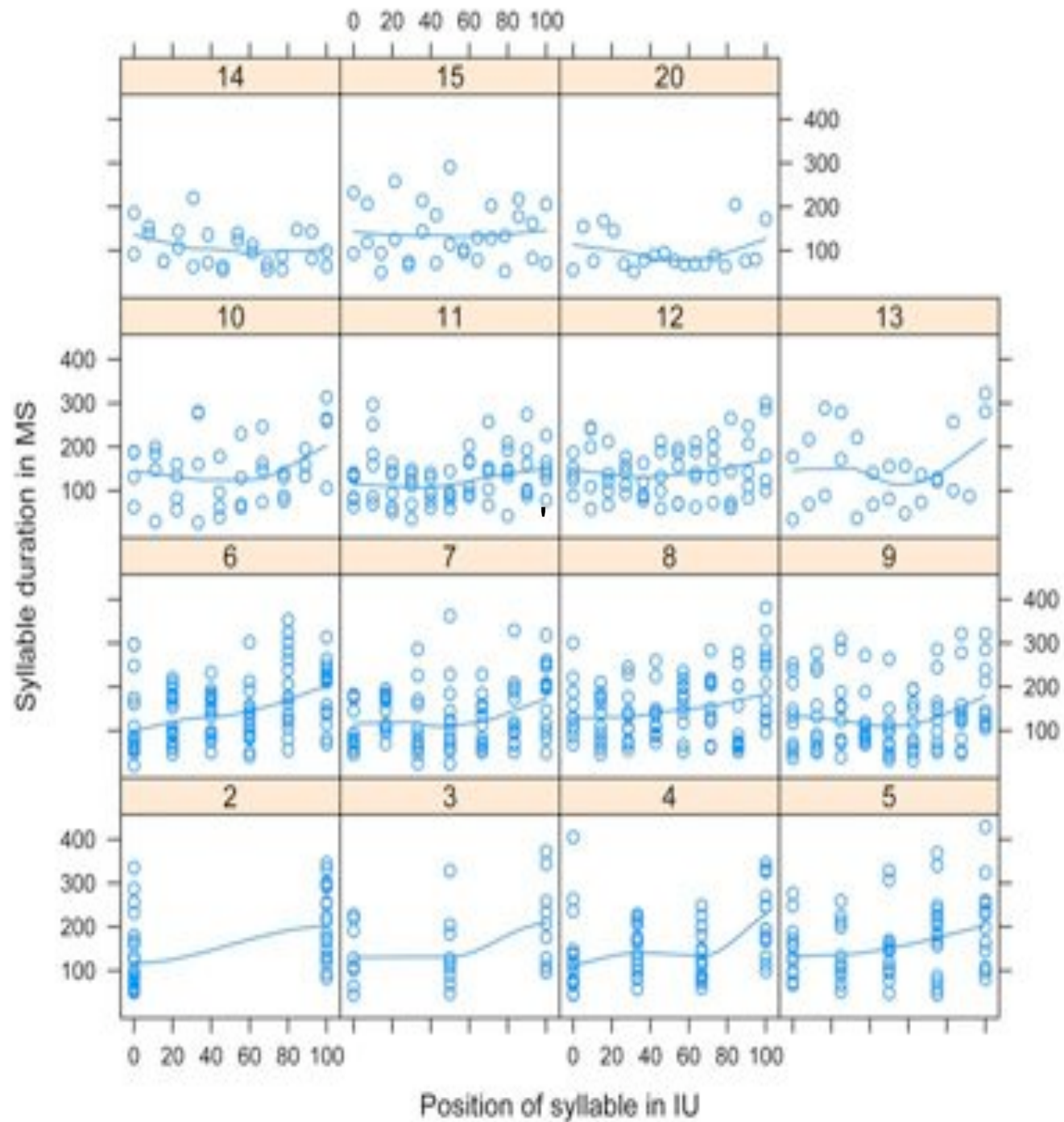
Pause by genre

- 126 pauses over 10 ms.
- 122 pauses occur between IUs.
- **Distribution** of pauses not significantly different between genres. $p=0.4216$
- **Duration** of pauses not significantly different between genres. $p=0.824$
- **▶ Neither pause distribution nor pause duration marks a difference in genre.**

IU-internal syllable pacing

- Corresponds to DT2 *lag/rush*.
- Prediction is that—all things being equal—**syllables at the ends of IUs are longer than those at the beginnings of IUs.**
- Scatterplot of rhyme duration, measured from end of onset C to end of nonmodal phase.
 - Each cell contains data for syllables by position in IU for a particular IU length:

Syllable Duration in MS by Position in IU,
Plotted for All Values of IU Length; Both Stories



Of course, all things aren't equal.

