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# Declarative and Interrogative Intonation in Derry City English

An argument for a register tier

**Antoin Eoin Rodgers**

Phonetics and Speech Laboratory, TCD

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# northern Irish English (nIE) and Derry

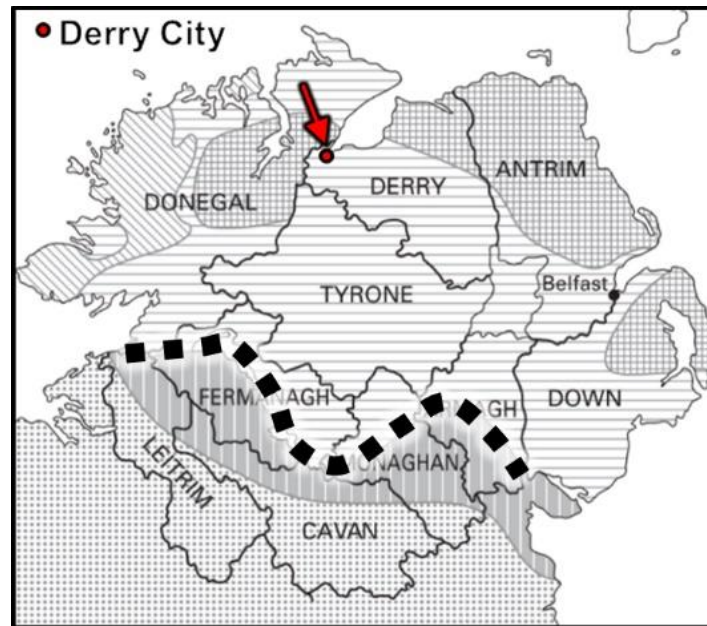
## Background

### Derry City

- 2<sup>nd</sup> largest urban area in NI [1]
- DCE intonation less documented [2]

### nIE and Intonation

- Prevalence of nuclear rises across sentence modes [3]
- Jarman and Cruttenden (1976) [2]
- McElholm (1986) [3]



# AM Analysis and nE Intonation

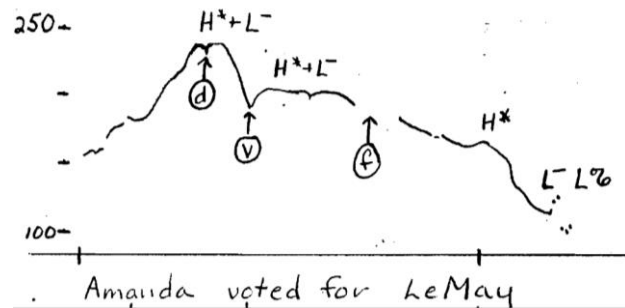
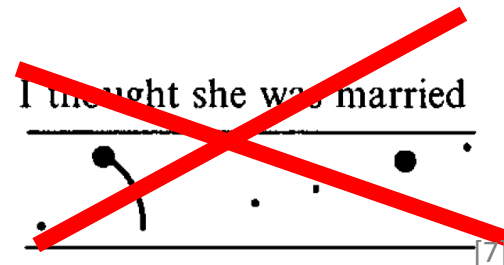
AM pitch contour analysis & K-Max

## AM Fundamentals<sup>[4,5,6]</sup>

- Sequence of Low and High phonological primitives.
- Pitch accents (PAs) edge tones.
- PA associated with lexically stressed syllable though *starred tone*.
- Implemented in the pitch contour.

L H H L H L

%L H\* H\* L\* H L%

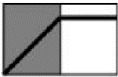

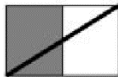



# AM Analysis and nE Intonation

AM pitch contour analysis & K-Max

## AM studies of nE

- **Belfast:** Lowry<sup>[8-10]</sup>, IViE<sup>[9-14]</sup>, Sullivan<sup>[14-16]</sup>
- **Donegal:** TCD Speech & PhLab <sup>[17-18]</sup>
- even more L\*H!
- L\*H % is the unmarked nuclear form.
- L\*H % 83% of all nuclear contours <sup>[11]</sup>
- L\*H H% 5.6% YNQs ...
- ... 16.9% DECQs

Schematic representation				
Impressionistic description	rise-plateau	rise-plateau-slump	high rise	fall
IViE labelling	L*H %	L*H L%	L*H H%	L*H %

[10]

# Phonological & paralinguistic use of pitch

## Background

### The Problem (for me) in AM

- Phonological Contrasts:
  - $H^*L\%$  |  $L^*H\%$  |  $L^*H H\%$
- Paralinguistic scaling effects:
  - Ohala: frequency code <sup>[19]</sup>
  - Gussenhoven: biological codes <sup>[20, 5]</sup>
- Haan's PhD Thesis on Dutch Q forms <sup>[21]</sup>
  - ***Paralinguistic pitch raising in Q forms inversely proportional to semantic and Grammatical content.***



# AM phonology and northern Irish English

## Background

### Current study

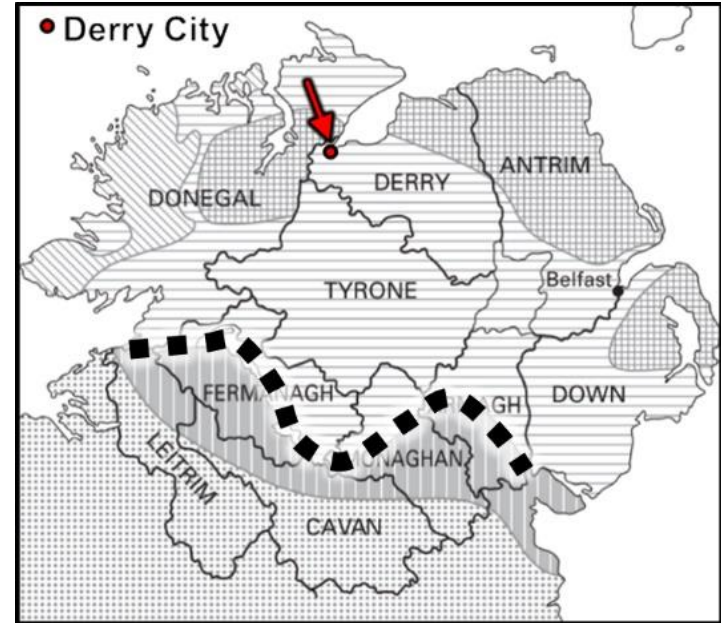
## Phonological and Phonetic Analysis of Intonation of Sentence Modes in Derry City English.

### Descriptive

- What are the phonological and phonetic characteristics of nuclear pitch contours in DCE across sentence modes?

