TRANSCRIBING THE "TUNE"

Prosodic and sociolinguistic properties of the *toːnada cordobesa*

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Why study the speech of Córdoba?

- **Numbers**: capital of Córdoba is the second largest city in the country (1.3 million as of 2010 census), but is rarely studied
- **Historical Language Contact**: City was an important hub for westward expansion
  - Implicated in slave trade and transfer of African workers north through Tucumán and silver mines of Potosí (Mellafe 1975:80). At one time Africans outnumbered whites (Vidal de Battini 1964:37)
  - Little influx of indigenous groups (Vidal de Battini 1964:37), but tonal properties have been claimed to originate with the *comechingones* (cf. Vidal de Battini 1964:149).
- Is, and has been, an area of **transition** and intense **variation** (Vidal de Battini 1964:80)

What is the *tonada cordobesa*?

- Highly salient dialect of capital city of Córdoba, Argentina and surrounding areas
- Characterized by **pre-tonic lengthening** and perceived **pitch excursion** in pre-tonic syllable (Fontanella de Weinberg 1971; Vidal de Battini 1964:148)
- Used predominately in nuclear accents of phrases, often **phrase-finally**

Previous descriptions of *la tonada*

- In the pre-tonic syllable of the final accented word, there is both vowel lengthening and pitch excursion within the vowel (Fontanella de Weinberg 1971:13, 20)
  - Sometimes produces the **percept of a geminate vowel** (Fontanella de Weinberg 1971) **and a shift in accent** (Vidal de Battini 1964: 148)
  - This is confined to the same lexical word (Fontanella de Weinberg 1971:18)
  - The *tonada* can also be used for emphasis elsewhere in the phrase
- Vidal de Battini also claims that the pre-pre-tonic syllable (when it exists) carries an **additional rhythmic accent** (1964:146)

Vidal de Battini 1964:147

"Estas entonaciones con sus ascensos y descensos de la curva melódica, son completamente extraños a los esquemas rítmicos del castellano."

These intonational patterns, with their rises and falls in pitch, are completely alien to the rhythmic schemas of Spanish.

Acoustic Studies

- Until this year, **few (if any) acoustic phonetic studies** had been used to test previous claims made about positional, durational, and intonational qualities of the *tonada cordobesa*

- Lang-Rigal (2014) is the first large-scale study to describe acoustic properties of the *tonada* in conjunction with speech perception.

- Since you've just heard about it, I won't describe it here, but it dovetails nicely with the current study.

Research Questions:

1. Is the *tonada cordobesa* preferred or enhanced in certain phrasal positions (e.g. phrase-finally)?

2. Is the pre-tonic syllable the only lengthened syllable in an accented phonological word?

3. Are there any consistencies in overall pitch modulation in pre-tonic syllables which might give the *tonada* a musical quality?

4. How is the *tonada cordobesa* conditioned by sociological or discourse factors?

5. How well do elicited tokens of intonation correlate with real world data regarding the *tonada*?

ELICITATION STUDY

Positional and Gender Effects in Production

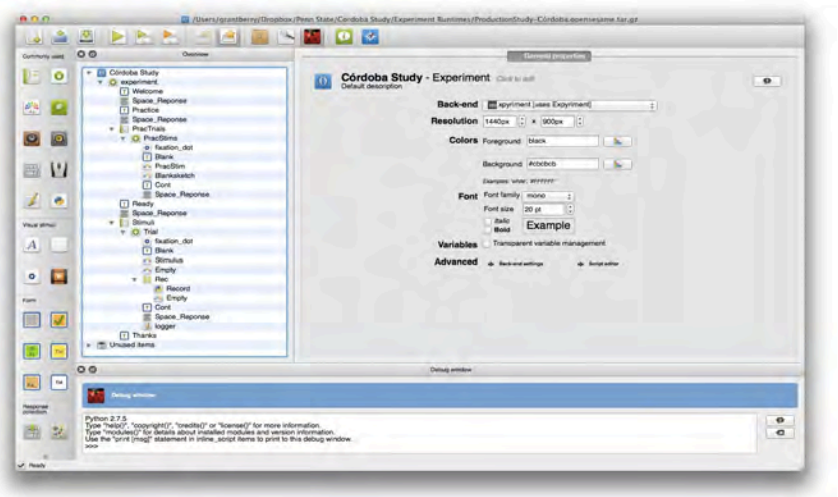
Methodology

- Ex: ***caminamos*** (we walk)
  - Initial: ***caminamos*** *juntos con frecuencia* (we often walk together)
  - Final: *Les sorprende lo mucho que* ***caminamos*** (It surprises them how much we walk)

- Participants (6):
  - 6 Participants from Córdoba with limited experience living elsewhere
  - 3 Male, 3 Female
  - Ages 18-25 (mean 21.8 yrs; sd 2.8 yrs)
- Stimuli (120):
  - 20 Paroxytonic targets in sentences with 3 accented syllables
    - 10 with two pre-tonic accents (pre-tonic and pre-pre-tonic)
    - 10 with one pre-tonic accent
  - Placed in first accented position or nuclear position (phrase-final)
  - 3 Repetitions

Procedure:

1. Participants were asked to fill out a demographic and language history questionnaire on Google Drive
2. They were then fitted with a head-worn dynamic microphone connected to a Macbook Air computer
3. The experiment was implemented using OpenSesame (Mathôt et al. 2012); http://osdoc.cogsci.nl/



Procedure:

