

Airstream
mechanisms

Phonation

Obstruents

Fricatives

Stops

References

Phonations, Obstruents

G. Moroz

12 March, 2020

Previously

- Waves, Fourier transform, Tube model
- Vowels
- Sonorants

Airstream
mechanisms

Phonation

Obstruents

Fricatives

Stops

References

Previously

- Waves, Fourier transform, Tube model
- Vowels
- Sonorants

Today we are going to talk about

- Airostream mechanisms
- Phonations
- Obstruents

Airstream
mechanisms

Phonation

Obstruents

Fricatives

Stops

References

Airstream mechanisms

Airstream
mechanisms

Phonation

Obstruents

Fricatives

Stops

References

| | egressive | ingressive |
|-----------|--------------------|------------|
| pulmonic | majority of sounds | rare |
| glottalic | ejectives | implosives |
| velaric | | clicks |

Here is some MRI video.

Phonation types

Airstream
mechanisms

Phonation

Obstruents

Fricatives

Stops

References

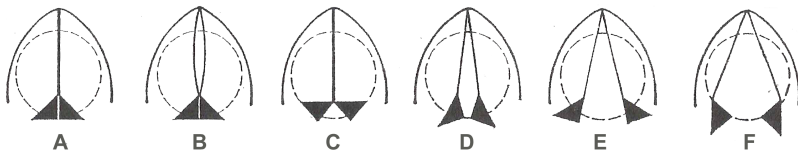
Modal voice — the vocal folds are closed during half of each glottal cycle and open during the other half (approximately). Thus, the proportion of time that the glottis is open (the open quotient) during each cycle is 0.5.

Creaky voice — the vocal folds are held together loosely, and air bubbles up through them. This causes longer closed phase of the glottal period and a comparably shorter open phase (and thus a smaller open quotient).

Breathy voice — the vocal folds vibrate, but without much contact (for some people the vocal folds do not completely close during breathy voicing). So the glottis is open for a relatively long portion of each glottal cycle.

A device called an artificial larynx is often used as a prosthesis for patients who have had their larynx removed due to disease.

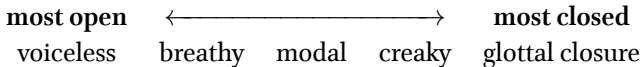
Phonation types



- A** the closed vocal folds produce a **glottal stop** ʔ
- B** the air forced through the closed vocal folds produce **creaky voice**
- C** air can go through vocal folds without extra pressure, making them vibrate, this is called **modal voice**
- D** high rate of airflow makes vocal folds vibrate even if they are slightly pulled apart (**breathy voice**)
- E** pulling the vocal folds further apart doesn't allow them to vibrate, the result is a **voiceless sound**
- F** pull the vocal fold further apart, this is called **aspiration**

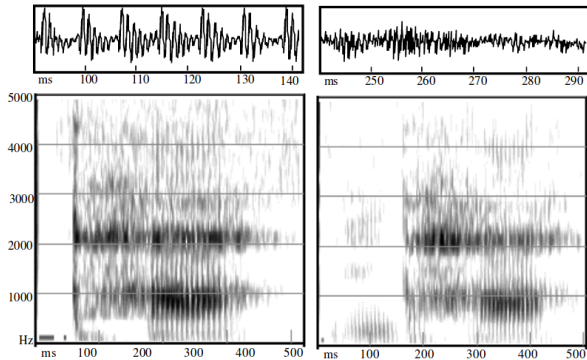
Phonation types

In [Ladefoged 1971] it is suggested that there might be a continuum of phonation types:



Phonation types

As a consequence of noise in breathy phonation, there is much more aperiodic energy across the spectrum and the formant structure is less clear [Gordon and Ladefoged 2001]



Spectrograms of modal and breathy voiced nasals in the Jalapa Mazatec words /nt^hæ/ 'seed' and /ndæ/ 'horse' (female speaker)

