

LING 450/550

11-Airstream, Phonation

Trill vs Tap/Flap

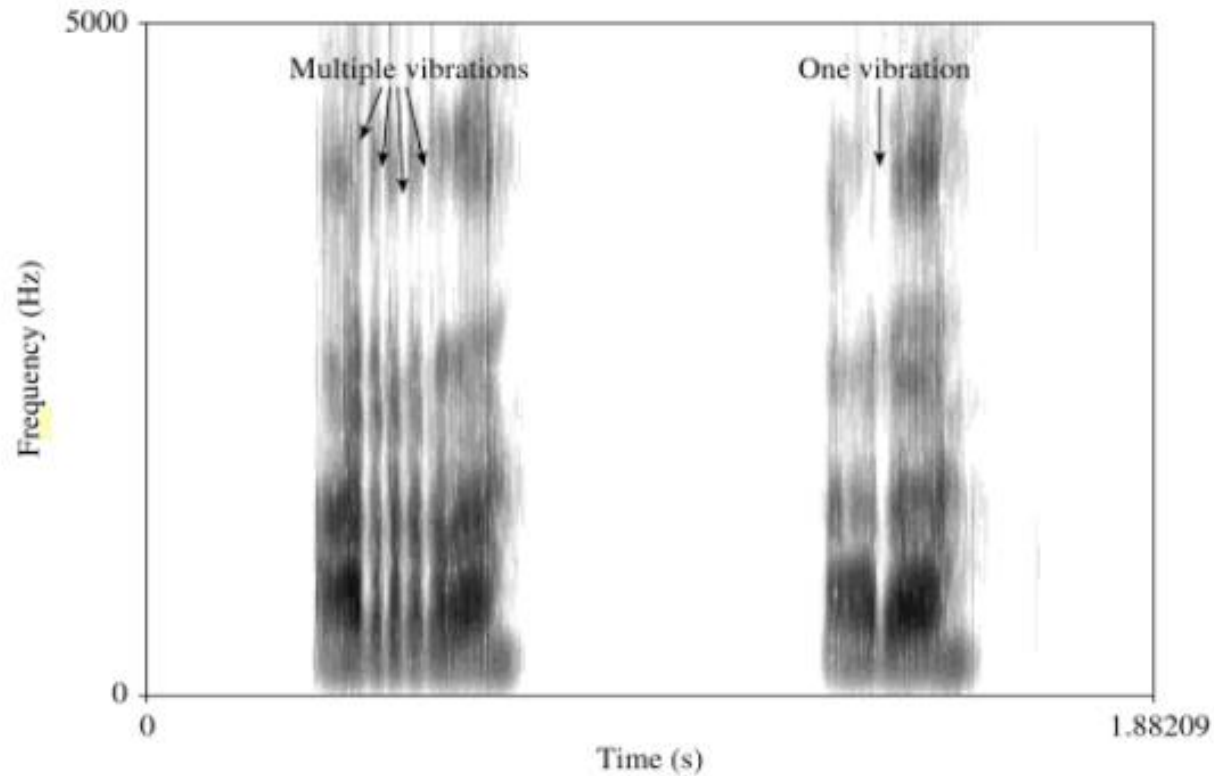
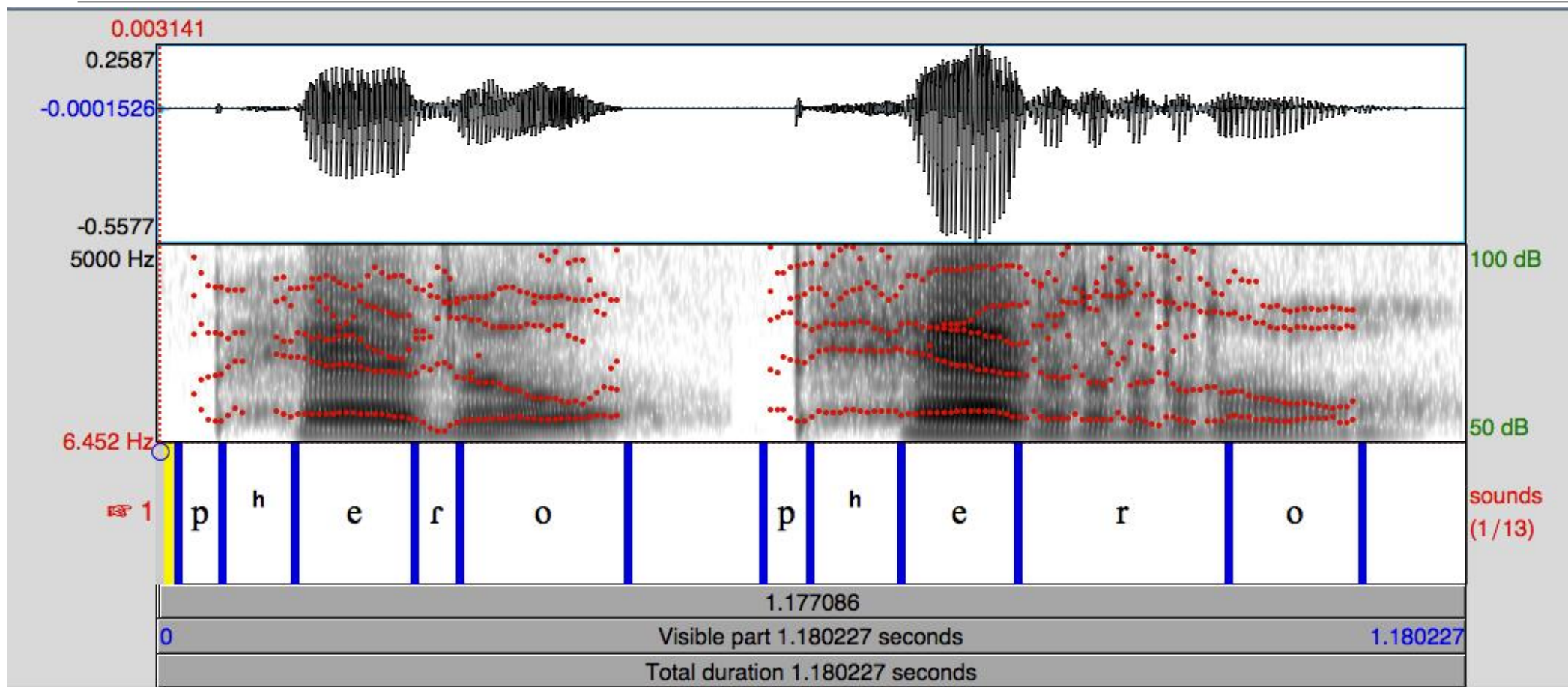