### Theoretical

- Does a register tier provide a plausible phonological explanation for variation across sentence modes in DCE? [22,23]



# Stimuli and Target Utterances

## Materials

- 4 sentence modes x 3 Variants x 5 reps

DEC	I valued the vases.
	I live in the valley.
	I've hidden the valuables
YNQ	Have you valued the vases?
	Do you live in the valley?
	Have you hidden the valuables?
WHQ	Who valued the vases?
	Why do you live in the valley?
	Where have you hidden the valuables?
DCQ	You valued the vases?
	You live in the valley?
	You've hidden the valuables?

- Embedded in short dialogues

### Talking about work...

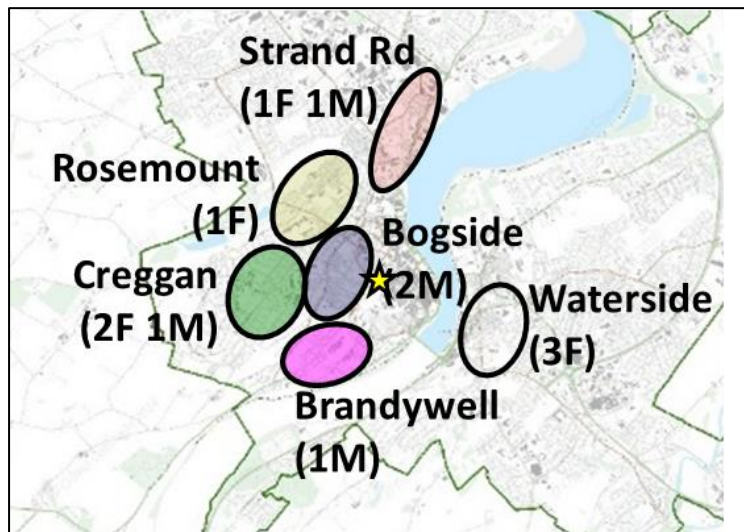
A: I think everything's ready for the auction.

B: Have you valued the vases?

Set A.1.1

# Speakers and Recording

## Materials



- 11 Derry City English Speakers
- 6 Female, 5 male, 35-60 y/o ( $\bar{x}=40$  s.d.=9.9)



- Verbal Arts Centre studio
- Pairs (friends, family, co-workers)
- Largely self-directed



# Sentence Mode Corpus

## Materials

### Final corpus for sentence mode

	11 speakers
×	12 target phrases
×	5 repetitions
<hr/>	
	660 utterances
-	21 errors
<hr/>	
	<b>639 valid utterances</b>

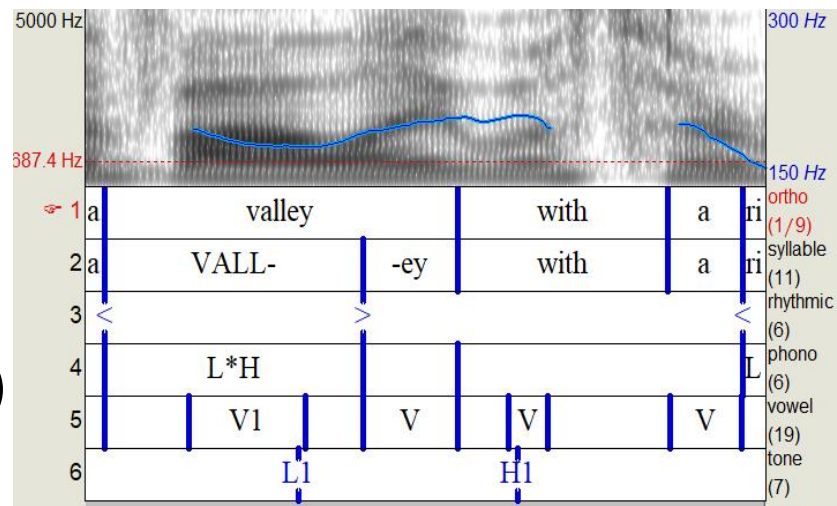


# Materials and Methods

## Annotation and analysis

### Annotation and analysis

- Praat for annotation<sup>[24]</sup>
- IViE labelling<sup>[25]</sup>
- PA judgments by researcher...
- ...with another trained phonetician
- **Tonal Targets:**  $f_0$  extrema (ST re 1 Hz)
- **Temporal alignment:** onset of vowel in stressed syllable to tonal target (ms)



# Phonological Labelling

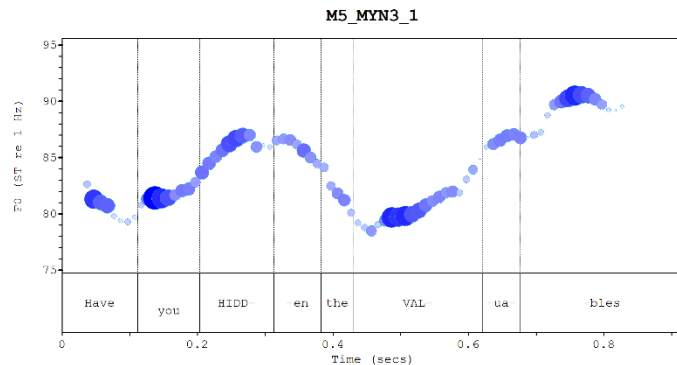
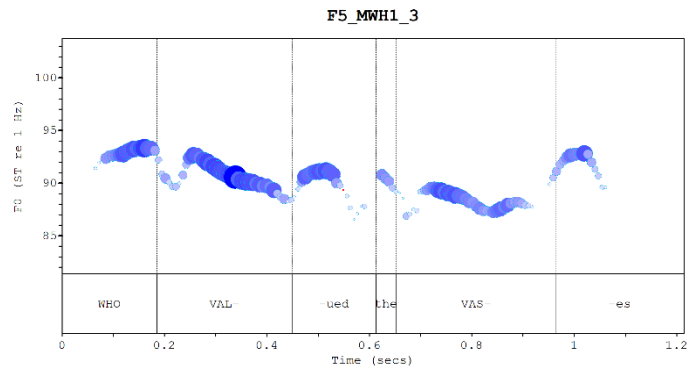
## Annotation and analysis

— Sometimes clear apparent distinction between contour type:

- **L\*H %**
- **L\*H H%**

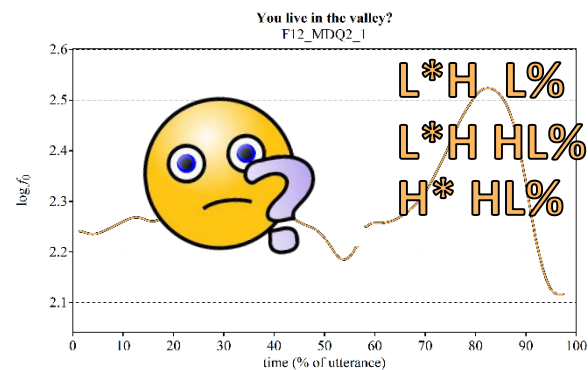
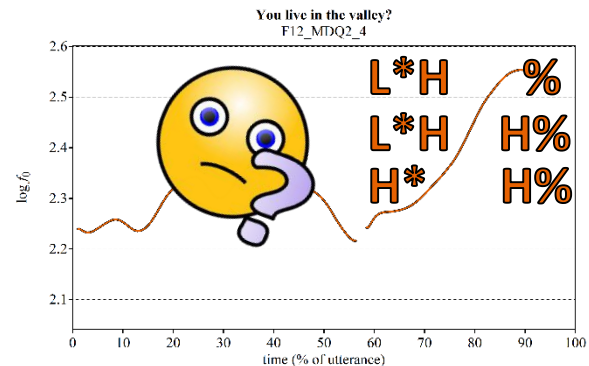
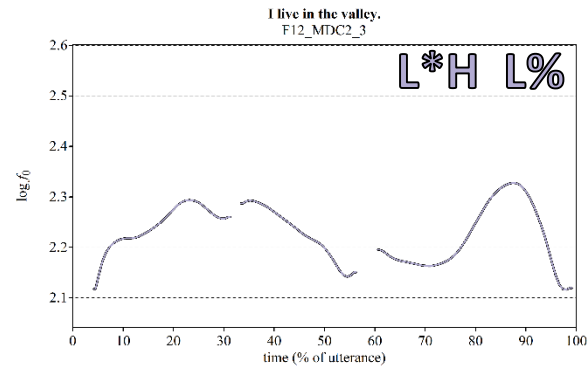
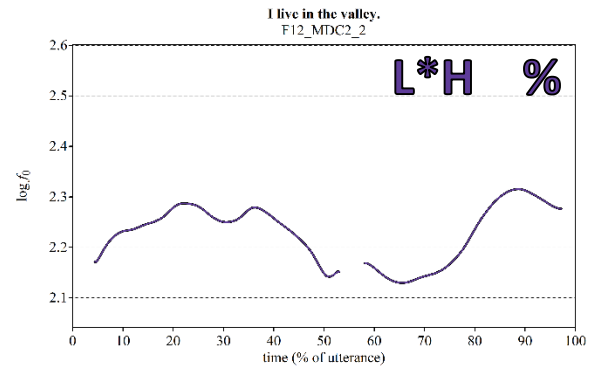
— But...

...not really so clear cut.