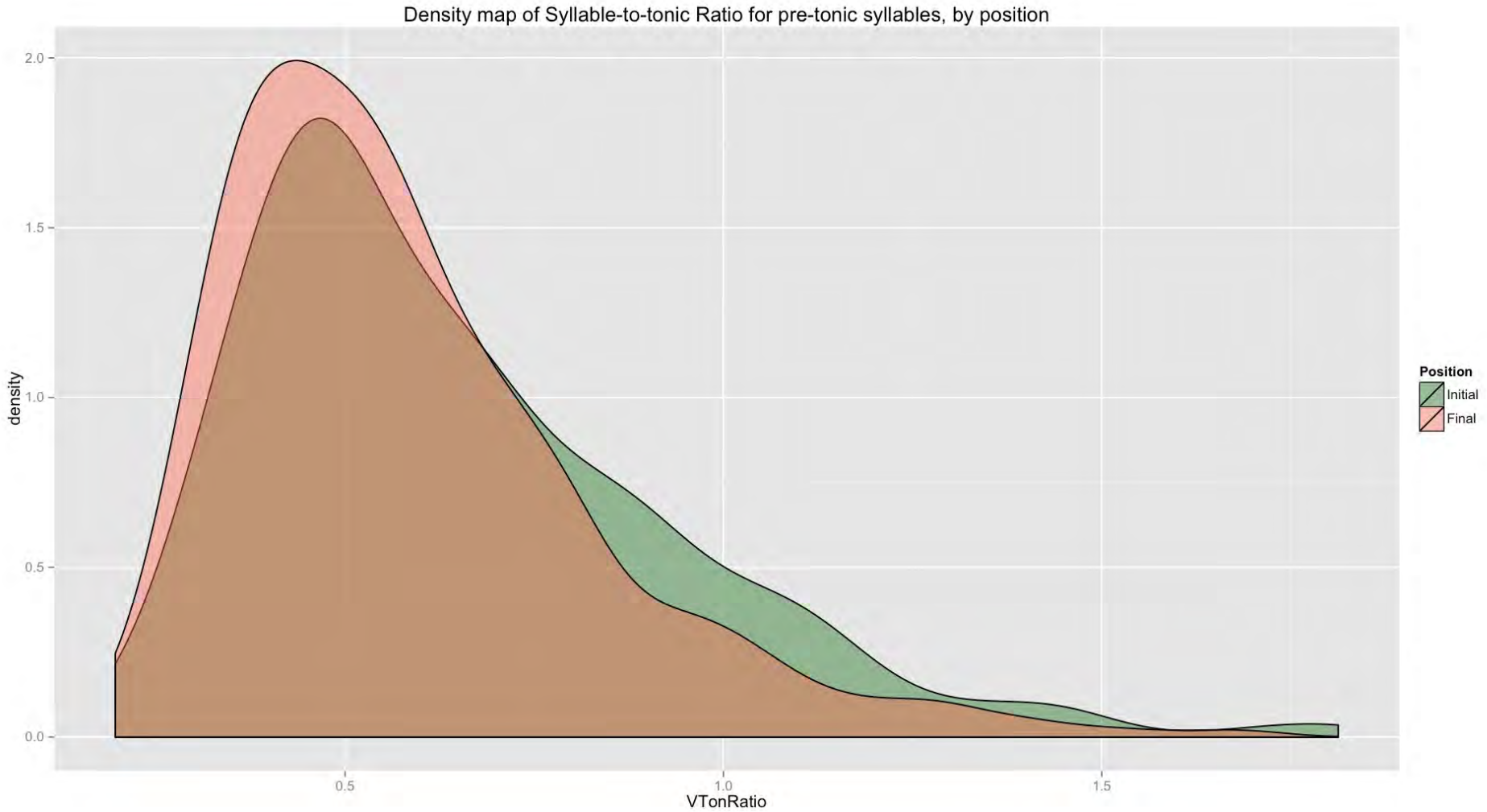
- Fixation dot: 500 ms
- They were told to memorize a sentence which appeared for 2500 ms
- Then, this sentence disappeared and they had to recite it from memory
  - They had four seconds after the sentence disappeared to recite it.
- Participants were given four practice trials
- Order of stimuli was randomized by participant, including repetitions

Coding:

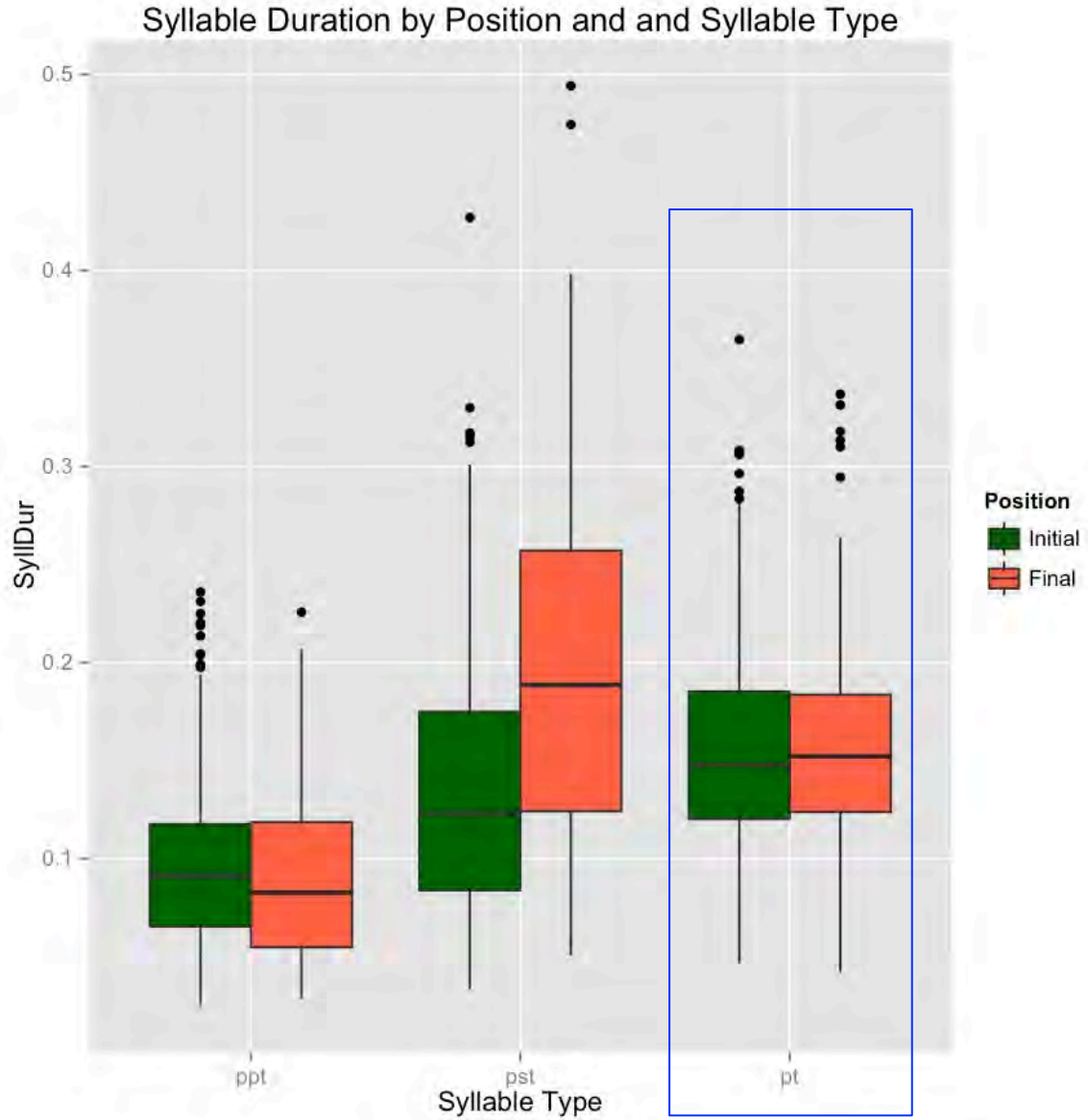
- Each target word, syllable, and vowel was hand-measured in PRAAT (Boersma and Weenik 2014)
- Syllables were coded by position relative to the tonic syllable: (pre-pre-tonic, pre-tonic, tonic, post-tonic)

- By means of a PRAAT script, the following were extracted:
  - Syllable Duration and Vowel Duration (all syllables)
    - Syllable Duration in relation to the tonic syllable
    - Vowel duration in relation to the tonic vowel
  - Syllable type in relation to tonic syllable
  - Pitch range ($pitch_{max}$-$pitch_{min}$) within the vowel
  - Position of the target