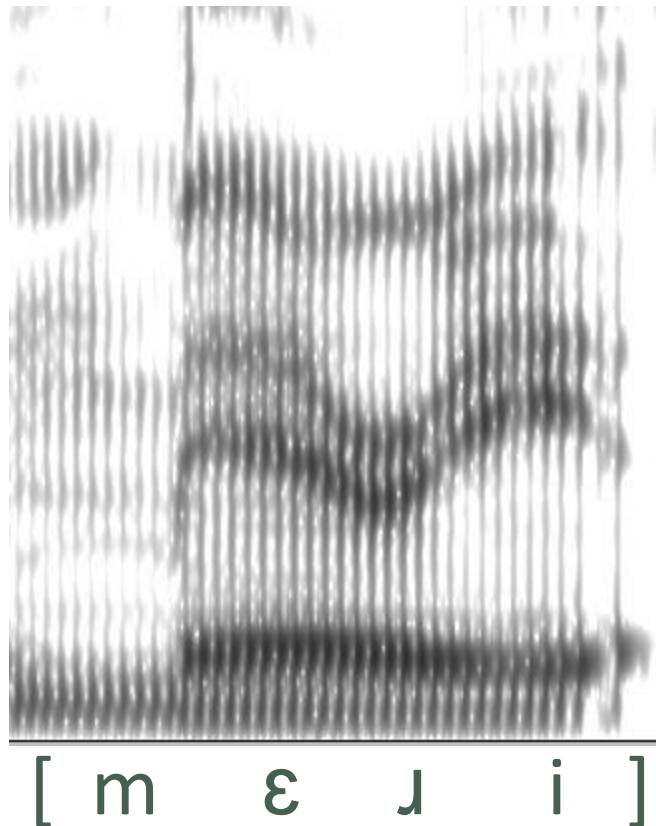
Figure 4.41 Comparison of an alveolar **trill** in [ʀʁ] and an alveolar tap in [ɾɾ]. The **trill** shows several vibrations, the tap only one.

Trill vs Tap/Flap

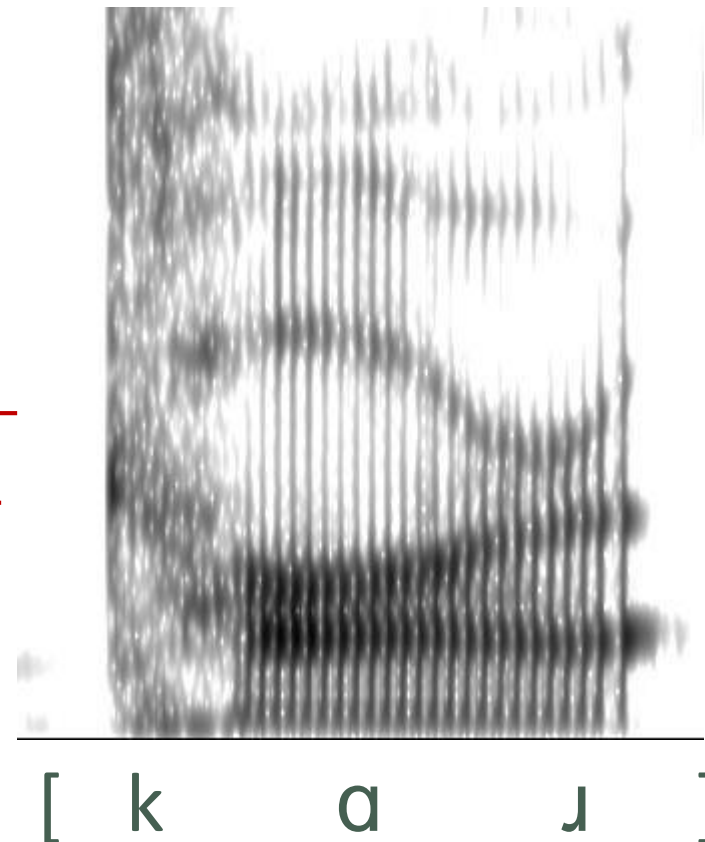


Spectrogram Examples: [ɹ]

- SCOOP SHAPE TO F3



- F2 CENTRAL (BETWEEN FRONT & BACK VOWELS)



Project Tips

Inventories

Make sure your inventory charts encode distinctions that are phonemic in your language, and that it is clear how these distinctions are encoded.

Any dimension that is phonemic in your language (e.g., voicing, roundedness) should be consistently encoded wherever it might apply.

On the other hand, if you have no phonemic contrasts involving a particular dimension, it does not need to be encoded in your charts.

- Exception: roundedness is often specified in vowel charts even if there is no roundedness-only contrast.