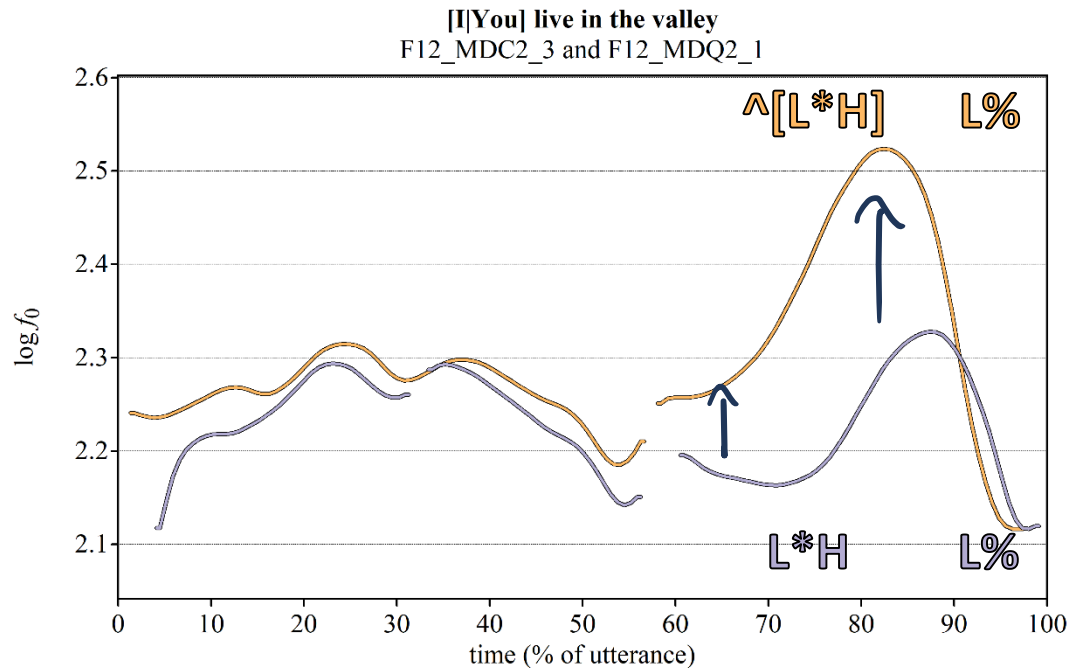
# Labelling Issues

## Annotation and analysis



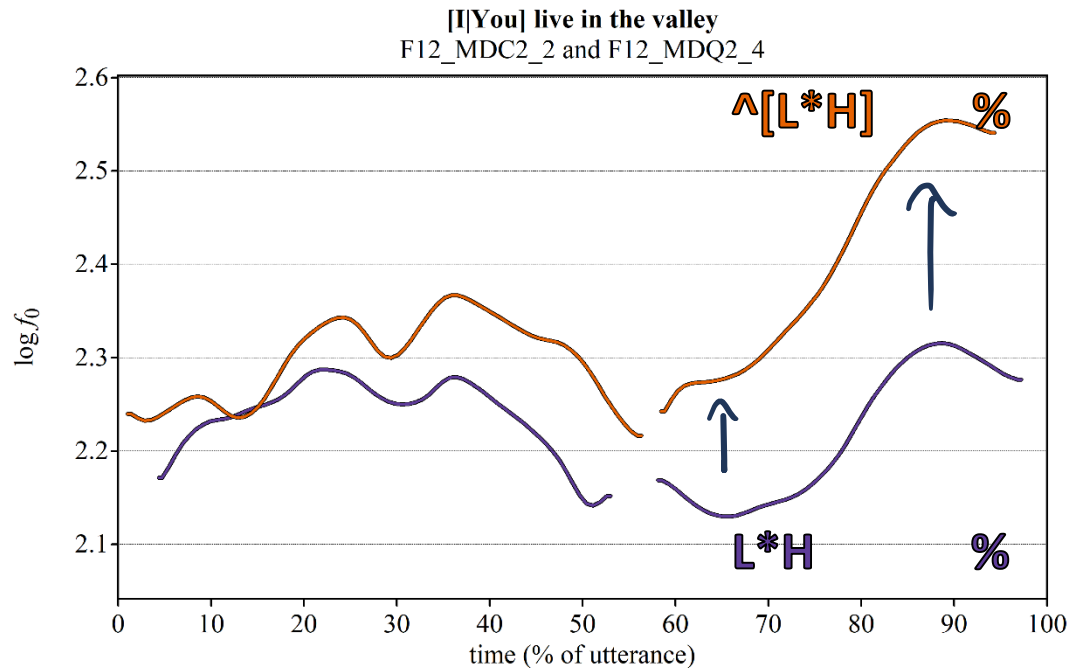
# Labelling Register

## Annotation and analysis



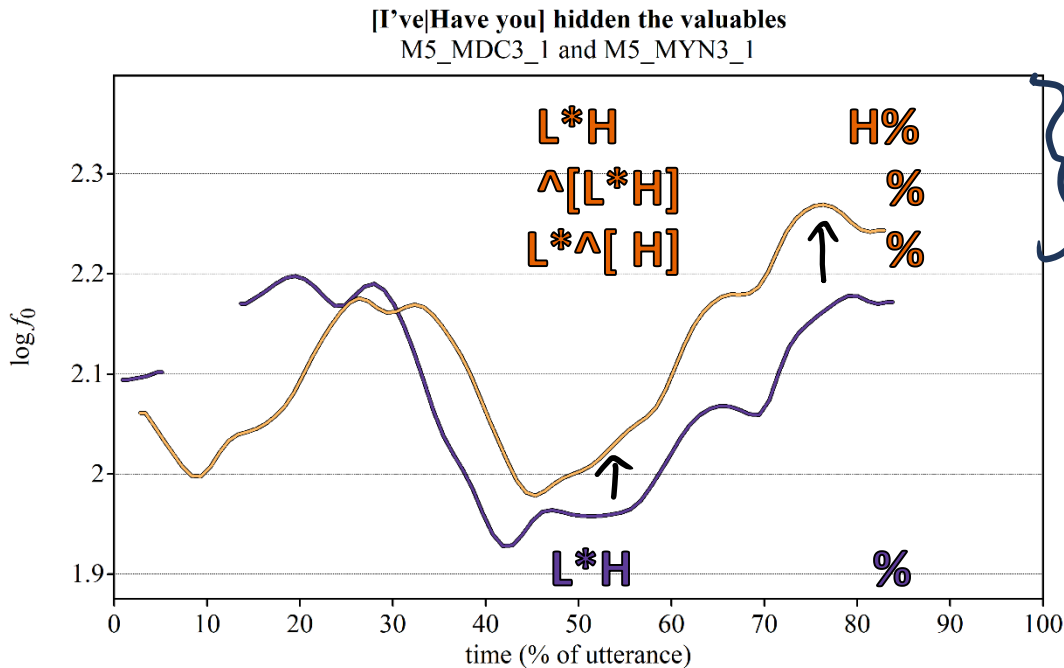
# Labelling Register

## Annotation and analysis



# Labelling Register

## Annotation and analysis

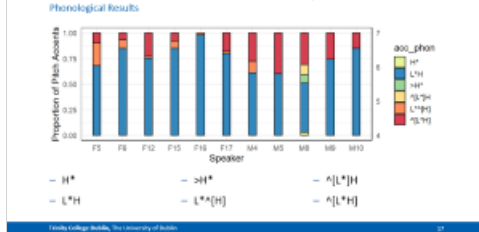


$L^*H$   $H\%$   
 $^{\wedge}[L^*H]\%$   
 $L^*\wedge[H]\%$

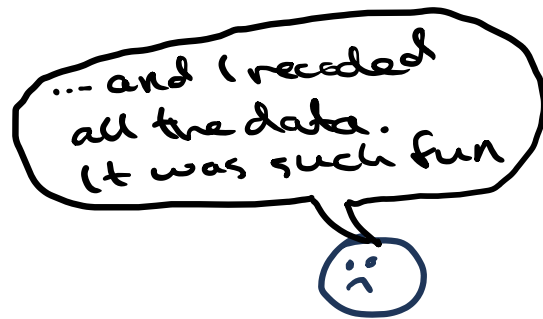
possible ambiguity!



## Annotation and analysis



- $\wedge$   $\rightarrow$  high register
- [...]  $\rightarrow$  scope of high register
- $\wedge[\% H^* L^* H L\%]$  utterance-wide\*
- $\% H^* \wedge[L^* H L\%]$  nuclear contour\*\*
- $\% H^* \wedge[L^* H] L\%$  pitch accent
- $\% H^* L^* \wedge[H] L\%$  tone



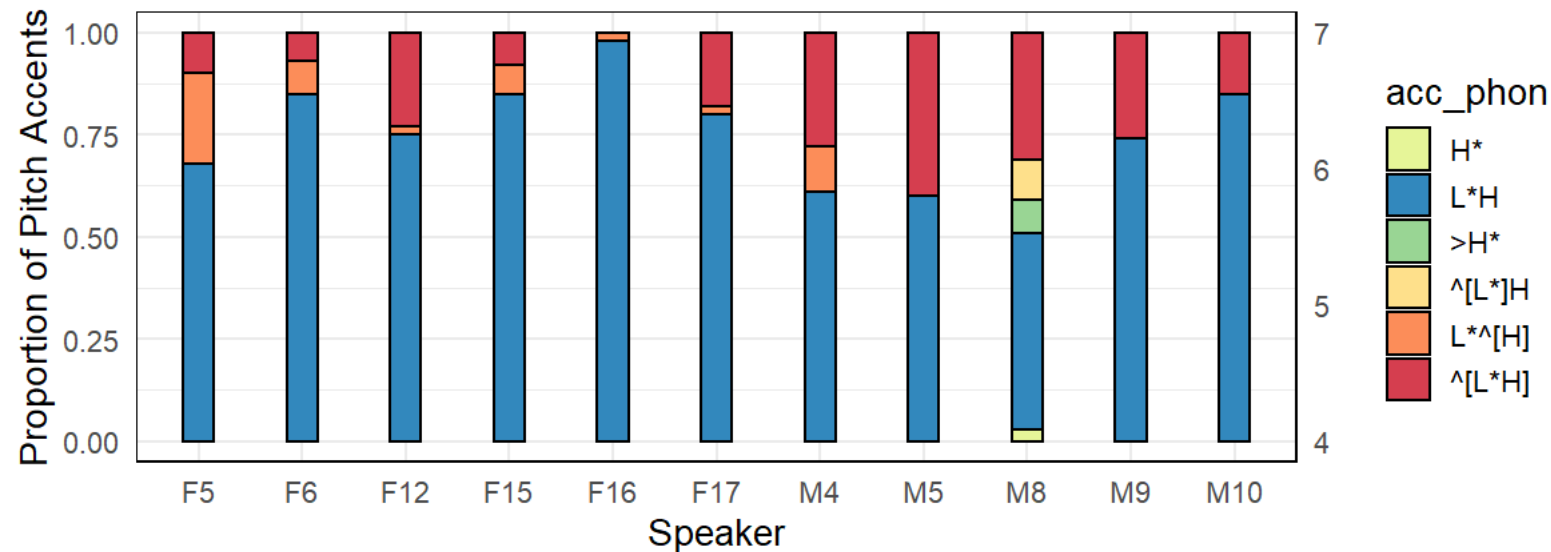
\*NB: This study focuses on nuclear contours only.