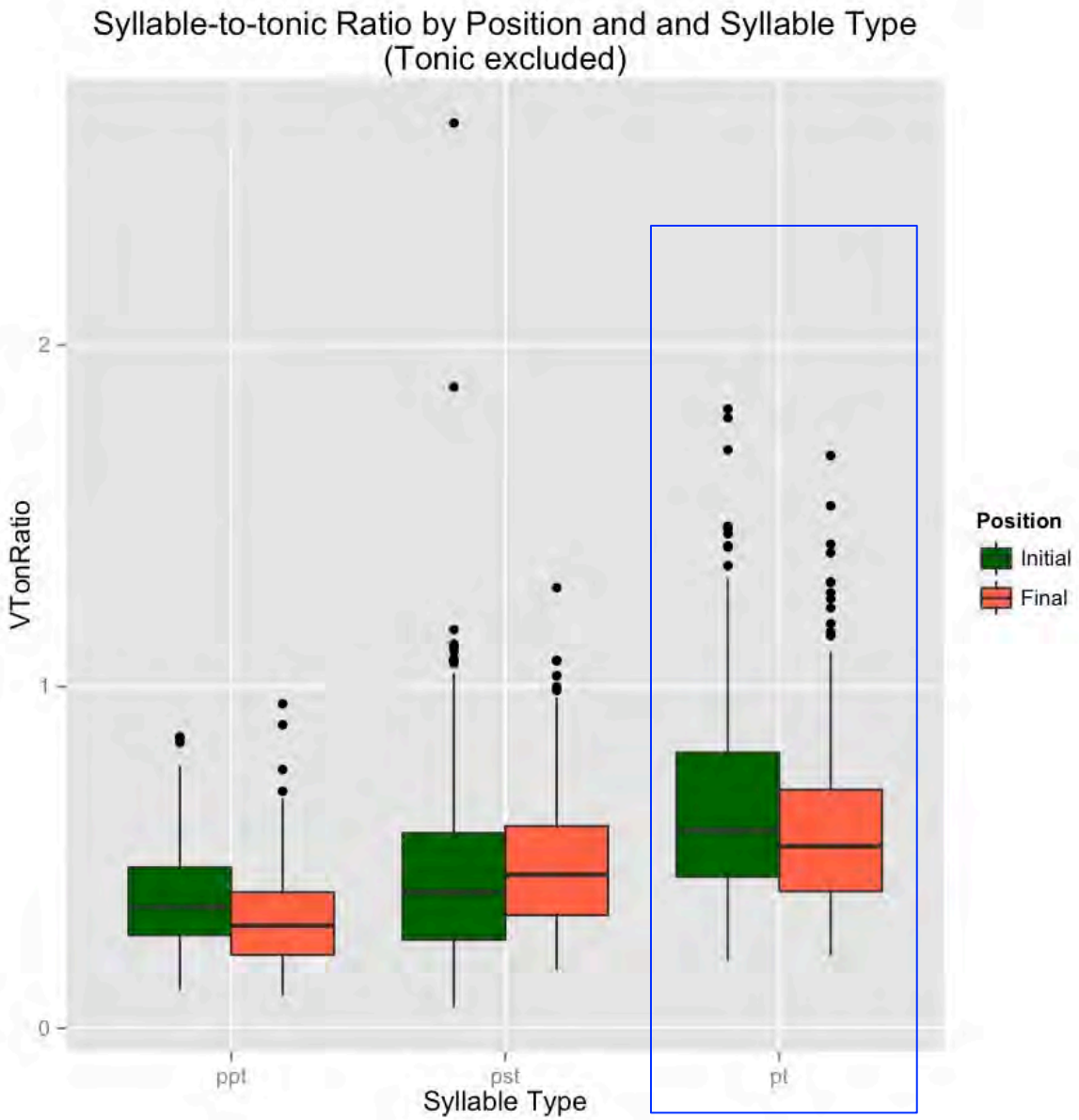
Tonic ratio for pre-tonic syll's by position



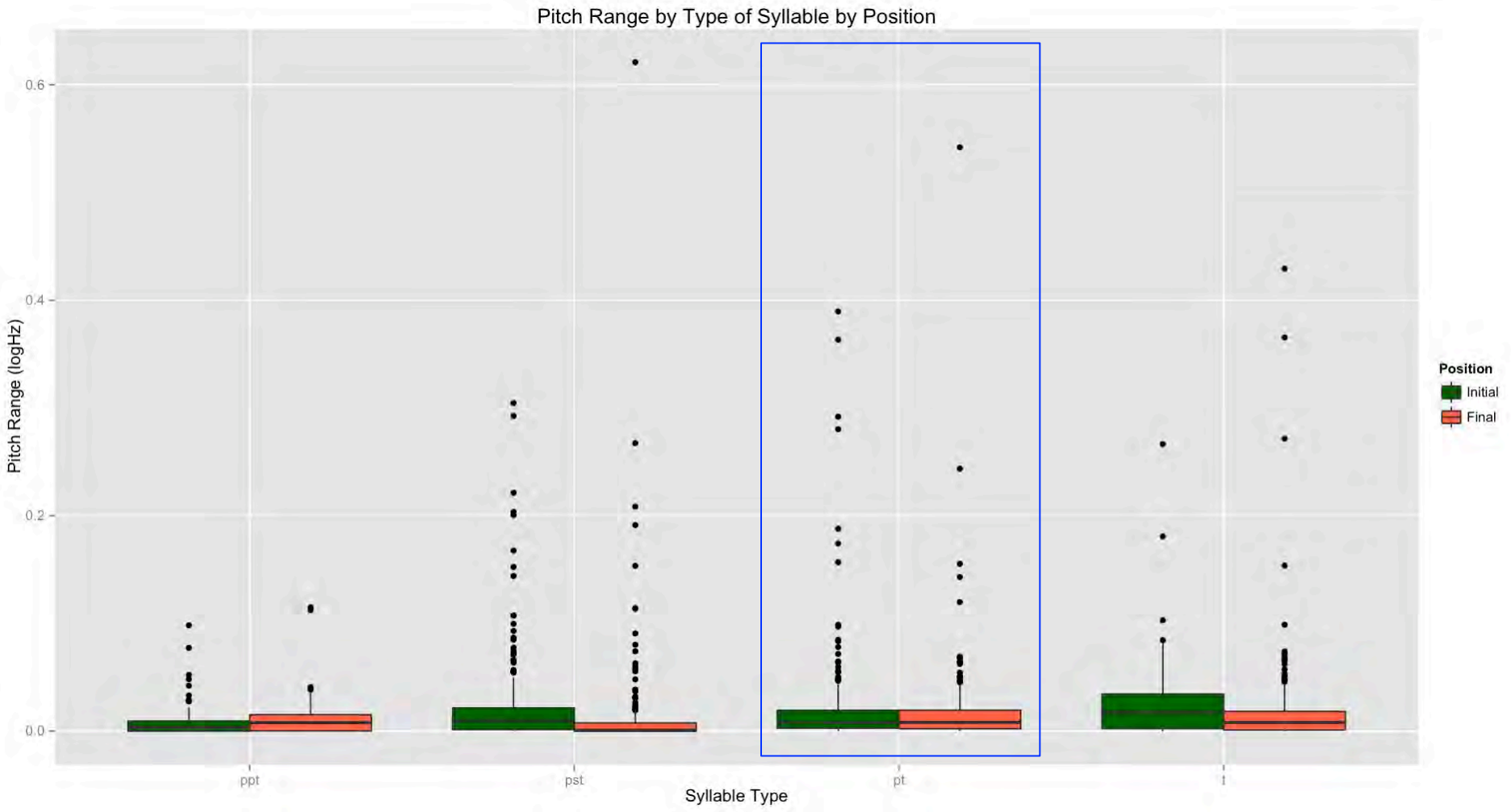
Absolute Duration by Type and Position:



Tonic Ratio By Type:



Pitch Range by Type and Position:



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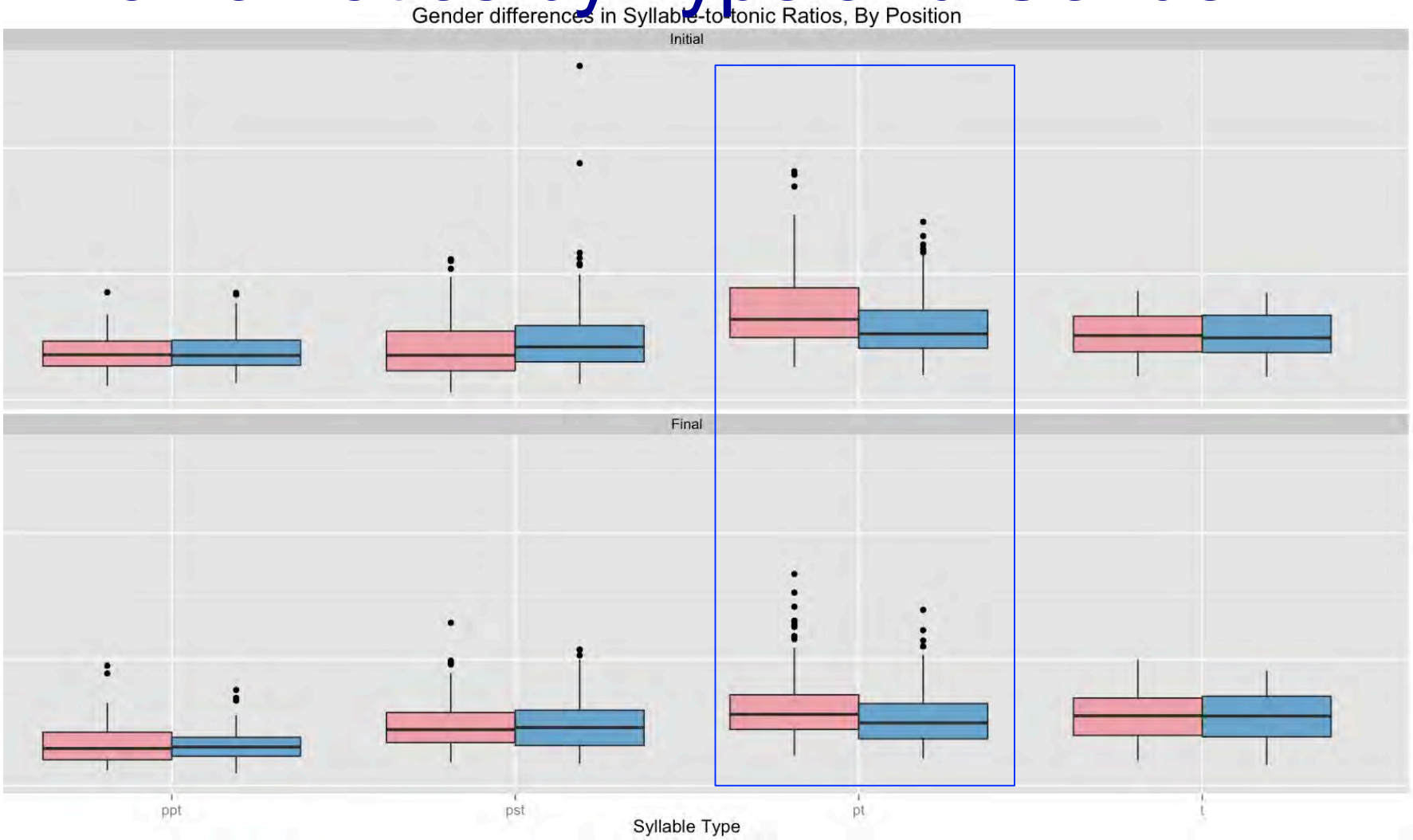
Tonic Ratios by Type and Gender:



Analysis:

- Data were analyzed using mixed effects models in the lme4 package (Bates et al. 2014) in R (R Core Team 2014)
- Tokens were referenced to tonic syllables in initial position produced by female speakers
- Outcome: **Duration Ratio to Tonic Vowel (V/V_{tonic})**
- Model was fit with random intercepts by stimulus

Fixed Effects:	
Gender	Trial Order
Pitch Range (logHz)	Position
Gender/Pitch Range Interaction	*Syllable Type*

MODEL RESULTS

All tokens

Random Effects:

Groups	Name	Variance	Std.Dev.	Correlation	
Stimulus	(Intercept)	0.0306405	0.17504		
Male	0.0022676	0.04762	-0.63		
Pitch Range	0.0001742	0.0132	-0.49	-0.09	
Male:PitchRange	0.0005128	0.02265	0.25	-0.2	0.03
Residual	0.0263235	0.16225			
Observations: 2129		Groups: Stimulus, 20			

Fixed Effects:

	Estimate	Std. Error	t-value
(Intercept)	0.5370839	0.0407006	13.196
Male	-0.0339988	0.0135224	-2.514
Pitch Range	0.010723	0.0052557	2.04
Pre-pre-tonic	-0.1776673	0.0119003	-14.93
Post-tonic	-0.0608276	0.0096482	-6.305
Pre-tonic	0.0869207	0.0091719	9.477
Order	0.0001163	0.0001047	1.11
Final	-0.0078355	0.007113	-1.102
Male:Pitch Range	0.0202095	0.0085763	2.356

ANOVA Results

	Chisq	Df	Pr(>Chisq)	
Gender	3.3546	1	0.067019	.
PitchRange	10.1191	1	0.001467	**
SyllType	565.2273	3	<2e16	***
Order	1.2329	1	0.266838	
Position	1.2135	1	0.270649	
Gender:PitchRange	5.5529	1	0.018451	*

Correlation of Fixed Effects

	(Intr)	Male	Range	PPT	PST	PT
Male	-0.544					
PitchRange	-0.342	0.148				
Pre-pre-tonic	-0.094	0.007	0.064			
Post-tonic	-0.118	0.013	0.046	0.385		
Pre-tonic	-0.118	-0.003	0.032	0.398	0.482	
Order	-0.156	-0.015	0.019	-0.009	-0.005	0
Final Position	-0.092	-0.003	0.028	0.005	0.047	0.002
Male:PitchRange	0.173	-0.334	-0.382	0.011	-0.004	0.018

MODEL RESULTS

Only Pre-tonic tokens

Note: Syllable Type was removed from model

Random Effects:

Groups	Name	Variance	Std.Dev.	Correlation		
Stimulus	(Intercept)	0.0548167	0.23413			
	Male	0.0084896	0.09214	-0.85		
	Pitch Range	0.0002598	0.01612	-0.64	0.13	
	Male:PitchRange	0.0013543	0.0368	0.64	-0.14	-1
	Residual	0.0300192	0.17326			
	Observations: 644		Groups: Stimulus, 20			

Fixed Effects:

	Estimate	Std. Error	t-value
(Intercept)	7.11E-01	5.57E-02	12.764
Male	-1.23E-01	2.63E-02	-4.665
Pitch Range	-4.72E-03	1.04E-02	-0.456
Order	1.14E-05	2.04E-04	0.056
Final Position	-6.56E-02	1.37E-02	-4.788
Male:PitchRange	2.20E-02	1.55E-02	1.418

ANOVA Results

	Chisq	Df	Pr(>Chisq)
Gender	19.7632	1	8.77E-06 ***
PitchRange	1.7321	1	0.1881
Order	0.0031	1	0.9556
Position	22.9262	1	1.68E-06 ***
Gender:PitchRange	2.0121	1	0.156

Correlation of Fixed Effects

	(Intr)	Male	PtchRn	Order	Final
Male	-0.728				
Pitch Range	-0.341	0.304			
Order	-0.227	-0.015	0.051		
Final Pos.	-0.125	-0.006	0.008	0.012	
Male:Pitch	0.405	-0.331	-0.834	0.01	0.01

Discussion:

- **Females** are more likely to lengthen the pre-tonic syllable relative to the tonic syllable than males ($p<.001$)
- When all syllable types are considered, the only type to significantly increase the tonic ratio is the **pre-tonic syllable** ($p<.001$). There is no lengthening effect for other syllables ($p<.001$)
- Though in aggregate men and women use pitch distinctively with respect to lengthening ($p<.05$), this is not significant within the pre-tonic syllables.
- There is no independent effect of **pitch range** within the pre-tonic syllable
- There is a slight difference in pre-tonic lengthening by **position** (nuclear vs. phrase-initial), but not in the direction expected.

