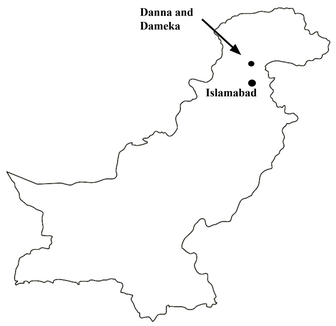
Acoustic Correlates of Stress in Mankiyali

Jonathan Charles Paramore[1], Aurangzeb[2]
[1]Linguistics, UC Santa Cruz; [2]University of North Texas
[1]*jcparamo@ucsc.edu*, [2]*zeb296@gmail.com*

Language Background



- **Mankiyali** is an **understudied** and **endangered** Indo-Aryan language.
- Spoken by roughly 500 people in two remote villages in the Mansehra District of **Northern Pakistan**.

Preliminaries

- Mankiyali stress is **penultimate by default.**
  - *a.na.* ˈ***gu***.*gu* “owl”
  - *dʒan.* ˈ***dar***.*yoz* “locks”
  - ˈ***kaa***.*rɪɪ* “millet”
- Mankiyali stress is **weight-sensitive**: CVV(C) > CVC(C) > CV
  CVVC, CVV > CVCC, CVC, CV
  - *muk.* ˈ***lee*** “open (IMP)” *gand.* ˈ***gii*** “dirtiness”
  - *luŋ.* ˈ***gaaɽ*** “fox” *ma.* ˈ***sĩĩ*** “fly”
  CVCC, CVC > CV
  - ˈ***baŋg***.*su.va* “buckle” *ma.* ˈ***čʰɪr*** “mosquito”
- The relationship between **CVVC ~ CVV** and **CVCC ~ CVC** is undetermined for the stress system.

Acoustic Correlates of Stress

Previous Research

- Very little work analyzing acoustic correlates of stress in Indo-Aryan languages (Gordon & Roettger, 2017)
- **Functional Load Hypothesis**: Predicts that use of an acoustic property in other areas of the phonology prevents it from being used as an acoustic correlate to stress.
- Most acoustic studies of stress have failed to disentangle **word-level stress** from **phrase-level stress.**

The Current Study

- What are the acoustic correlates of word-level and phrase-level stress in Mankiyali?
- Does the Functional Load Hypothesis hold true in Mankiyali?

Methodology

Participants

- 30 Native speakers of Mankiyali
- All at least trilingual in Mankiyali, Hindko, and Urdu.

Speech Materials

- Tokens were disyllabic words grouped into near minimal pairs: ˈ***ya***.*ka ~ ya.* ˈ***kaɽ***

Target σ stressed	Target σ unstressed
ˈ**CV**.CV	**CV**.ˈCVC
ˈ**CVC**.CV	**CVC**.ˈCVV
ˈ**CVV**.CVV	**CVV**.ˈCVVC
ˈ**CVCC**.CV	**CVCC**.ˈCVV
CVV.ˈ**CVVC**	ˈCVVC.**CVVC**

- Five word pairs for each syllable type = **50 tokens**.
- Tokens embedded in **carrier sentences** within 3-sentence **mini-monologues**.
- 30 participants X 2 repetitions X 2 Stress levels X 50 Tokens = 6,000 Tokens (3,000 word-level and 3,000 phrase-level)

Sentence 1 (target sentence to analyze **phrase-level stress**)
Miɲi saŋgi **[token]** mandʒu
My friend **[token]** said
“my friend said **[token]**”

Sentence 2
Miɲi saŋgi du var **[token]** mandʒu
My friend two times **[token]** said
“my friend said **[token]** two times”

Sentence 3 (target sentence to analyze **word-level stress**)
Miɲi saŋgi coor var **[token]** mandʒu
My friend four times **[token]** said
“My friend said **[token]** four times”

Analysis

- **3 acoustic properties** extracted from each target vowel: Duration, pitch, and intensity

Results

- Models examining acoustic correlates of **word-level** stress.
  - A significant effect of STRESS on duration.

Syllable Type	Coefficient (ms)	p-value
CV	β = -6.9032	p < 0.0001
CVC	β = -6.3230	p < 0.0001
CVCC	β = -6.1269	p < 0.0001
CVV	β = -8.1370	p < 0.0001
CVVC	β = -11.317	p < 0.0001

  - Generally no effect of STRESS on pitch or intensity.
- Models examining acoustic correlates of **phrase-level** stress.
  - A significant effect of STRESS on all three acoustic properties.

Duration

Syllable	Coefficient (ms)	p-value
CV	β = -8.3417	p < 0.0001
CVC	β = -12.8367	p < 0.0001
CVCC	β = -10.204	p < 0.0001
CVV	β = -24.552	p < 0.0001
CVVC	β = -25.294	p < 0.0001

Pitch

Syllable	Coefficient (Hz)	p-value
CV	β = -16.079	p < 0.0001
CVC	β = -12.827	p < 0.0001
CVCC	β = -11.566	p < 0.0001
CVV	β = -8.2913	p < 0.0001
CVVC	β = -13.4577	p < 0.0001

Intensity

Syllable	Coefficient (dB)	p-value
CV	β = -4.1828	p < 0.0001
CVC	β = -4.0198	p < 0.0001
CVCC	β = -3.169	p < 0.0001
CVV	β = -3.4589	p < 0.0001
CVVC	β = -4.8317	p < 0.0001

Implications

- **Duration** is the only acoustic correlate to word-level stress, of the the properties we measured, indicating that the FLH does not hold in Mankiyali.
- All three acoustic properties measured act as acoustic correlates to **phrase-level** stress.
  - This is interesting, given that most studies suggest pitch is the sole acoustic correlate to phrase-level stress.

Acknowledgements: Research generously supported by The Humanities Institute, the UCSC linguistics department, and UCSC Dean’s Graduate Research Grant.