Vowel charts that are not based on acoustic measurements should include labels regarding (at least) height and backness.

Inventories

Diphthongs (and triphthongs) should be included in your vowel inventory, but they can't be easily put into a table the way monophthongs can.

- Sometimes arrows are drawn in the vowel chart to show the possible movements of diphthongs (from /e/ to /ɪ/, from /o/ to /ʊ/, etc.).
- Otherwise, especially in languages with many diphthongs, they may be given as a simple list.

Descriptions

Your inventory charts and descriptions should be interpretable independently.

- Others shouldn't need one to make sense of the other.
- Someone who knows nothing about your language should be able to recreate your charts based on your descriptions. For each sound, make sure that somewhere in your description you specify all the information that's relevant for your language.

When listing sounds, pay attention to parallel structure.

- If you say, e.g., “voiced and voiceless stops at the following places of articulation,” each example you list should have the voiced stop followed by the voiceless one.

Descriptions

In the final version, your description of your language's sound system should be a straightforward description, not a commentary. In other parts of the assignment you can elaborate on sounds that you had trouble distinguishing, etc.

Airstream Mechanisms

TYPES OF AIRFLOW AND CORRESPONDING SPEECH
SOUNDS

READ LADEFOGED & JOHNSON, CHAPTER 6

adapted from slides by Richard Wright, Dan McCloy, and Valerie Freeman

Types of Airflow

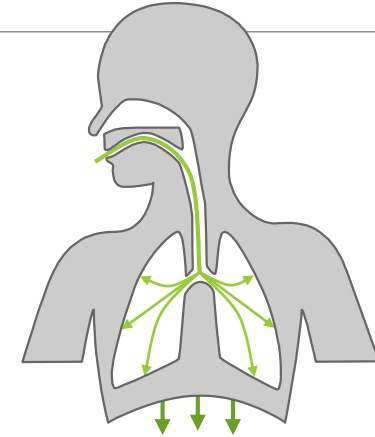
All speech sounds are vibrations in the air, and require airflow for their production. There are many ways to move air into or out of the vocal tract.

- The *pulmonic* airstream mechanism uses the lungs to create airflow.
- The *glottalic* airstream mechanism uses the up-and-down movement of the glottis to compress or rarefy the air trapped in the vocal tract between the closed glottis and an oral closure.
- The *velaric* airstream mechanism uses the tongue to compress or rarefy air trapped in the vocal tract (usually between the tongue and the hard palate).
- *Egressive* airflow is air moving out of the vocal tract, while *ingressive* airflow is air moving into the vocal tract.

The Pulmonic Airstream Mechanism

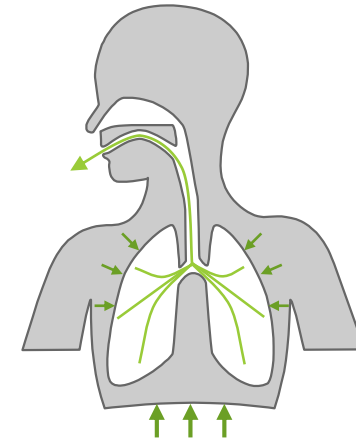
Inhalation

- The diaphragm flexes down, creating an area of low pressure in the lungs.
- The lungs passively expand as air moves in through the vocal tract.
- The ribcage expands to accommodate the lungs' expansion.



Exhalation

- The diaphragm relaxes upwards.
- Abdominal muscles push the diaphragm from below and the intercostal (ribcage) muscles pull the ribcage in and down, squeezing air out of the lungs through the vocal tract.



Pulmonic Sounds

Pulmonic egressive sounds

- All human languages have pulmonic egressive sounds.
- All vowels, glides, and nasals are made via the pulmonic egressive airstream mechanism.
- In many languages (e.g., English) *all* speech sounds are pulmonic egressives.

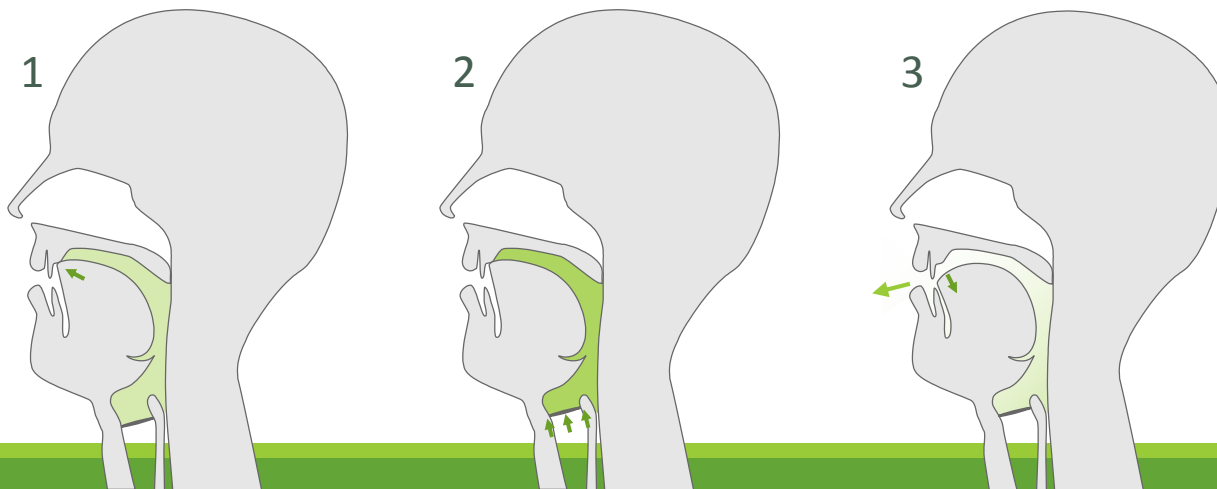
Pulmonic ingressive sounds

- Pulmonic ingressive sounds are not phonemic in any known language, though in some cultures ingressive sounds are used for paralinguistic purposes (e.g., expressing shock in English).