- Relative syllable pacing is **multifactorial**.
- Variables possibly contributing to pacing:
 - **Phonemic length** of nuclear vowel
 - /i, e, a, o, u/ contrast with /i:, æ, a:, o:, u: /
 - Plus a reduced vowel.
 - **Morpheme type** (stem vs. conjunct prefix vs. disjunct prefix vs. suffix vs. other)
 - Stems and “disjunct” prefixes (usually) have full vowel.
 - “Conjunct” prefixes (usually) have reduced vowel.
 - **Syntax**
 - Are typical word orders conspiring to place prominent stems at the ends of IUs?
 - No. The morpheme in ult and penult position is likely to be something *other* than a stem.
 - **Genre**

ANOVA

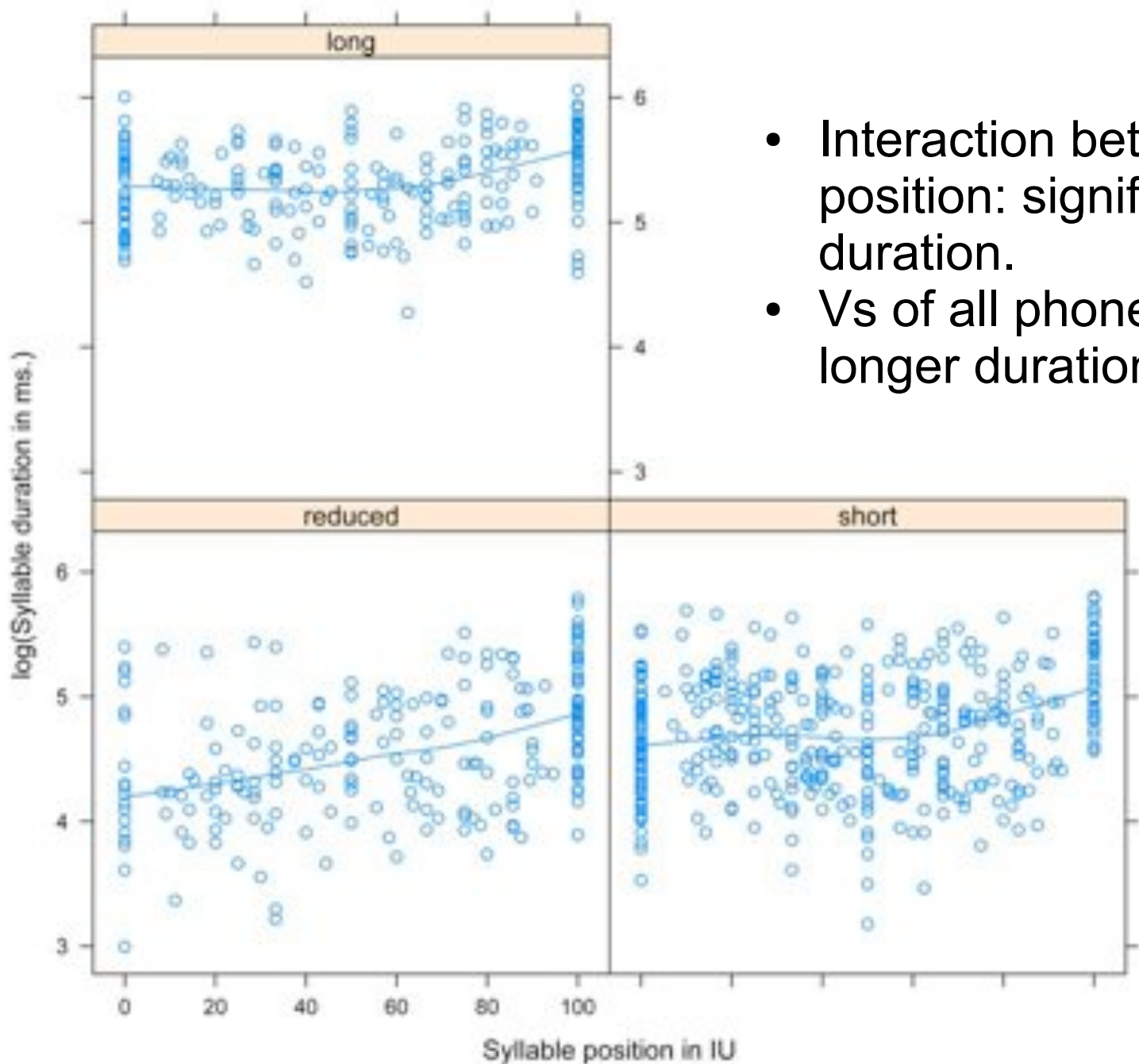
- Dependent variable: Syllable duration
- Independent variables: phonemic V length, morpheme type, syllable position, genre.
- All 3-way interactions, and some 2-way interactions were not significant; these were removed stepwise from the model.
- Results highly significant overall. ($p < 0.001$)
- Quick preview for the impatient:
 - Genre is very important
 - But so is the interaction between a syllable's position and both morpheme type and vowel length.