**\*\*Hard to discriminate from  $\wedge[L^* H]$  0%, so both treated as the same here.**



# Nuclear Pitch Accent and Speaker

## Phonological Results



— H\*

— >H\*

— ^[L\*]H

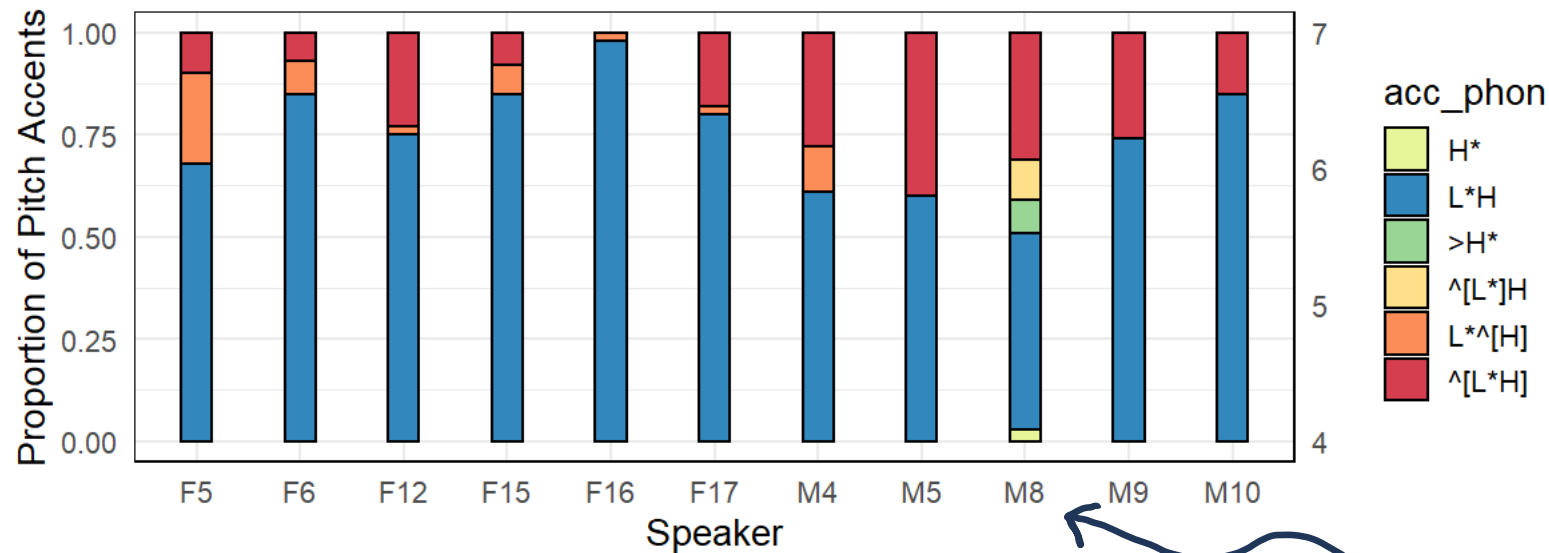
— L\*H

— L\*^[H]

— ^[L\*H]