The Glottalic Airstream Mechanism

Glottalic egressive sounds (ejectives)

- Air trapped between the glottis and an oral closure is *compressed* by *raising* the larynx.
- When the oral closure is released, a burst of compressed air exits the oral cavity, generating the speech sound.
- All ejectives are voiceless, and are transcribed with a diacritic added to the symbol for the corresponding pulmonic voiceless consonant: / p' t' k' /



Quechua

Plain

“tongue”

[gaɭu]



“bridge”

[tʃaka]



Aspirated

“shawl store”

[qʰaɭu]



“large ant”

[tʃʰaka]



Ejective

“tomato sauce”

[qʼaɭu]



“hoarse”

[tʃʼaka]



<http://archive.phonetics.ucla.edu/>

More Ejective Examples

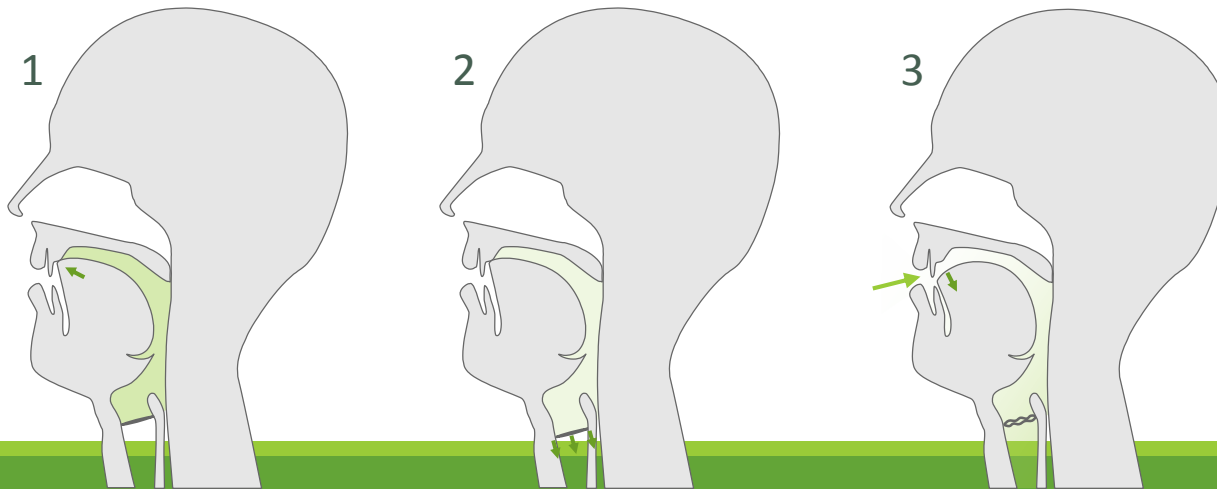
<http://corpus.linguistics.berkeley.edu/acip/course/chapter6/hausa/hausa.html>

<http://corpus.linguistics.berkeley.edu/acip/course/chapter6/lakhota/lakhota.html>

The Glottalic Airstream Mechanism

Glottalic ingressive sounds (implosives)

- Air trapped between the glottis and an oral closure is *rarefied* by *lowering* the larynx.
- Implosives are almost always voiced; usually voicing happens as the larynx moves down. In such cases rarefaction is slight because air flows through the glottis as the vocal folds vibrate.
- Implosives are transcribed like their voiced pulmonic stop equivalents but with a right-pointing upper hook: / b̥ d̥ g̥ /



Sindhi

Aspirated “snake hood”	[pʰaŋu]	
Voiceless “leaf”	[panu]	
Voiced “forest”	[banu]	
Implosive “field”	[bani]	

More Implosive Examples

<http://corpus.linguistics.berkeley.edu/acip/course/chapter6/sindhi/sinhi.html>

The Velaric Airstream Mechanism

Velaric ingressive sounds (clicks)

- Uses rarefaction of trapped air between velar and anterior closures (labial, dental, alveolar, palatal) to create speech sounds.
- Clicks can be voiced, voiceless, aspirated, unaspirated, nasal, oral, and may be accompanied by a variety of secondary articulations (e.g., lip rounding).
- Examples: / ǀ ǂ ǃ Ǆ /