ANOVA results

(adj. $R^2=0.4005$, $F=27.05$, $df=836$, $p<0.001$)

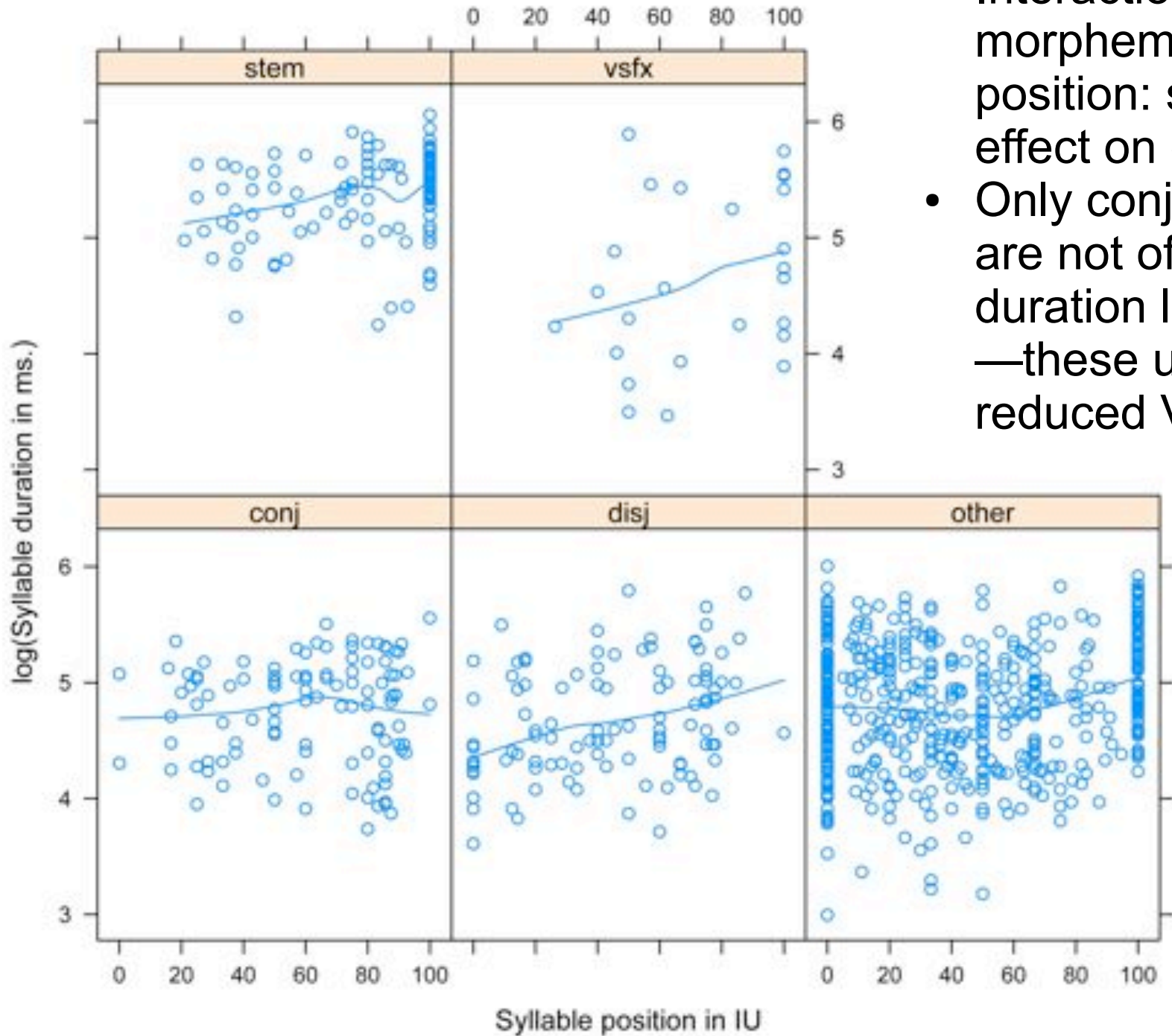
Predictor	F	df	p	η^2
Story	14.28	1	<0.001	0.018
Phonemic V length	6.23	2	<0.001	0.015
Position	0.00	1	0.002	<0.001
Morpheme Type	0.13	4	0.980	<0.001
Phonemic V length:Position	4.38	2	0.013	0.010
Phonemic V length:Morpheme Type	2.44	8	0.013	0.023
Position:Morpheme Type	2.40	4	0.048	0.011

Syllable Duration by Position in IU and Phonemic Length of Nuclear Vowel: All Data