# Nuclear Pitch Accent and Speaker

## Phonological Results



— H\* L%

— >H\* L%

— ^[L\*]H L%

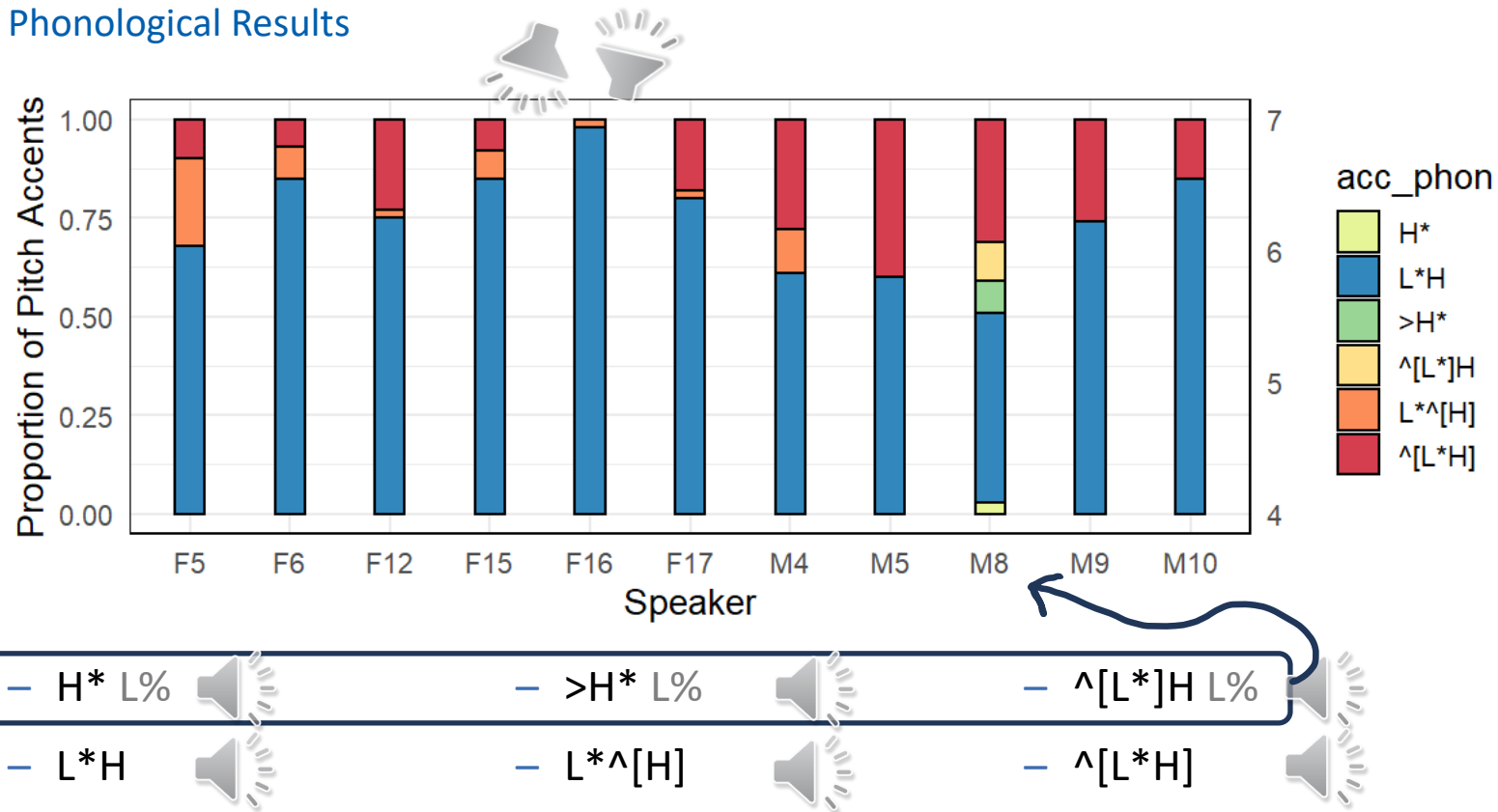
— L\*H

— L\*^[H]

— ^[L\*H]

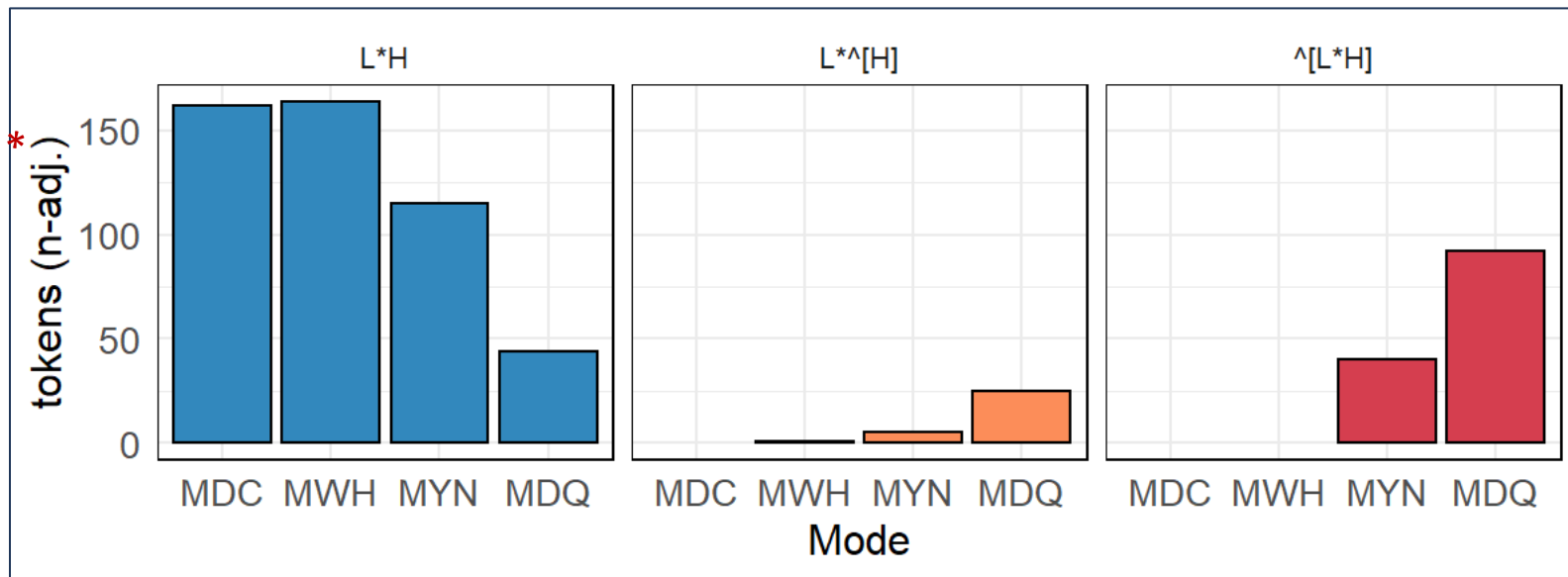
# Nuclear Pitch Accent and Speaker

## Phonological Results



# Nuclear Pitch Accent and Sentence Mode

## Phonological Results



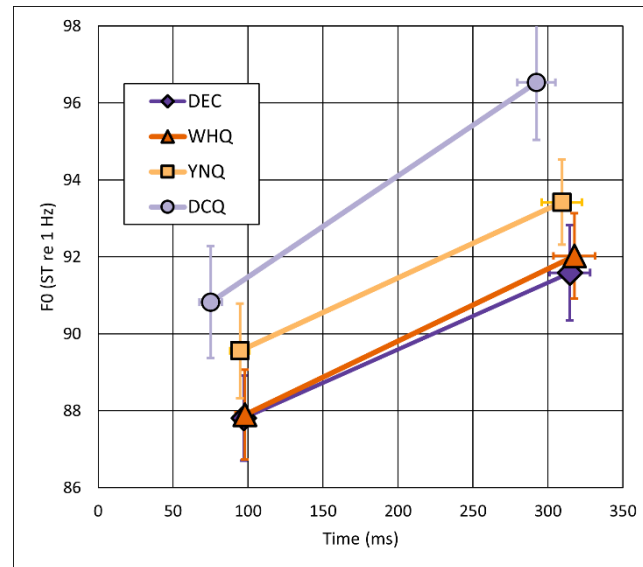
— Marginal tokens not shown:  $H^*$  ( $\hat{n}=2$ ),  $>H^*$  ( $\hat{n}=5$ ),  $^[L^*]H$  ( $\hat{n}=6$ )

**\*Projected Distribution of nuclear PA tokens after accounting for uneven distributions of speaker utterances and stimuli.**

# Phonetic Parameters and Sentence Mode

## Statistical analysis

- This component of the analysis is blind any phonological variation.
- DECQ parameters tend to be significantly and noticeably different from other modes.
- There is generally little difference between DEC and WHQ parameters.
- There still likely a paralinguistic component.



[tiny.one/AER-NPIE7](https://tiny.one/AER-NPIE7)

# Register Tier in DCE

## Take Aways

- An attempt to adapt the theory to the data.
- Register tier seems to provide the best solution for an efficient description of the observations.
- Lack of standard  $L^*H$  /  $H^*L$  phonological contrast brings role of register tier to the fore.
- Recourse to register tier most likely when there is less lexical / grammatical marking of Q-forms.
- Use of register tier seems optional.