!Xóõ

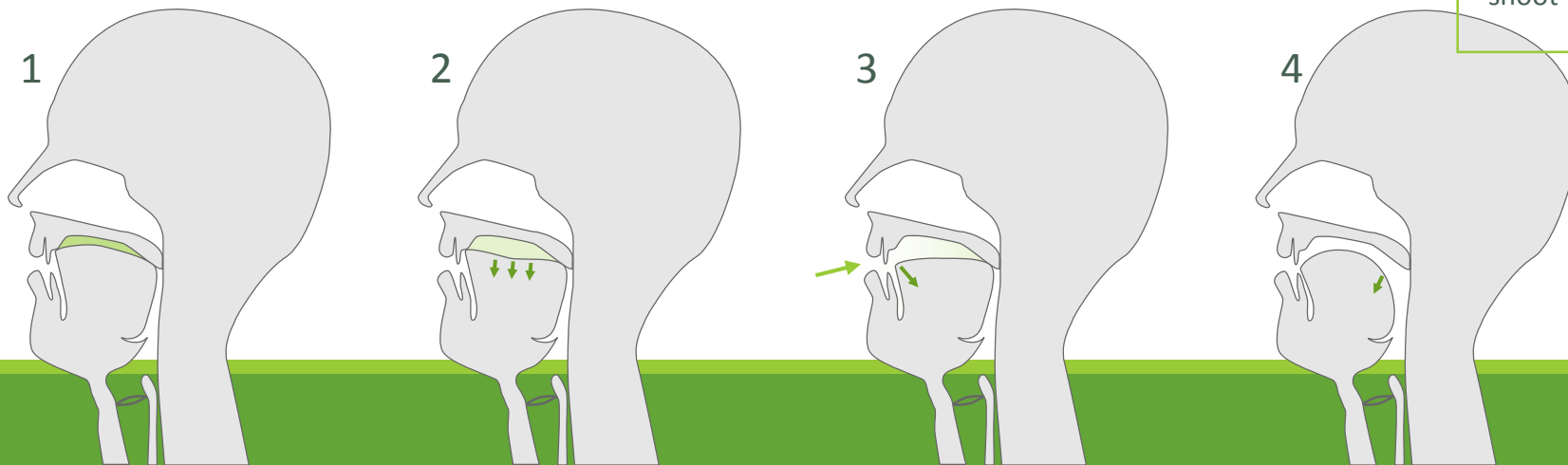
Bilabial
“get stuck”  [kǀʔǝo]

Dental
“die”  [kǀʔǝa]

Alveolar
“be seated”  [kǀʔǝã]

Alveolar Lateral
“not to be”  [kǀʔǝa]

Palatal
“shoot you”  [kǀʔǝa]



<http://archive.phonetics.ucla.edu/>

Transcribing Clicks

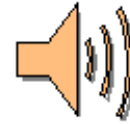
Some recent research suggests that many clicks are made with a uvular constriction rather than a velar one. Because of this, some phoneticians prefer the term “lingual ingressive” rather than “velaric ingressive” to describe the airstream mechanism.

Note that, though not an official IPA symbol, occasionally you may see the anterior portion of the dental click transcribed as [ɽ] instead of [ǀ], especially in cases where it helps to avoid confusion with the prosodic marker [ː].

Name That Click! (Zulu)

“a conversation”

ín̥'ŋ||o:k||o



nasal lateral; voiceless lateral

“to make clear”

'k|à:k|á



voiceless dental

“to pound”

'g||o:bá



voiced lateral

“to undo”

k!ák!á



voiceless alveolar

“to be loose”

'k||è:gá



voiceless lateral

More Click Examples

<http://corpus.linguistics.berkeley.edu/acip/course/chapter6/zulu/zulu.html>

<http://corpus.linguistics.berkeley.edu/acip/course/chapter6/nama/nama.html>

Phonation

STATES OF THE GLOTTIS AND VOICE ONSET TIME

READ LADEFOGED & JOHNSON, CHAPTER 6

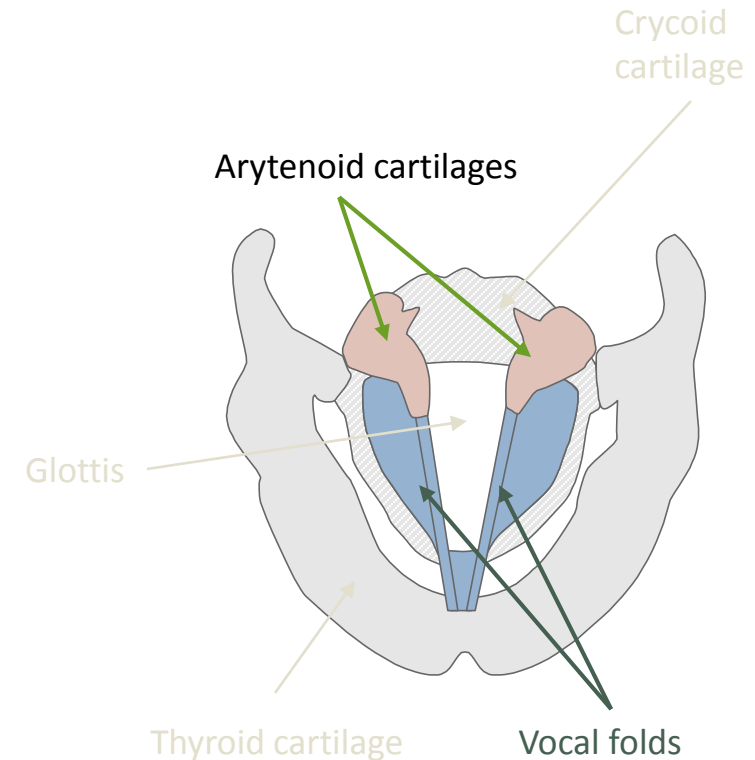
adapted from slides by Richard Wright, Dan McCloy, and Valerie Freeman

Anatomy of the Larynx

The *vocal folds* are drawn together or apart by the movement of the *arytenoid cartilages*.

The *glottis* is the space between the vocal folds through which air passes.

The position of the vocal folds at right corresponds to a *voiceless* sound.



Breathy Phonation

Transcription of breathy sounds:

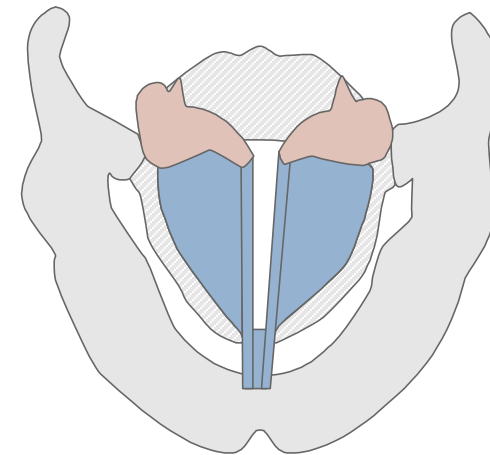
- “Breathy h” has its own symbol: [h]
- Other breathy sounds are transcribed with a diacritic:
[e̤ z̤ ɲ̤ ɖ̤ ɭ̤]
- Breathy stops (but only stops) can be transcribed with a superscript diacritic instead: [d^h]
- Some authors use the aspiration symbol with voiced stops to indicate breathy voicing (e.g., [d^h]). This is not compliant with IPA standards and should not be done.