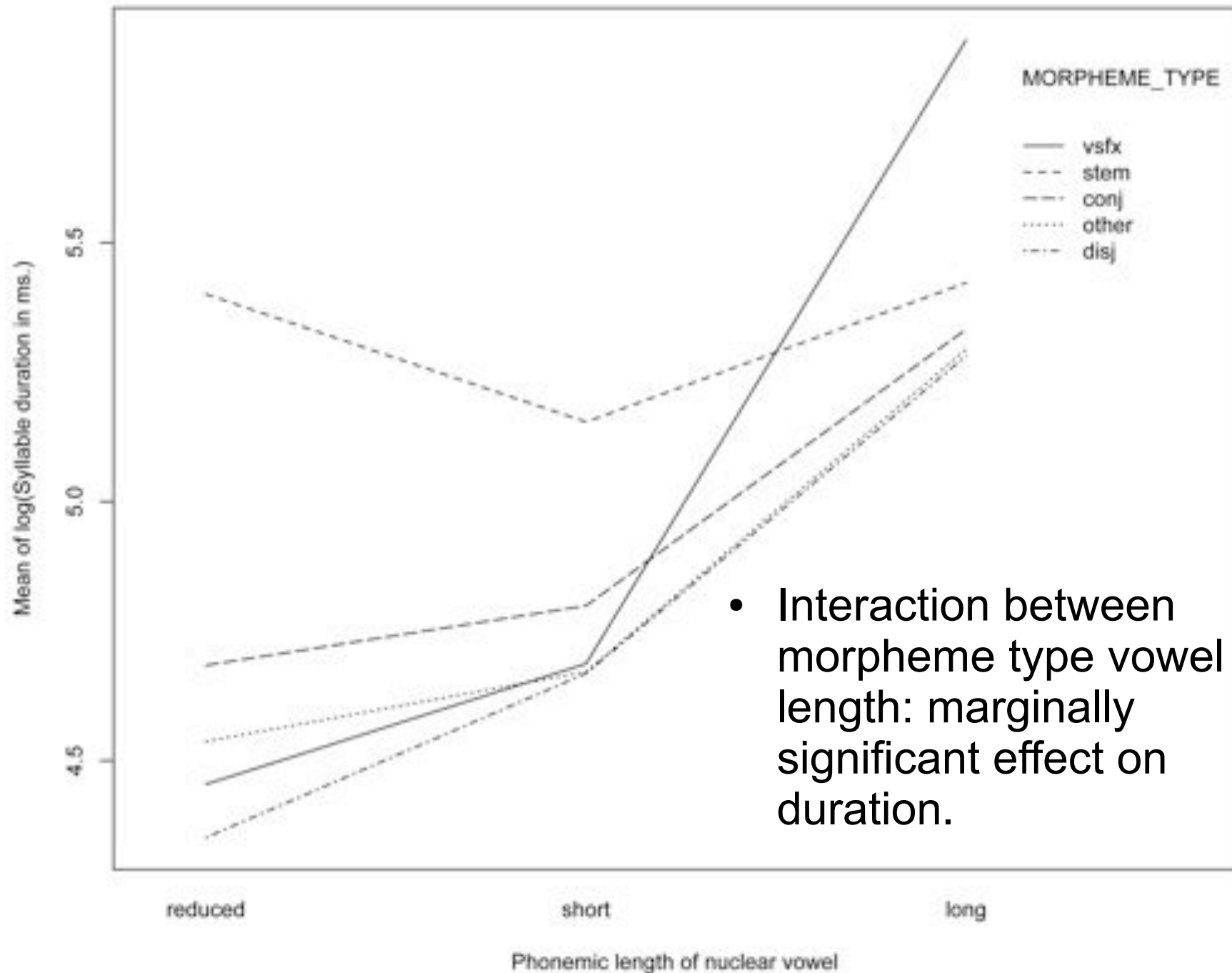
- Interaction between V length and position: significant effect on duration.
- Vs of all phonemic lengths are of longer duration later in the IU.