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**Thank You**



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The slides that time forgot...



# Phonetic Parameters and Sentence Mode

## Annotation and analysis

- Linear Mixed Effects Model Analysis
- R – LmerTest, etc...
  - $l\_t \sim \text{mode} + \text{gender} + (1 + \text{mode} \mid \text{speaker})$
  - ~~$h\_t \sim \text{mode} + \text{gender} + (1 + \text{mode} \mid \text{speaker})$~~
  - $l\_f0 \sim \text{mode} + \text{gender} + (1 + \text{mode} \mid \text{speaker})$
  - $h\_f0 \sim \text{mode} + \text{gender} + (1 + \text{mode} \mid \text{speaker})$
  - $\text{exc} \sim \text{mode} + \text{gender} + (1 + \text{mode} \mid \text{speaker})$
  - $\text{slope} \sim \text{mode} + \text{gender} + (1 + \text{mode} \mid \text{speaker})$
- Tested models + pairwise comparison of modes.
- All intercepts statistically significant ( $p < 0.0001$ )
- Not so with pairwise comparisons (as expected)



[tiny.one/NPIE7-AER](https://tiny.one/NPIE7-AER)

# Phonetic Parameters and Sentence Mode

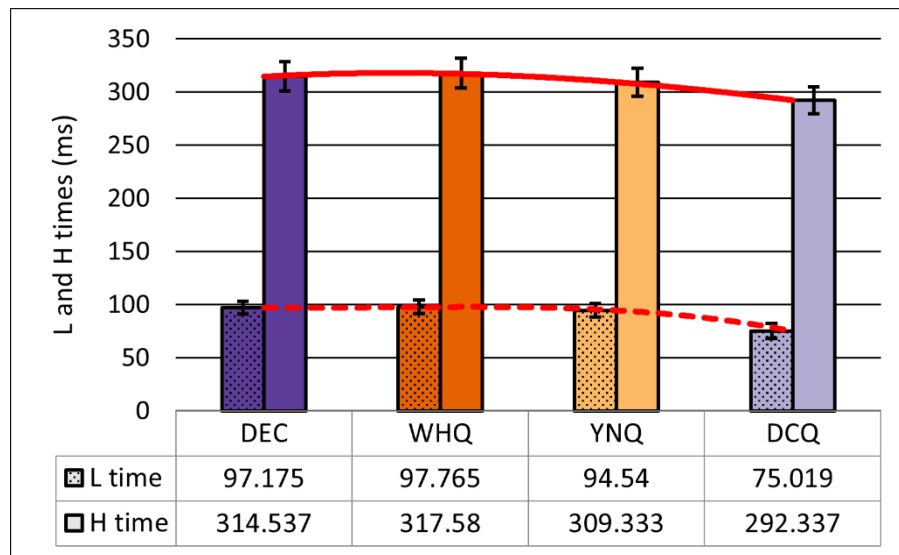
## Annotation and analysis

### TIME PARAMETERS

- Little variation in time for DEC, WHQ, YNQ
- DCQ timed earlier.

### Statistically significant results\*

- L<sub>t</sub> pairwise comparison:
  - DEC v DCQ ( $p=0.010$ )
  - WHQ v DCQ ( $p=0.002$ )
  - YNQ v DCQ ( $p=0.022$ )



\*p.values Bonferroni adjusted by factor of 5

# Phonetic Parameters and Sentence Mode

Annotation and analysis

$L f_0$  and  $H f_0$

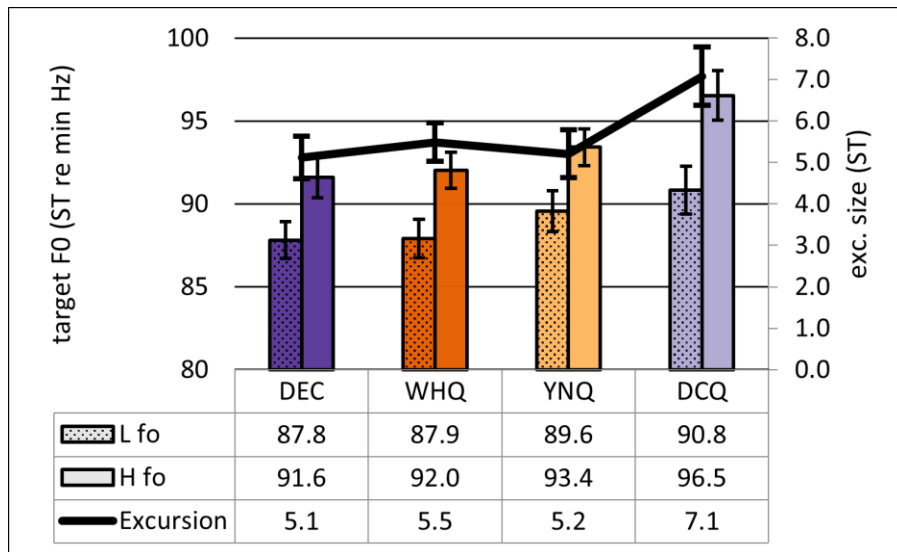
- DEC  $\approx$  WHQ
- increase: YNQ  $\rightarrow$  DCQ

Excursion Size

- Noticeable increase for DCQ

Statistically significant results\*

- $L f_0$ ,  $H f_0$ :
  - All but DEC v WHQ ( $p. \approx 1$ )
- Excursion:
  - DEC v DCQ ( $p.=0.0102$ )
  - YNQ v DCQ ( $p.=0.0003$ )

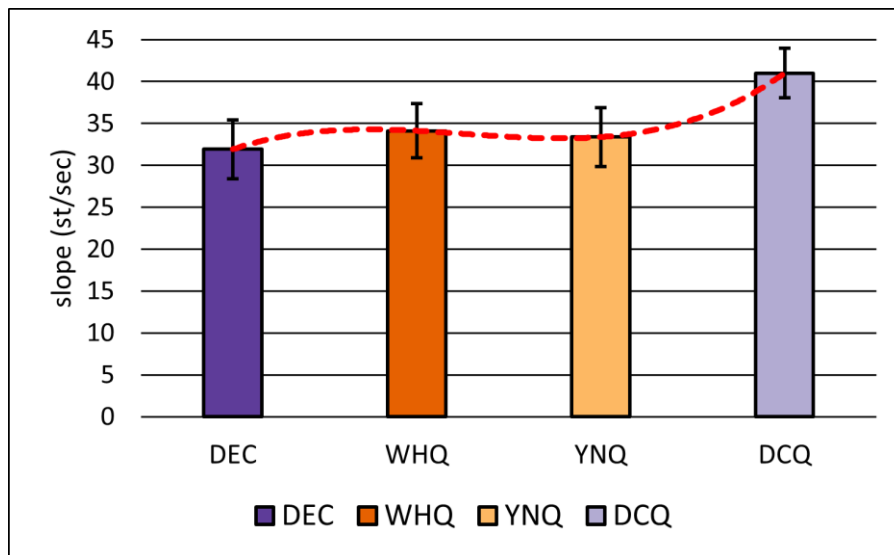


# Phonetic Parameters and Sentence Mode

## Annotation and analysis

### COMPOSITE PARAMETER

- Slope matters for DCQ!
  - **DEC v. DCQ**  
 $\beta_1 = 9.105$  ST  
 $p. = 0.0461$
- Non-significant for other pairwise comparisons.