presentation is available: <https://tinyurl.com/u25j79m>

Phonation types

Airstream
mechanisms

Phonation

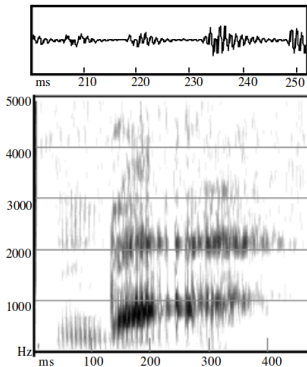
Obstruents

Fricatives

Stops

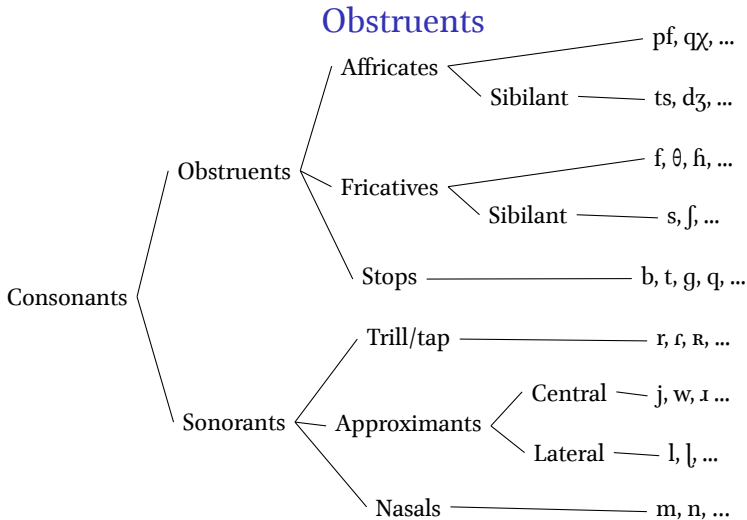
References

Creaky phonation is characterized with irregular glottal periods (jitter) but with clear formant structure. As a consequence of this irregularity, F_0 is not (usually) calculated so accurately.



Spectrograms of modal and breathy voiced nasals in the Jalapa Mazatec word /ndáé/ 'horse' (female speaker)

presentation is available: <https://tinyurl.com/u25j79m>



For obstruents the articulators form constrictions and occlusions within the vocal tract that generate **aperiodic noise** as the airflow passes through obstructions: much more restricted airflow;

acoustically, little or no of formant structure

Turbulence

Airstream
mechanisms

Phonation

Obstruents

Fricatives

Stops

References

The main factors that determine whether airflow is turbulent:

- the size of the channel and
- the volume velocity of the airflow (volume of air going past a certain point per unit time).

If 100 cm^3 per second of air flows through a channel, turbulent airflow is created if the channel area is less than 10 mm^2 , but not if the channel area is 20 mm^2 . It's easier to get turbulent airflow from a narrow straw than a wide one

Fricatives

Airstream
mechanisms

Phonation

Obstruents

Fricatives

Stops

References

- sibilant are most intensive fricatives vs. non-sibilant
- for sibilants
 - the constriction between the alveolar ridge, or in the postalveolar area and the tip of the tongue, or the blade of the tongue
 - a second constriction between the upper and lower incisors must be narrow so that the airstream is directed over the edges of the teeth, creating turbulent airflow behind the teeth
- for non-sibilants noise is not so prominent, hardly audible

Fricatives

Airstream
mechanisms

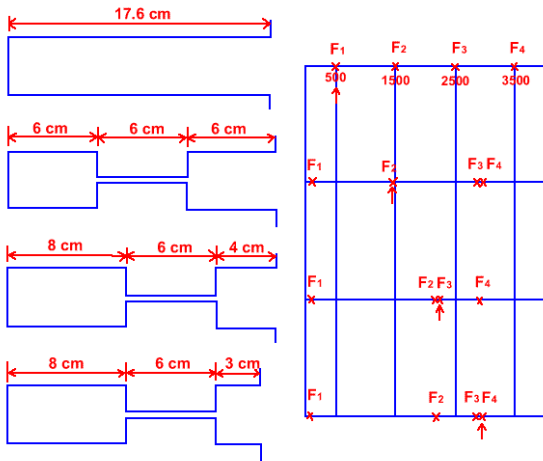
Phonation

Obstruents

Fricatives

Stops

References



This diagram shows the results for some models of velar and palatal consonants compared to a single tube model of a neutral vowel. (adapted from [Fant 1960: 73])

Stops

- The main articulatory posture during a stop is complete closure of the vocal tract, acoustically silence.
- However, languages use a great variety of stops, utilizing different places of articulation, stop release sounds, and accompanying noises

Airstream
mechanisms

Phonation

Obstruents

Fricatives

Stops

References

Airstream
mechanisms

Phonation

Obstruents

Fricatives

Stops

References

Thank you!

Please, don't hesitate to write me
agricolamz@gmail.com

Reference

Airstream
mechanisms

Phonation

Obstruents

Fricatives

Stops

References

Fant, G. (1960). Acoustic Theory of Speech Production. Mouton: The Hague.

Gordon, M. and P. Ladefoged (2001). Phonation types: a cross-linguistic overview.
Journal of Phonetics 29(4), 383–406.

Ladefoged, P. (1971). Preliminaries to linguistic phonetics. University of Chicago Press.