Syllable Duration by Position in IU and Morpheme Type: All Data

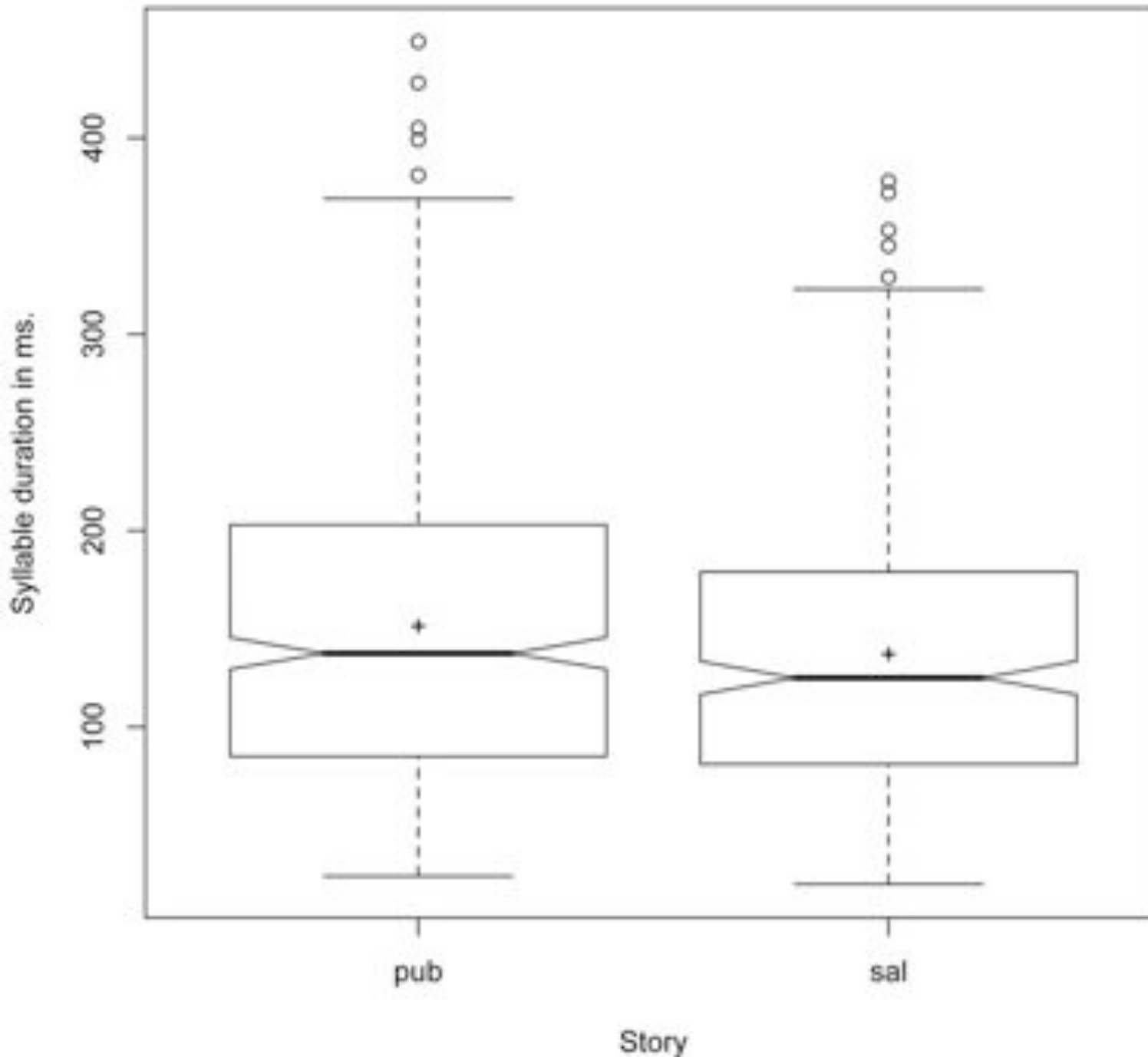


- Interaction between morpheme type and position: significant effect on duration.
- Only conjunct prefixes are not of longer duration later in the IU —these usually have reduced V.

Syllable Duration by Phonemic Length of Nuclear Vowel and Morpheme Type



Syllable Duration in ms. by Story



- Effect of genre alone on a given syllable's duration is highly significant.
- Syllables in *Puberty Practices* are generally longer than those in *Salmon Boy*, but not by much.

Interim summary of temporal features

- Size of IU does **not** differ by genre, either in terms of length in syllables or duration in ms.
- Pause does **not** differ by genre, either in terms of distribution or duration.
- Syllable pacing:
 - **IU-internal position** interacts significantly with both **phonemic V length** and **morpheme type** to determine syllable duration.
 - Ahtna data exhibit **lag**. Syllables later in the IU are longer than those earlier in the IU.
- Syllables in *Puberty Practices* are a little longer than those in *Salmon Boy* (but the difference is significant).

Introduction | Temporal Features | Pitch Features | Summary

Pitch reset
IU chaining
Multi-peak downstep intonation



Pitch reset

- Du Bois: Pitch reset is a return to baseline pitch at the beginning of an IU, following the “boundary tone” at the end of the previous IU.
- Perceptually: an upward or downward “jump” in pitch that sounds larger than the series of pitch transitions across syllables immediately preceding or following it.
- First, consider pitch transitions in general:
 - Pairwise comparisons of all adjacent-syllable mean F0.
 - ► No difference between genres in median pitch transition.

Pitch reset

- Where in the discourse do the most extreme adjacent-syllable pitch transitions fall?
 - Upper 5% considered here to be “reset.”
- How frequently do they occur?
- **See graphs.**
- Significant majority fall within 1 syllable of (hypothesized) IU boundary. $p < 0.001$
- Difference in density between genres:
 - Greater density of resets in *Salmon Boy* than in *Puberty Practices*. $p = 0.003$
- ▶ **Distribution of pitch reset marks difference in genre.**

But why?

IU chaining

- Of course, pitch reset is not an independent phenomenon, but a result of low final fall or high final rise at the end of an IU. DT2's *boundary tone*.
 - ***Continuative***: speaker projects the next IU to be a continuation of the current prosodic act. Transcribed with comma. “Non-final.”
 - ***Terminative***: speaker reached end of current prosodic act. Transcribed with period. “Final.”
- Speakers do not produce IUs in isolation, typically in larger chains of IUs defined by their boundary tones.
- Chains are a series of continuative-tone IU “links” ending in a terminative-tone IU.

But why? IU chaining

Short (1 link):

15 **Kiic'a' tezyaayi.**
They went away from him.

Long (5 links):

17 **K'ay' uk'ay' udatcezi datsatnini'ax,**
18 **koht'aene ldu' 'u'eł kustna' 'oox,**
19 **dinac'iighiłtaen dae,**
20 **dae,**
21 **dinac'ighiłtaen dae'.**

'It was full of bundles tied with willows, but the salmon man had disappeared out there, someone had put him inside thus, thus someone had put him inside.'

((Bac'its'aadi/Salmon Boy: Martha Jackson))

But why?