Discussion

- Pitch results are surprising, given:
  - previous descriptions of pitch modulation (Fontanella de Weinberg 1971: Vidal de Battini 1964)
  - findings of **early valleys** in the pre-tonic syllable (Lang-Rigal 2014:116)
  - and general attribution of song-like qualities to the dialect by most Argentines.
- Similarly, position results would suggest that the **tonic syllable is shortened** in initial position.
  - This provides support for the percept of **stress shift**.
- Questions:
  - Could these be the result of elicitation task demands?
  - Is the gender effect more pronounced in discourse?

CORPUS STUDY

Two speakers from elicitation task

1M, 1F

Methodology:

- Participants were friends and came to do the experiment together.
- They were asked to speak to one another candidly for approximately 30 minutes on any topics they wished.
- The investigator left the room during this time.
- For today, I've analyzed 6 minutes of one interview between a male and female speaker who participated in the elicitation task.

Coding Discourse Factors:

- Speech was transcribed in Intonation Units (IUs) in ELAN (Sloetjes and Wittenburg 2008), and then exported as a PRAAT text grid
  - IU: "stretch of speech uttered under a single, coherent intonation contour" (Dubois et al., 1993)
- Following the convention of Dubois et al., each IU was assigned a type of transitional continuity
  - **(.) Final**: Indicates that an idea is completed; characterized in part by drop in pitch.
  - **(,) Continuiting**: Indicates an idea that is not complete; typically ends in high tone
  - **(--) Truncated**: Speech was cut off
  - **(?) Appeal**: Appeal for information or "validating response from the speaker" (Dubois et al. 1993:55); typically high rise in pitch

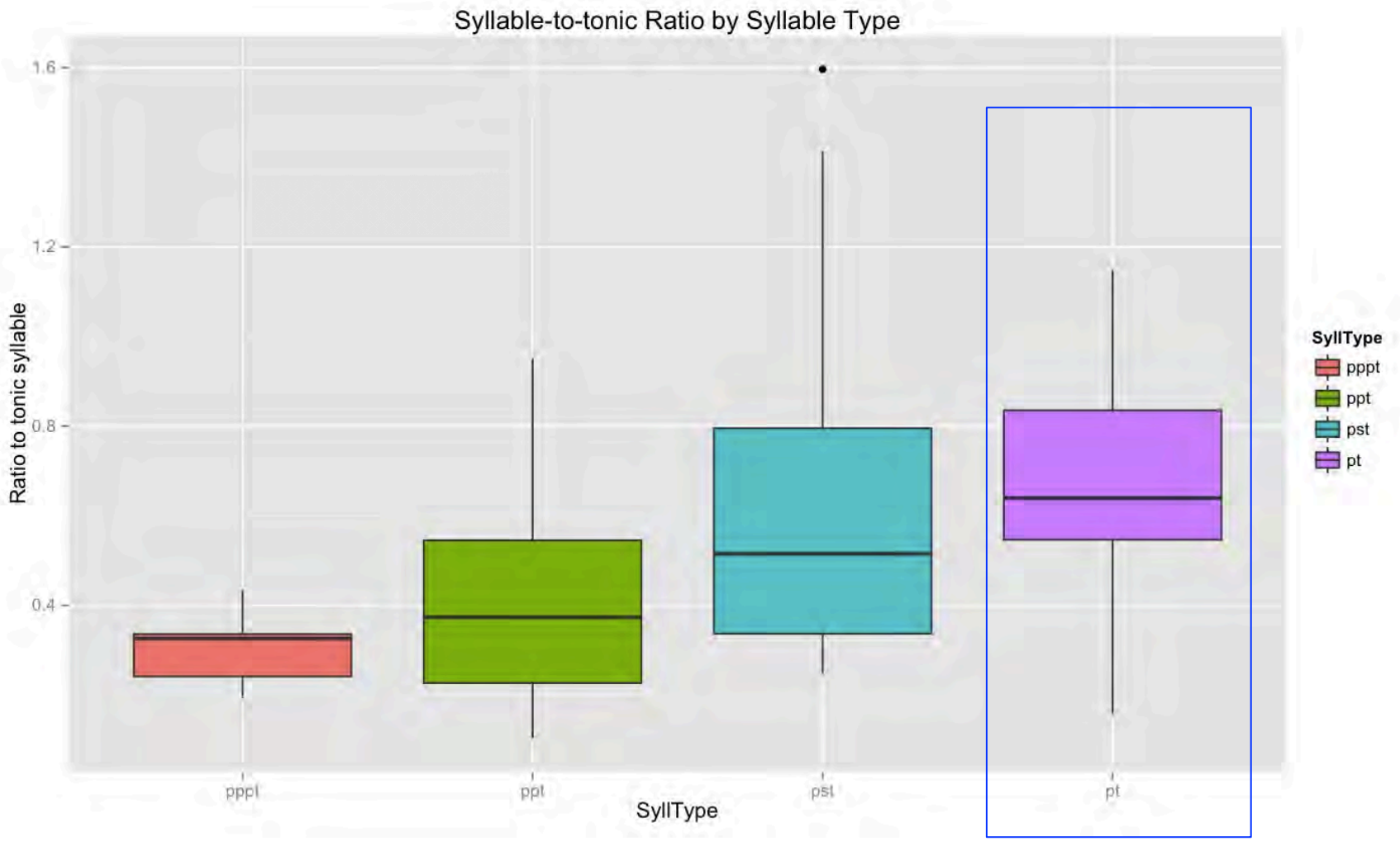
Breakdown of the data:

- 43 words
  - 23 from male speaker; 20 from female speaker
- Transitional Continuity:
  - 29 had continuing intonation
  - 3 had appeal continuity
  - 10 had final continuity
  - 1 was truncated
- Due to low n, Transitional Continuity wasn't included in the statistical model