Mazatec

Modal
“for a while” [t^hæ] 

Breathy
“horse” [ˈdæ̤] 

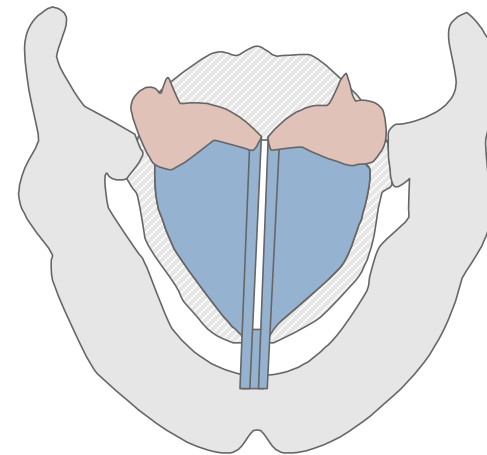
<http://archive.phonetics.ucla.edu/>



Modal Phonation

Normal voice (modal)

- Vocal folds are held closely together and vibrate regularly along their full length, creating moments of full closure alternating with moments of airflow.
- Unlike breathy sounds, there is no accompanying [h]-like sound in modal voicing.
- Examples:
[b d g m n ŋ v z ʒ w ɹ l i u ə]



Creaky Phonation

Creaky voice (laryngealization)

- The vocal folds are held tightly together, such that they vibrate irregularly and only at the thyroid end, along roughly half their length.
- Any sound that can be voiced can have creaky voicing.

Transcription of creaky sounds:

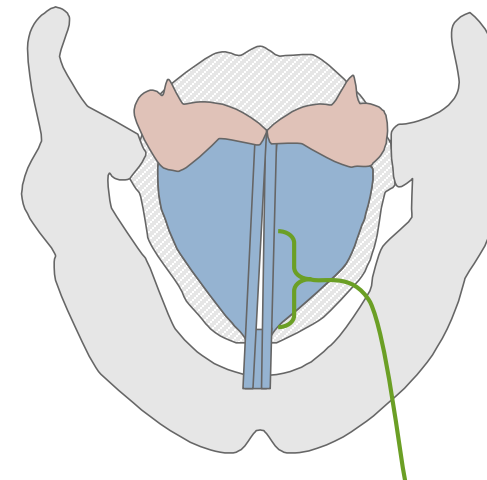
- All creaky voiced sounds are transcribed with the same diacritic (an under-tilde).
- Examples: / d̰ n̰ z̰ l̰ w̰ ḛ /

Mazatec

Modal
“for a while” [tʰæ̰] 

Creaky
“becomes” [næ̰] 

<http://archive.phonetics.ucla.edu/>



Area of vibration

The Open Quotient

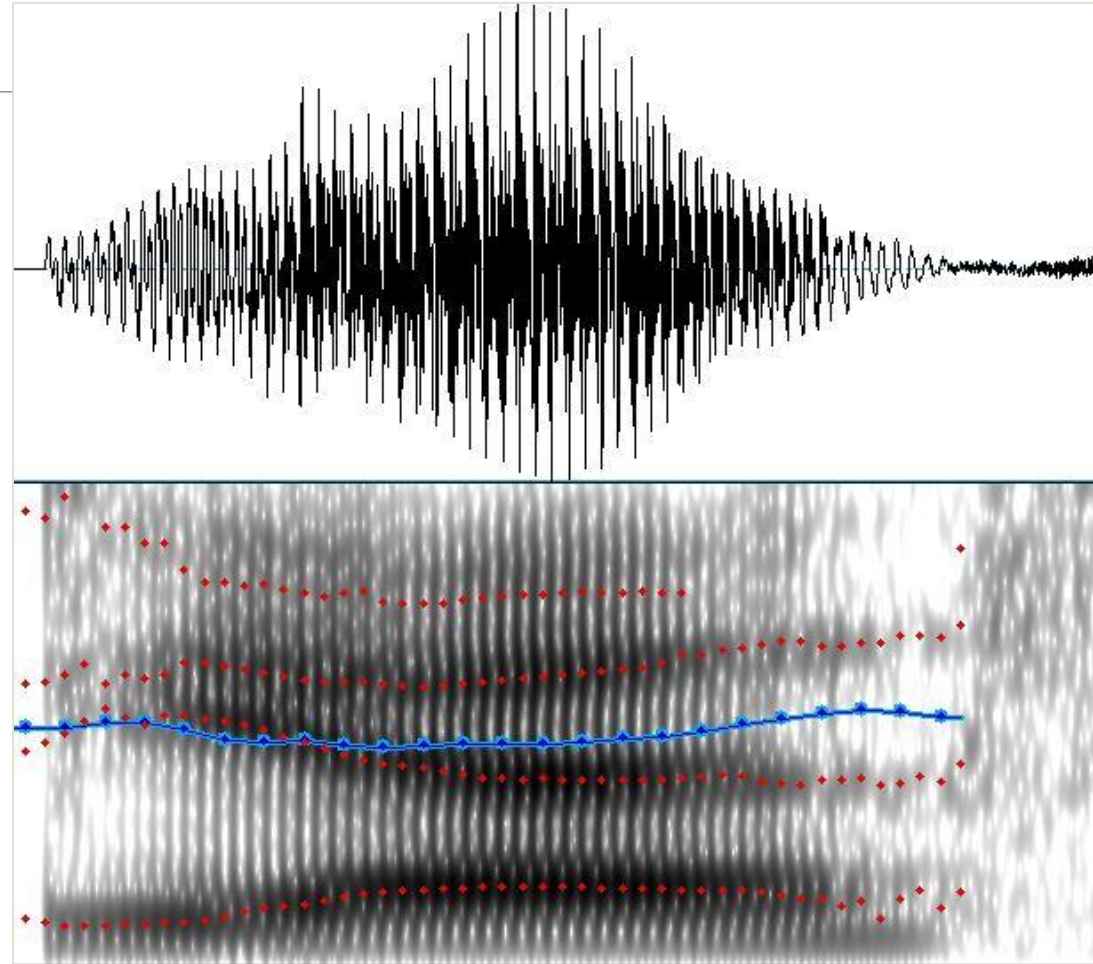
One way to think about the different phonation types is to consider the percentage of time the vocal folds are open during a given vibrational cycle.