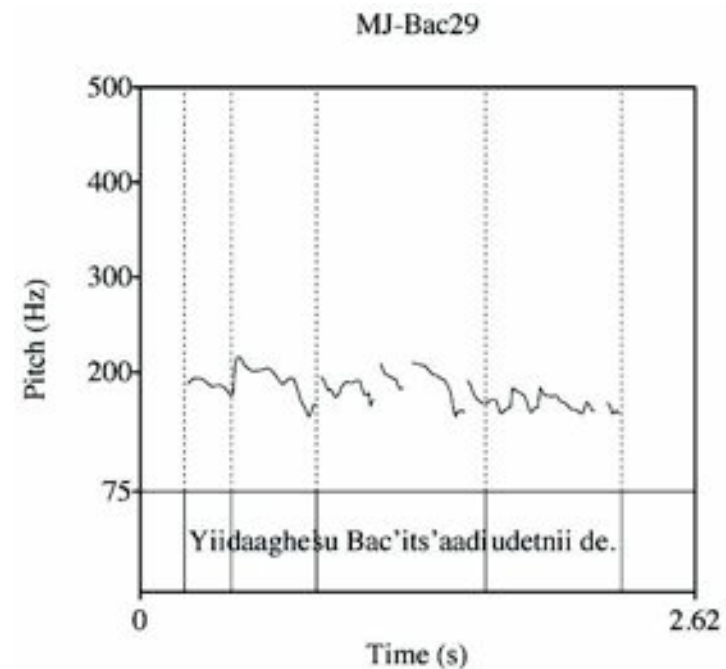
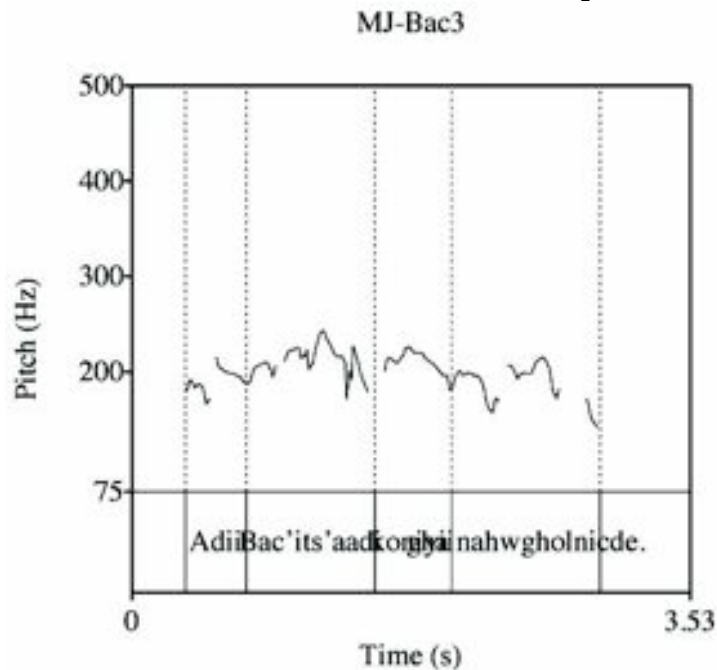
IU chaining

- Pitch of terminative tone falls well below that of continuative tone, so we expect an **inverse relationship between chain length in IUs and frequency of [extreme] pitch reset.**
- This is the case in the Ahtna data: *Puberty Practices* contains significantly longer chains and fewer pitch resets than *Salmon Boy*. $p=0.043$
 - *Puberty Practices*: 43 chains over 91 IUs
 - *Salmon Boy*: 34 chains over 53 IUs
- **► Length of IU chains differs across genres.**
 - Perhaps causing the impression that intonation-bearing units in *Puberty Practices* are somehow longer than in *Salmon Boy*?

