

Fricatives

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Intro

Like vowels, fricatives can be modeled using source filter theory.

- source = frication noise generated by turbulence
- filter = the oral cavity in front of the fricative constriction

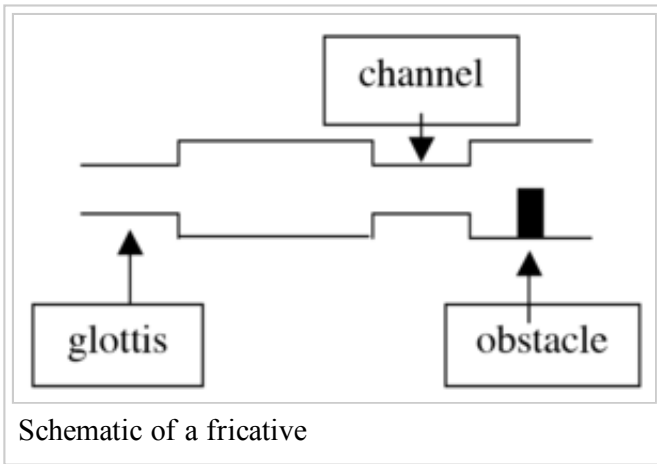
Acoustic Characteristics

Turbulence is chaotic movement (of air particles in this case). It's amplitude is determined by the velocity of the air particles (higher particle velocity = higher amplitude noise). The irregularity of the movement generates (quasi) random noise which has energy distributed equally in all frequencies (flat spectrum).

Turbulence

Two types:

- Channel turbulence — Air particles moving through a narrowing (channel) in the vocal tract increase in particle velocity. As they exit the channel they strike the relatively inert air at the end of the channel and their movement becomes chaotic and they generate aperiodic energy at a distance beyond the channel exit. If volume velocity remains constant, narrowing a channel (fricative constriction) causes air particle velocity to increase.
- Obstacle turbulence — When a jet of air hits a downstream obstacle the air particles are set into turbulent motion. Most aperiodic speech sounds can be argued to be generated by obstacle turbulence. Wall turbulence is generated when a jet of air is shot against one of the vocal tract walls (as in the velar fricative /x/).



Articulatory Characteristics

The vocal tract in front of the fricative is largely responsible for the spectral shape of the resulting fricative. Fricatives tend to have a much narrower constriction than vowels and therefore acoustic coupling accounts for only a small part of the noise spectrum.

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