- In voiceless articulations, the vocal folds are open 100% of the time.
- In breathy articulations, the vocal folds are open 66% of the time.
- In modal articulations, the vocal folds are open 50% of the time.
- In creaky articulations, the vocal folds are open 33% of the time.

Modal Phonation Example

Modal voicing on a spectrogram:

- Regular spacing between pulses (space = silence = vocal folds are closed about half the time)
- Pitch (blue line) and formants (red dots) track well

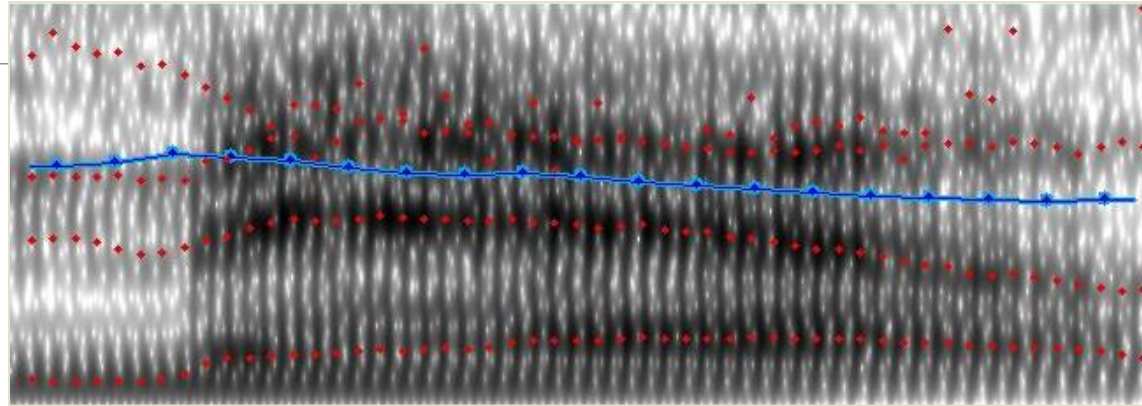


[ɛ] in “yes” said by PNW female

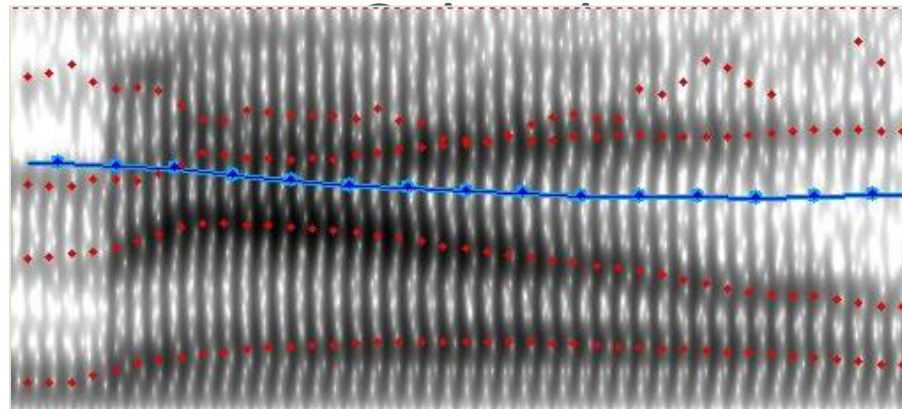
Breathy Phonation Example

Breathy voicing on a spectrogram:

- Pulses closer together than for **modal**, spaces less clear (less space = vocal folds are closed less of the time)
- Pitch (blue line) and formants (red dots) track well for both



Breathy: [mɛl] 'palace' in

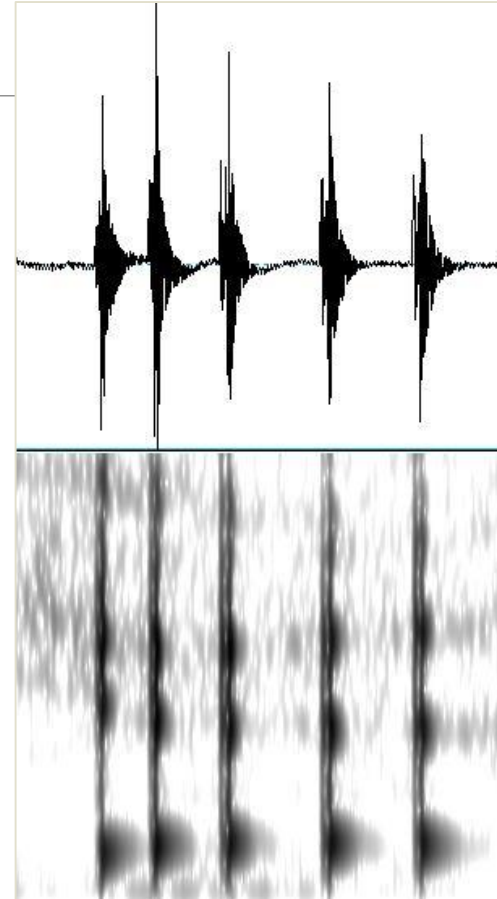


Modal: [mɛl] 'dirt' in Gujarati

Creaky Phonation Example

Creaky voicing on a spectrogram:

- Sharp spikes (glottal pulses) in waveform
- Wide, irregular spacing between pulses (space = folds are closed)
- Often causes errors in pitch tracking, sometimes formant tracking (not shown)



[ɣ] in “yes” said by PNW female

(extremely creaky)

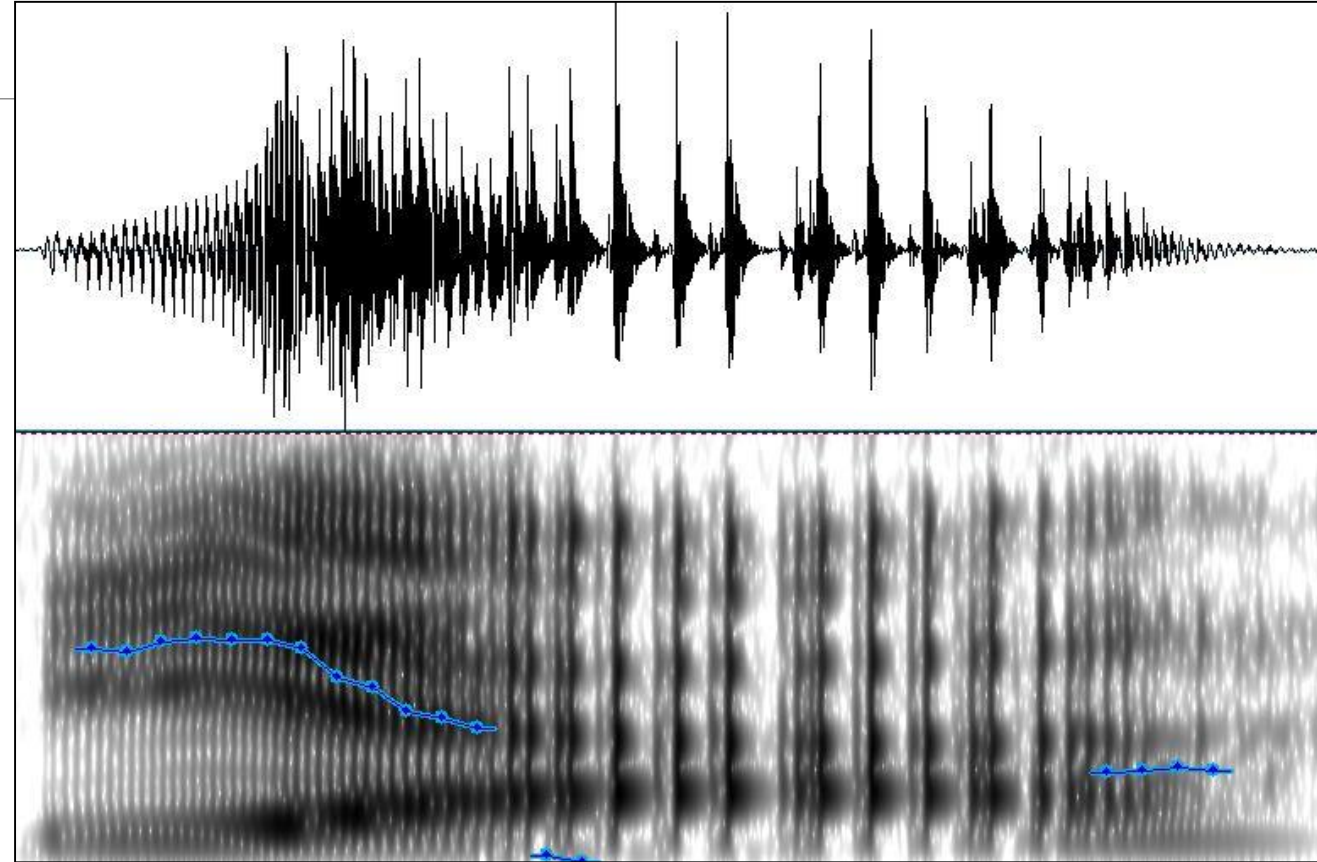
Modal and Creaky Phonation Examples

Spacing between pulses:

- Even
- Wide, irregular

Pitch tracking:

- Working
- Lost



moda

creak

|

y

[jɛə] “yeah” said by PNW female

Vocal Fry

“Vocal fry” is basically another term for creaky voice.

- http://www.youtube.com/watch?v=s_LmC-ynqGM

Creaky Voice in the Media.

- <https://www.youtube.com/watch?v=UuAQsnAVoMw>
- <http://www.thisamericanlife.org/radio-archives/episode/545/if-you-dont-have-anything-nice-to-say-say-it-in-all-caps?act=2>
- <http://jezebel.com/heres-audio-proof-that-dudes-can-have-vocal-fry-too-1719483363>

The media generally does not acknowledge that some languages build it into their sound systems.

Reminders

- VOT, LAB 2 Monday
- Read L&J Ch 6
- Lab 1 due 11/4