Stops & Affricates

From UW Phonetics/Sociolinguistics Lab Wiki

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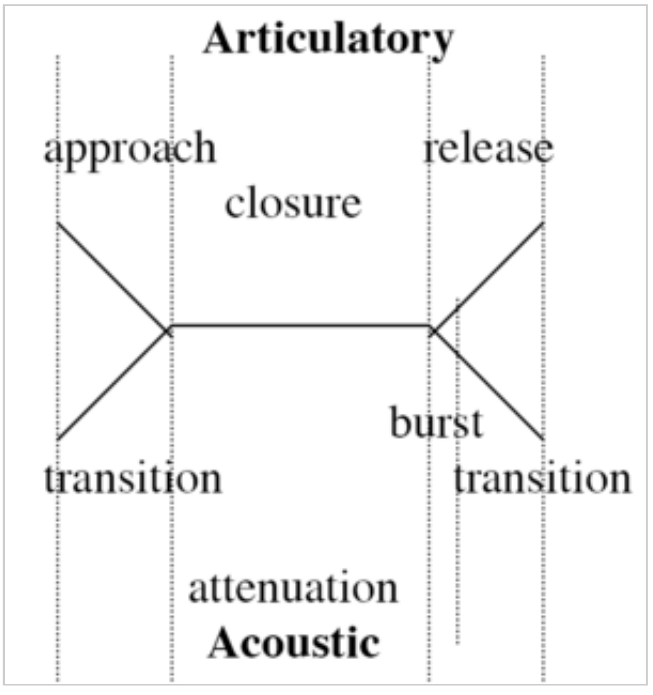
Contents

Intro

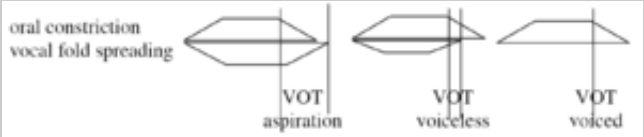
Stops are dynamic: their description can be broken down into 3 articulatory events (approach, closure, release) that result in at least 4 acoustic events (closure transition, closure attenuation, release burst, release transition).



Schematic of articulatory and acoustic events in stops

Contrast

Like other speech sounds stops involve a coordination of laryngeal and oral articulations. The most common contrast in stops is a two way one that involves either voiced-voiceless stops or aspirated-unaspirated stops. Voicing and aspiration contrasts can be measured in terms of voice onset time (VOT). VOT is determined by the coordination of the laryngeal and oral articulations.



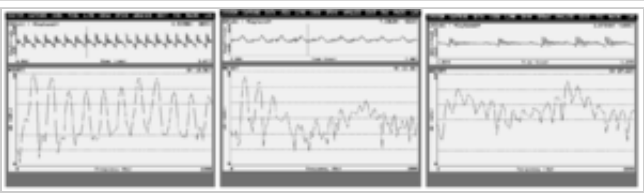
Schematic of VOT and oral/laryngeal coordination

Phonation

In voiced stops there are three major types of phonation: creaky, breathy, and modal. Modal voicing in which the vocal folds are open the same amount of time as they are closed is the most common type. In creaky voicing the vocal folds are open for a shorter time than they are closed. In breath voicing they are open for a longer time than they are closed. The open to closed ratio is called an open quotient (oq). Johnson gives the following numbers for phonation types: modal oq .5, creaky oq .3, breathy oq .65.

Energy

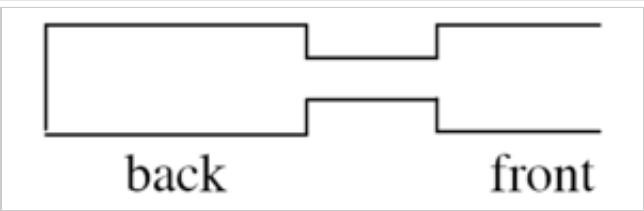
The shape of the wave determines the distribution of energy in the harmonics: the more sinusiodal the more energy in the first harmonic (H1), the more damped, the more energy in the higher frequencies.



Waveforms and spectra of modal, breathy and creaky voicing in the vowel /a/

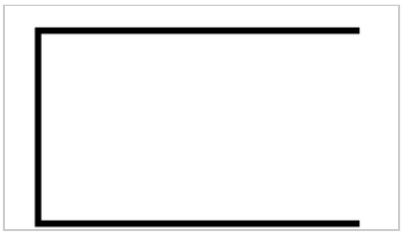
Source and filter in stops

During the approach and release phases the vocal tract is obstructed. Therefore, there is front and back cavity coupling resulting in vowel-like formant transitions with the vocal fold vibration (or aspiration noise) as the source.



Tube model for closure and release transitions in stops

During the closure any sound that is being generated at the larynx emanates through the walls of the vocal tract. Therefore only the lowest frequencies are present in the signal. Because of pressure buildup during closure voicing can continue for only a short time unless there is larynx lowering. At the release, there is a brief period when the narrow constriction generates turbulence. The result is a release burst (transient). Its source is in front of the point of constriction. Therefore, it is modeled like fricatives: the cavity in front of the stop determines the spectrum of the noise.



Tube model for release burst in stops

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