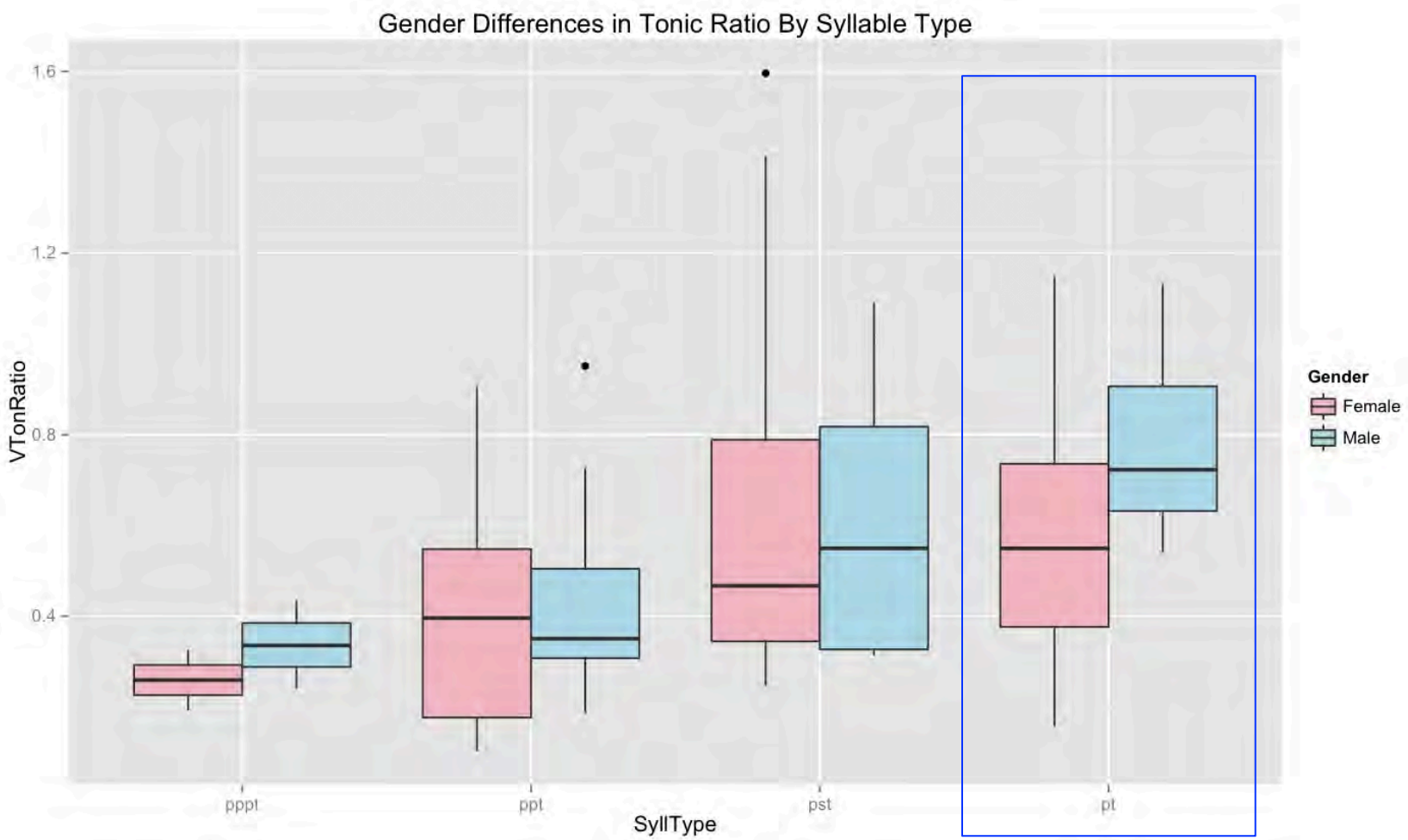
Coding Other Phonetic Factors

- Similar to the elicitation task, a PRAAT script was used to extract the following from the PRAAT text grid:
  - Syllable Duration and Vowel Duration (all syllables)
    - Syllable Duration in relation to the tonic syllable
    - Vowel duration in relation to the tonic vowel
  - Syllable type in relation to tonic syllable
  - Pitch range ($pitch_{max}$-$pitch_{min}$) within the vowel
  - Transitional Continuity of the IU