# Categorization of Mode by Nuclear PA

## Results and Analysis

- **Trained on Pitch accent only.**
- **41.9% Accuracy**
- **Performs better than:**
  - **PA + gender**
  - **PA + boundary**

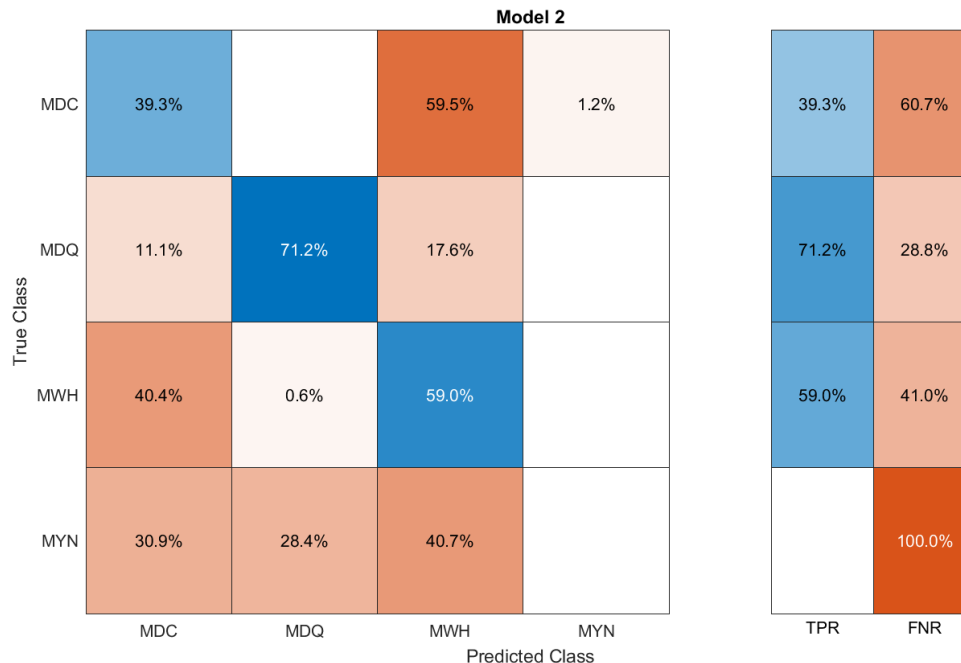
**Model 3**

True Class	MDC	MDQ	MWH	MYN
	64		97	2
	17	109	27	
	65	1	95	
MYN	50	46	66	
Predicted Class				

# Categorization of Mode by Nuclear PA

## Results and Analysis

- **Trained on Pitch accent only**
- **41.9% Accuracy**
- **Performs better than:**
  - **PA + gender**
  - **PA + boundary**
- YNQ never correctly identified!
- MDC & MWH most Confused
- DCQ best identified.



**TPR:** True Positive Rate  
**FNT:** False Negative Rate



# Categorization of Mode by Nuclear Contour

## Results and Analysis

- **Trained on Pitch accent only**
- **41.9% Accuracy**
- **Performs better than:**
  - **PA + gender**
  - **PA + boundary**
- YNQ misidentifications from DEC (2 instances)!
- **DEC never predicted as DCQ!**

**PPV:** Positive Predictive Value

**FDR:** False Discovery Rate

		Model 2			
True Class	MDC	32.7%		34.0%	100.0%
	MDQ	8.7%	69.9%	9.5%	
	MWH	33.2%	0.6%	33.3%	
	MYN	25.5%	29.5%	23.2%	

	MDC	MDQ	MWH	MYN
	32.7%	69.9%	33.3%	
PPV	32.7%	69.9%	33.3%	
FDR	67.3%	30.1%	66.7%	100.0%

# Best Model with Phonetic Parameters

## Results and Analysis

### PARAMETERS

- Gender
  - L<sub>t</sub>
  - Slope
  - L<sub>f0</sub>
  - H<sub>f0</sub>
  - Boundary f0
  - Excursion (L to H)
  - Excursion (H to %)
- **65.3% accuracy**
  - **Model with phonological params performs more poorly!**

Model 4

True Class	Model 4			
	MDC	MDQ	MWH	MYN
MDC	96	10	40	17
MDQ	5	133	6	9
MWH	41	7	89	24
MYN	23	21	19	99
	MDC	MDQ	MWH	MYN

Predicted Class

# Best Model with Phonetic Parameters

## Results and Analysis

- Noticeable improvement in true positive rates!
- DCQ still highest true positive rate.

		Model 4					
True Class	MDC	58.9%	6.1%	24.5%	10.4%	58.9%	41.1%
	MDQ	3.3%	86.9%	3.9%	5.9%	86.9%	13.1%
	MWH	25.5%	4.3%	55.3%	14.9%	55.3%	44.7%
	MYN	14.2%	13.0%	11.7%	61.1%	61.1%	38.9%
		MDC	MDQ	MWH	MYN	TPR	FNR
		Predicted Class					

**TPR:** True Positive Rate  
**FNT:** False Negative Rate

# Best Model with Phonetic Parameters

## Results and Analysis

- **General improvement in PPV**
- **MDQ PPV “least improved”**
- **MDC false discovery != 0, but 5.8%**

		Model 4			
True Class	MDC	58.2%	5.8%	26.0%	11.4%
	MDQ	3.0%	77.8%	3.9%	6.0%
	MWH	24.8%	4.1%	57.8%	16.1%
	MYN	13.9%	12.3%	12.3%	66.4%
		Predicted Class			
		MDC	MDQ	MWH	MYN
PPV		58.2%	77.8%	57.8%	66.4%
FDR		41.8%	22.2%	42.2%	33.6%

**PPV:** Positive Predictive Value

**FDR:** False Discovery Rate