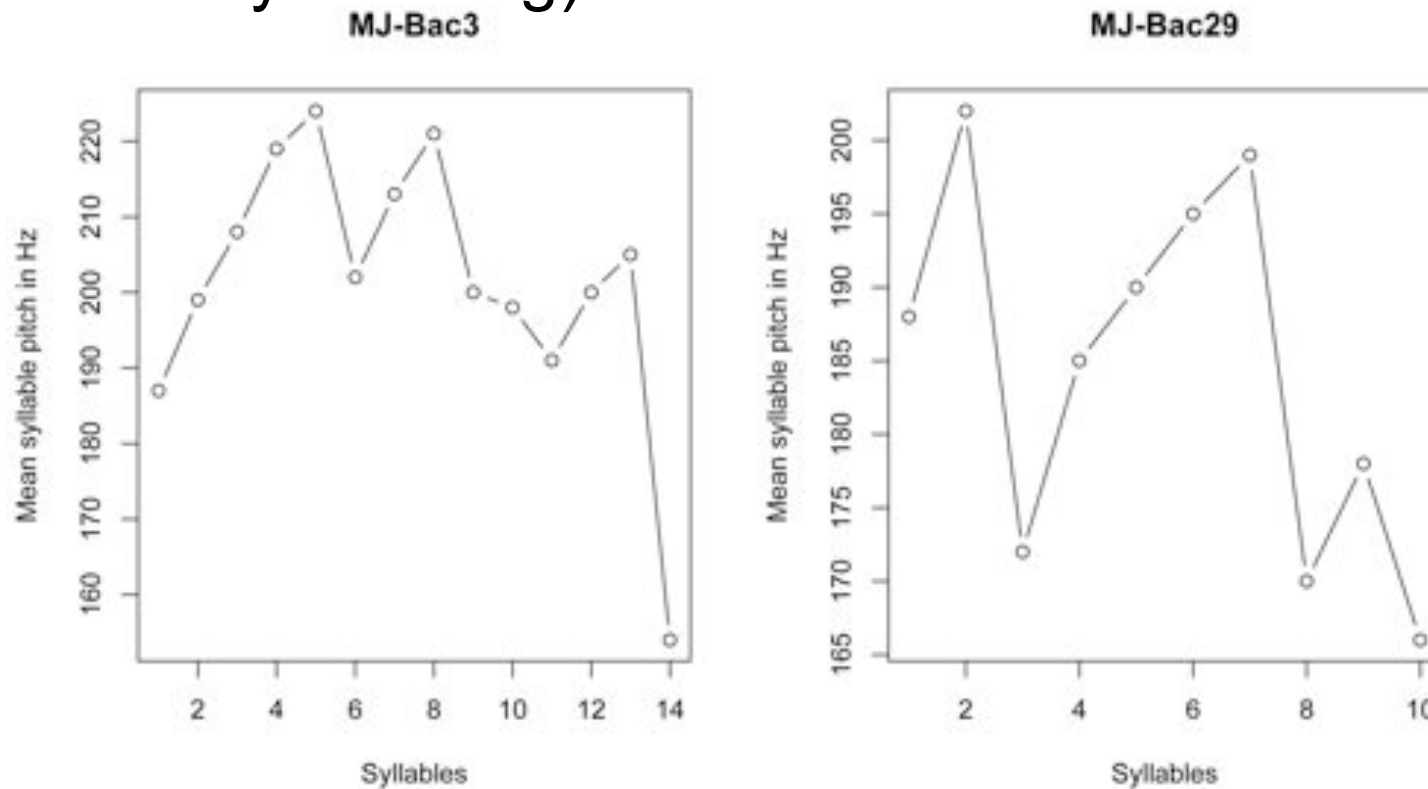
But again, why?

A repeated intonation contour

- Tonal gestalt realized over the duration of an IU.
- Mrs. Jackson's repetition of a **multi-peak downstep contour**:
 - Series of continually lessening high pitch peaks ending near or at bottom of pitch range.
- But how to identify it?



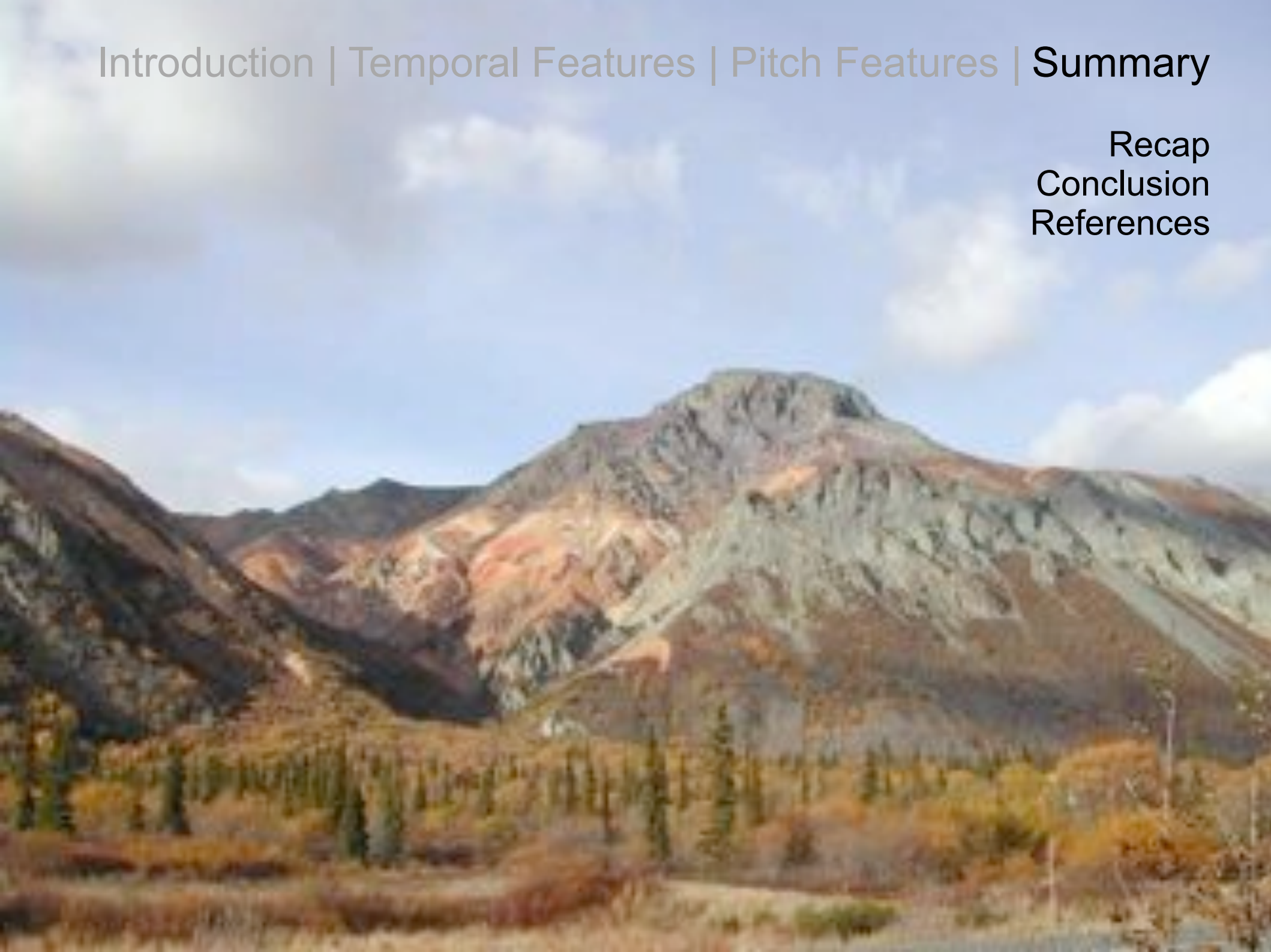
- Plotted mean F0 for every syllable with all timing information except sequentiality removed.
- Abstraction allows basic contour to be visually identified
- Same two IUs: multi-peak downstep is now apparent (confirmed by listening)