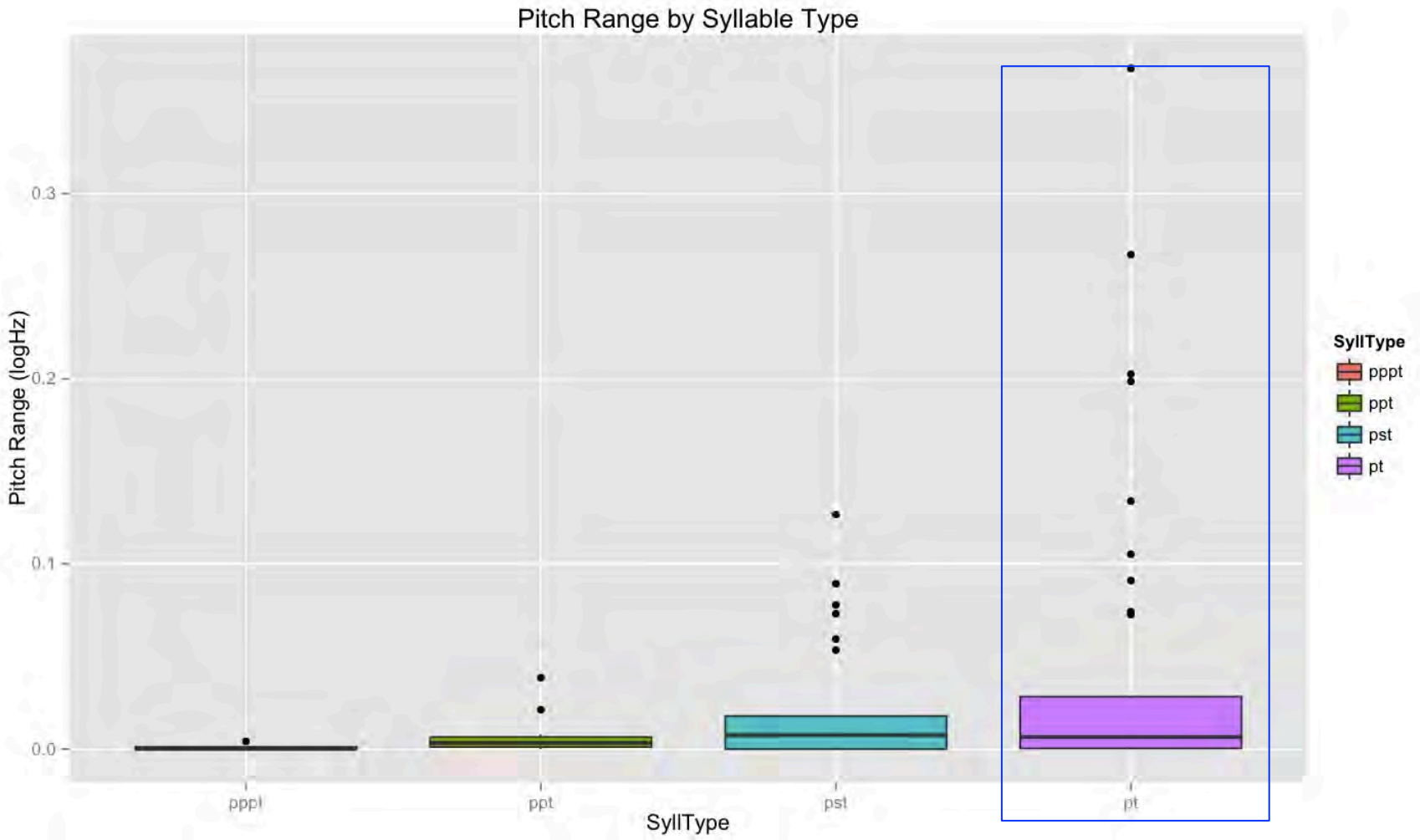
Tonic Ratio by Type



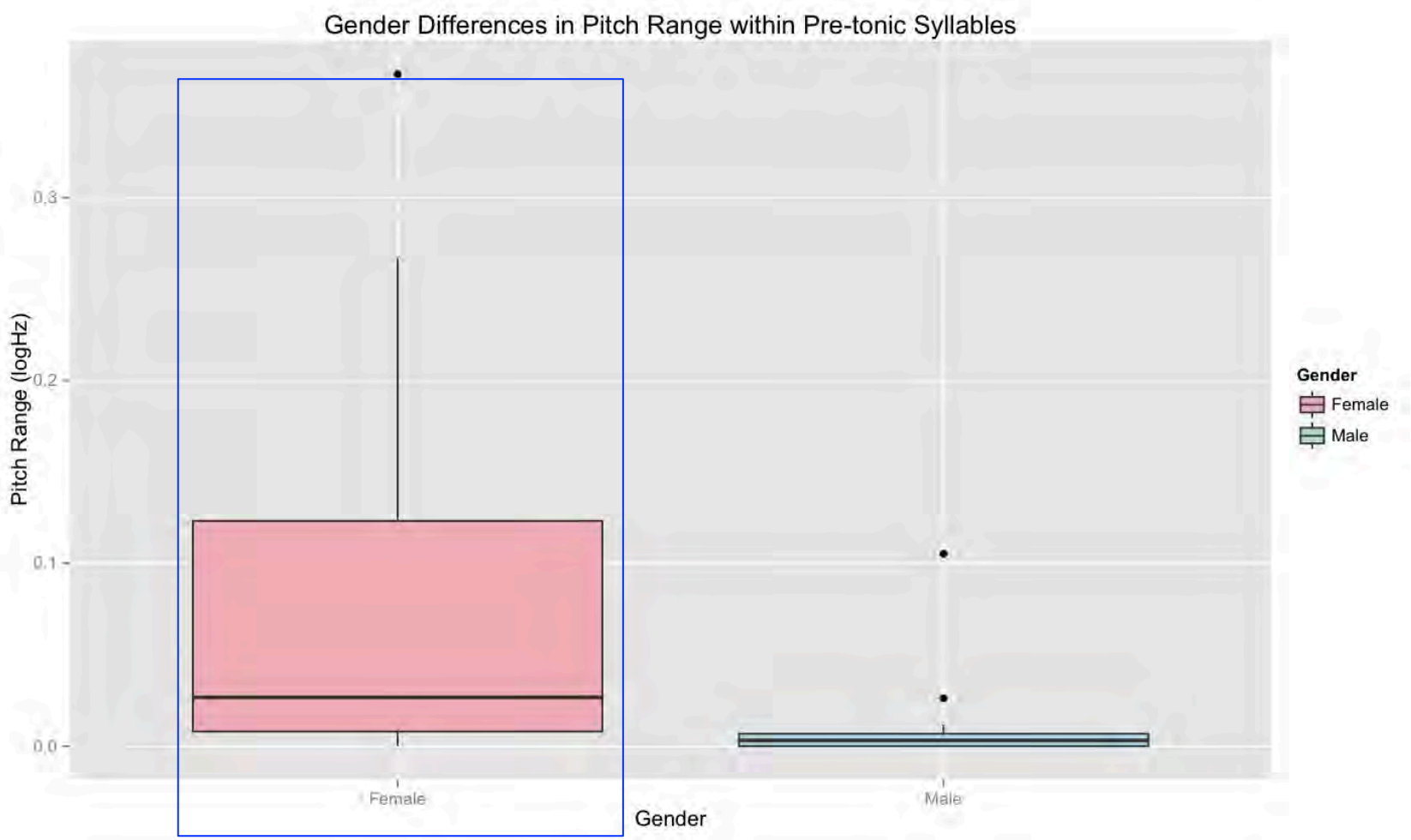
Gender Differences in Tonic Ratio by Type



