Fricatives and Affricates

• The class of fricatives most clearly illustrates how major phonetic categories may be characterized by intersections of articulatory, acoustic and auditory/perceptual criteria.

• The ‘articulatory’ degree of stricture for fricatives - close approximation - is defined by its acoustic consequence (the noise generated by turbulent airflow through a constriction) and the perceptual salience of this noise in the speech sound produced.

* Many thanks to Ian Maddieson who shared his teaching materials with me. These slides are adapted from his with minor changes.
• A major division between two types of fricatives, sibilant and non-sibilant, is also primarily acoustic.

• Sibilants are louder and have higher-pitched noise than non-sibilants. This is because the air is directed at an obstacle - namely, the teeth - after passing through a constriction, and so a second source of turbulence is created.
Symbols for fricatives

**Non-sibilants**

<table>
<thead>
<tr>
<th>Bilabial</th>
<th>Labio-dental</th>
<th>Dental</th>
<th>Palatal</th>
<th>Velar</th>
<th>Uvular</th>
<th>Pharyngeal</th>
</tr>
</thead>
<tbody>
<tr>
<td>φ β f v θ δ</td>
<td>ç ĵ x y χ κ ḥ ꞌ</td>
<td></td>
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**Sibilants**

- Laminal alveolar: S Z
- Laminal post-alveolar: ʃ Z “palato-alveolar”
- Apical post-alveolar: ʂ Z̆ “retroflex”
- Palatalized post-alveolar: Ɂ Z̧ “alveolo-palatal”
Shipibo sibilant fricatives

Alveolar  s  [tsisa]  “freckles”

Laminal post-alveolar  \( \mathbf{\mathfrak{j}} \)  [aʃa]  “frog (sp.)”
  “palato-alveolar”

Apical post-alveolar  s  [ʃana]  “hot”
  “retroflex”
This is a good moment to introduce

**A little basic acoustic terminology**

Three types of actual sound in speech from different sources

1. **Periodic vibration** - by the vocal folds (or sometimes other structures), characterized by repeating cycles of pressure change.

2. **Noise** (in a technical sense) - (partly) random pressure changes in the air, e.g. due to turbulent flow through a narrow constriction or around and obstacle.

3. **Transients** - rapidly decaying sound due to abrupt events.

Plus, 4. **Silence** - not a sound, of course, but a separator.
More than one sound source may be “active” at given moment, but use of different sources is often sequenced.

For example, an initial stop may consist of silence, a transient, an interval of noise, and then be followed by the onset of periodic sound for a following vowel.

Much can be learned by studying waveforms, which directly represent the pressure changes in the air.

Note that the waveform reflects both the source of any sound generated and the effect of filtering (on which more later).
Beginning of [ta]

Silence → Transient → Noise → Periodic sound

Stop → Vowel
Roughly double amplitude in sibilant fricatives
Voiced fricatives are produced with a combination of separate periodic and noise sources.

Periodic vibration of the vocal folds; noise generated at constriction between lower lip and upper teeth.

But because air flow is slowed by narrowed glottis, flow at constriction may be insufficient to reliably generate perceptible noise.
Symbols for fricatives

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German [fʁauˈçen] “little woman”
Tlingit [xuːts] “black bear”
Tlingit [χik] “puffin”
German [baχ] “stream”
German [buχ] “book”
Morroccan Arabic  (from a 2003 Linguistics 110 paper)

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<td>voiceless</td>
<td>[χali] “uncle”</td>
<td>[ḥalîl] “morning prayer”</td>
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Glottal
[hal] “solution”
Affricates

A stop whose release involves opening the closure to a narrow constriction position (with minimal other changes) often functions as a single unit. These units are called affricates.

Note: All stop releases must pass through a phase where the opening will be appropriate to create turbulent flow. In an affricate this phase is extended, but is typically shorter than for a fricative alone.

Affricates can be transcribed with the symbols for their stop and fricative components. If ambiguous, a ‘tie-bar’ can be used to join the symbols, e.g. English ‘hatchet’ [hætʃɪt] vs ‘hat-shop’ [hætʃæp]