- ► More frequent in *Salmon Boy* (1 in 3) than in *Puberty Practices* (1 in 7).
- Conspicuous rhythmic quality of *Salmon Boy* due in no small part to this contour.

Introduction | Temporal Features | Pitch Features | **Summary**

Recap
Conclusion
References



Recap

- Temporal features showed very little difference between genre, except for a small but significant difference in syllable duration.
 - Lag was confirmed as a general boundary cue for Ahtna.
- Pitch features showed notable difference between genres.
 - Greater density of pitch resets in *Salmon Boy*
 - ...which is tied to the presence of shorter chains of IUs
 - ...which is tied to the ubiquity of the multi-peak downstep intonation contour, which always has terminative boundary tone and requires a following pitch reset.

Conclusion

- Both stories index Mrs. Jackson's position as *Kuy'aa* in different ways:
 - *Salmon Boy* reveals her skills as an Ahtna storyteller
 - *Puberty Practices* displays her position as a bearer of knowledge about lifecycle rituals.
- Most of the work of distinguishing prosodically between the two is carried by the multi-peak downstep intonation:
 - A “complete package” (if you will)
 - A self-contained prosodic unit that is used to signal that *Salmon Boy* is a pragmatically marked oral performance.

With gratitude to: Jim Kari, Matt K. Gordon, Marianne Mithun, Stefan Th. Gries, Wally Chafe, Sandy Thompson, Jack Du Bois.

References

Du Bois, John W. 2006. Representing Discourse. Ms., University of California, Santa Barbara.

Du Bois, John W. In prep. Rhythm and tunes: The intonation unit in the structure of dialogic engagement.

Du Bois, John W., Susanna Cumming, Stephan Schuetze-Coburn and Danae Paolino. 1992. *Santa Barbara Papers in Linguistics, Volume 4: Discourse Transcription*. Santa Barbara: University of California, Santa Barbara Department of Linguistics.

Du Bois, John W., Stephan Schuetze-Coburn, Susanna Cumming and Danae Paolino. 1993. Outline of discourse transcription. In Jane A. Edwards and Martin D. Lampert (eds.), *Talking Data: Transcription and Coding in Discourse Research*, p. 45-90. Hillsdale, NJ: Lawrence Erlbaum Associates.

Englebretson, Robert. 2000. An empirical approach to the coding of Transitional Continuity and Terminal Pitch Direction in spoken American English. In Michael Henderson (ed.), *1999 Mid-America Linguistics Conference Papers*, p. 83-96. Lawrence: University of Kansas Press.

R Development Core Team. 2008. R: A language and environment for statistical computing. Vienna: R Foundation for Statistical Computing. ISBN 3-900051-04-0, <http://www.R-project.org>.

Tuttle, Siri. 2002. Prosody of incorporated structures in Ahtna Athabaskan. In Gary Holton (ed.), *Proceedings of the Athabaskan Languages Conference, Fairbanks, June 2002*, p. 91-106. Fairbanks: Alaska Native Language Center.

Tuttle, Siri. 2003. Realizations of stress and intonation in an Ahtna text. Paper presented at the SSILA annual meeting, Atlanta.

Tuttle, Siri. 2008. Phonetics and word definition in Ahtna Athabaskan. *Linguistics* 46(2): 439-470.

Tuttle, Siri and Olga Lovick. 2007. Intonational marking of discourse units in two Dena'ina narratives. *Nouveaux Cahiers de Linguistique Française* 28: 305-316.