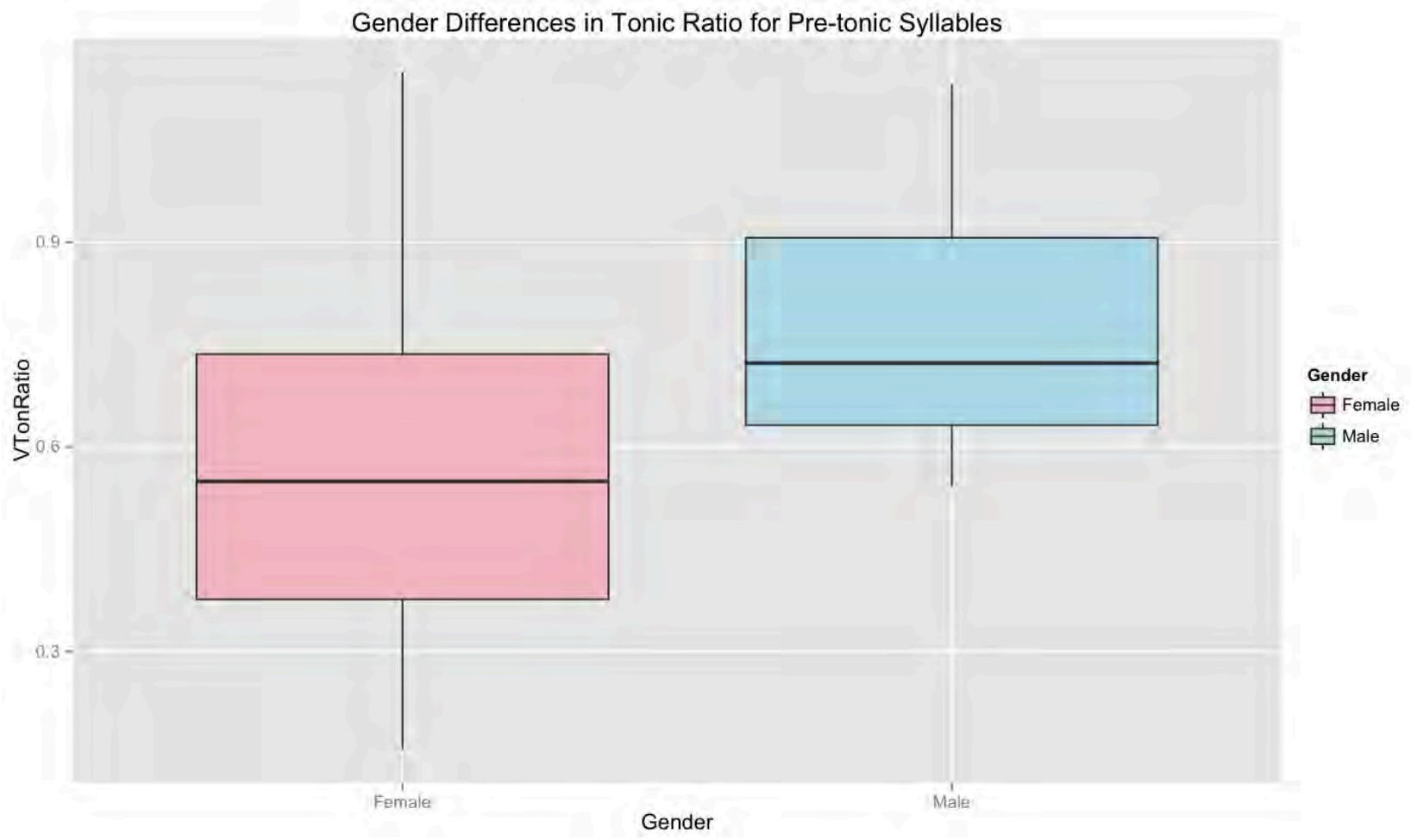
Pitch Range by Type



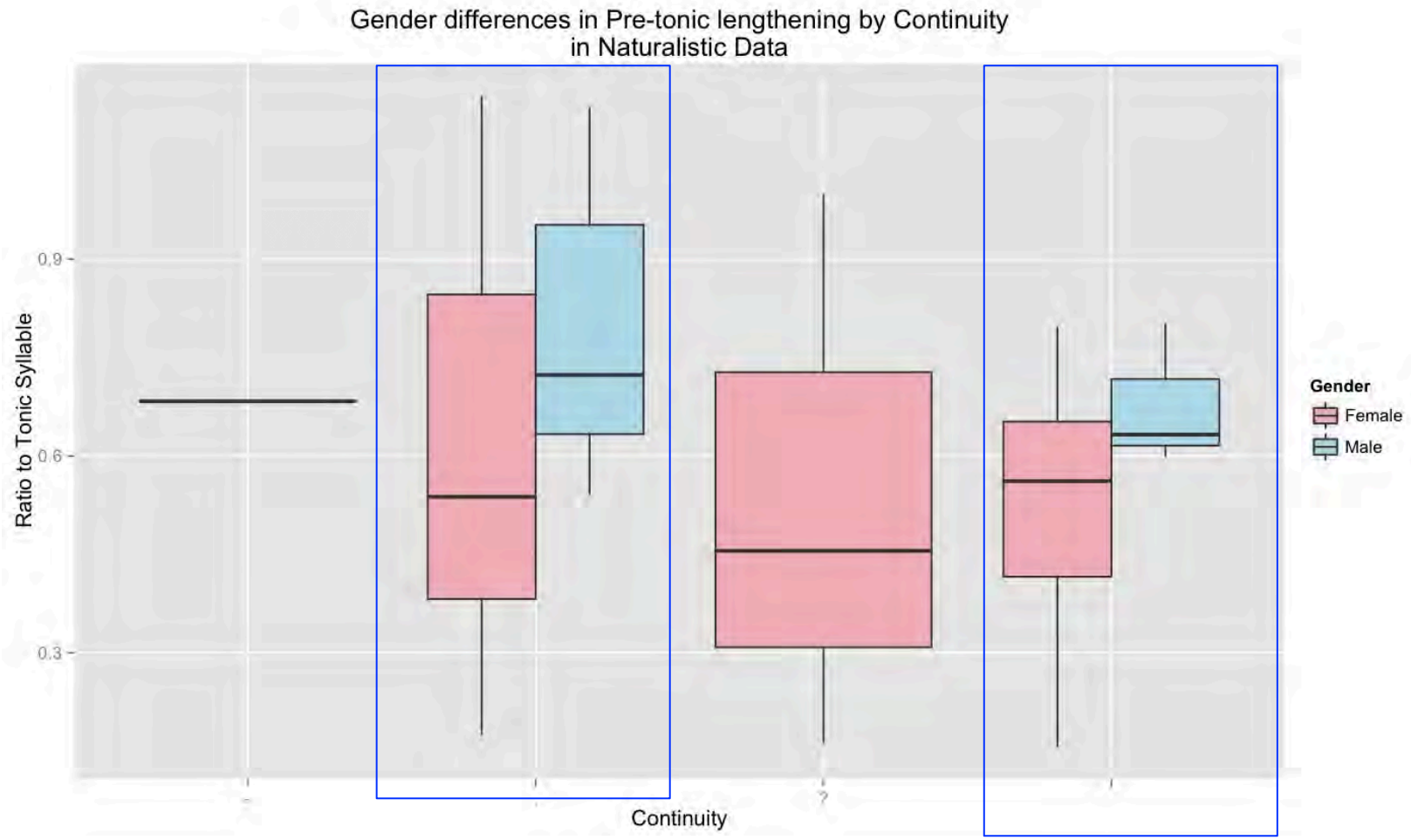
Pitch Range by Gender in Pre-tonic Syll's



Tonic Ratio by Gender in Pre-tonic Syll's



Tonic Ratio by Gender and Transitional Continuity



Analysis

- Data were fit to Type II ANOVAs in R's car() package (Fox and Weisberg 2011)
- Dependent Variable: Tonic Ratio (V/V_{tonic})
- Fixed Effects:
  - Gender
  - Pitch Range
  - Gender/Pitch Range Interaction
- The analysis was done with all data in aggregate to see if there were global trends in production which differed by gender, as well as on pre-tonic syllables only.

All data:

ANOVA					
	Sum sq	Df	F-value	Pr(>F)	Sig.
PitchRange	0.3014	1	3.3539	0.069525	.
Gender	0.6715	1	7.4727	0.007213	**
PitchRange:Gender	0.4037	1	4.4932	0.036089	*
Residuals	10.7828	120			

Analysis on Pre-tonic Syllables

ANOVA

	Sum sq	Df	F-value	Pr(>F)	Sig.
PitchRange	0.00767	1	0.1333	0.71741	
Gender	0.26446	1	4.5943	0.03954	*
PitchRange:Gender	0.1695	1	2.9446	0.09554	.
Residuals	1.89955	33			

Discussion

- While in aggregate males and females use pitch range distinctly when applied to relative syllable duration, this is not a significant predictor of pre-tonic lengthening.
- The corpus findings are distinct from laboratory findings in the gender effect
  - Male exhibits higher pre-tonic lengthening ($p<.05$)
  - Female uses more pitch excursion
- While not included in the analysis due to low n, it seems that men and women may be using the *tonada* distinctively, as well.
  - The male never used the *tonada* in an appeal, for example

GENERAL DISCUSSION

Gender effects

Intonation Research in Elicitation vs. Corpus Studies

Merits of studying the *tonada cordobesa*

Research Questions:

1. Is the *tonada cordobesa* preferred or enhanced in certain phrasal positions (e.g. phrase-finally)? **NO**

2. Is the pre-tonic syllable the only lengthened syllable in an accented phonological word? **YES**

3. Are there any consistencies in overall pitch modulation in pre-tonic syllables which might give the *tonada* a musical quality? **NO**

4. How is the *tonada cordobesa* conditioned by sociological or discourse factors?

   Gender differences?

5. How well do elicited tokens of intonation correlate with real world data regarding the *tonada*?

   Well, up to gender effects

Discussion of Findings:

- The lack of an effect for position could either be an **artifact of the elicitation task**, or an indicator that the *tonada* has expanded to other prosodic contexts.
  - Possibly due to ability to use it emphatically?
- Despite a **consistent pitch percept**, pitch range is not significantly correlated with pre-tonic lengthening
  - Because longer syllables are correlated with stress, and stress is often enhanced with pitch modulation, perhaps this is a perceptual illusion (but see Ortega-Llebaria and Prieto 1996).
- Genders seem to be behaving differently, but more work is needed to establish just how gender modulates pre-tonic lengthening.

Thanks to:

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