06 Spectrogram Analysis of Thai Speech II

Stop Consonants

- make complete closure in the oral cavity while maintaining the air flow from the lungs
- pressure behind the closure increases
- promptly release the closure (might generate the turbulence noise at the just-released closure → release burst)
- during the beginning of the closure phrase,
  - vocal folds vibrate → voiced
  - vocal folds do not vibrate → voiceless

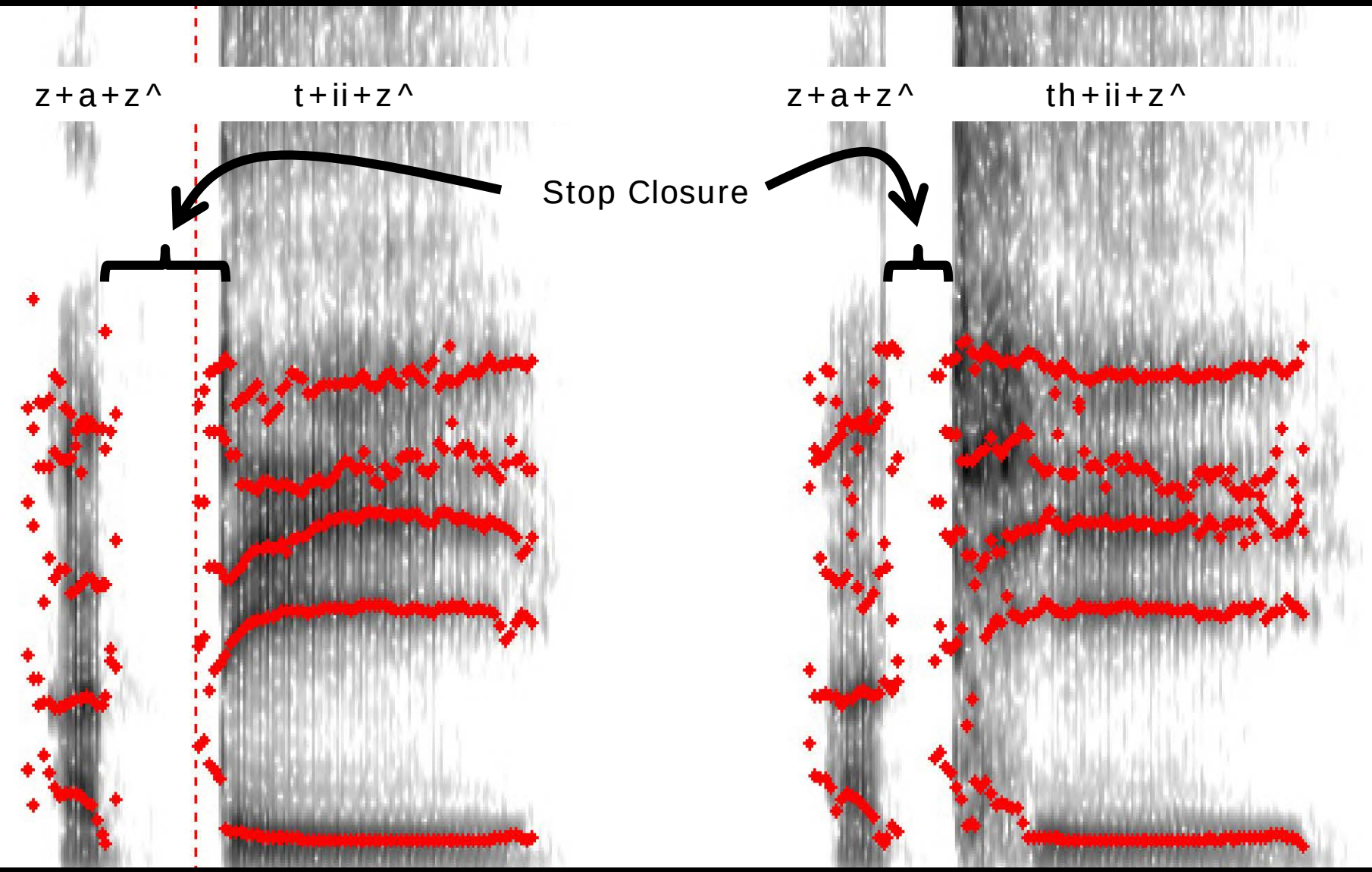
Place of Articulation

- closure can be made at:
  - labial → Labial stop consonant
  - alveolar ridge+tongue tip → Alveolar stop consonant
  - hard palate+tongue body → Velar stop consonant
- The spectral shape of the release burst for labial and alveolar can be explained in the same way as the spectral shape of the fricative consonant.
  - labial fricative → labial stop release burst
  - alveolar fricative → alveolar stop release burst
- For Velar , the portion of the vocal tract in front of the closure gives mid-freq. resonance.

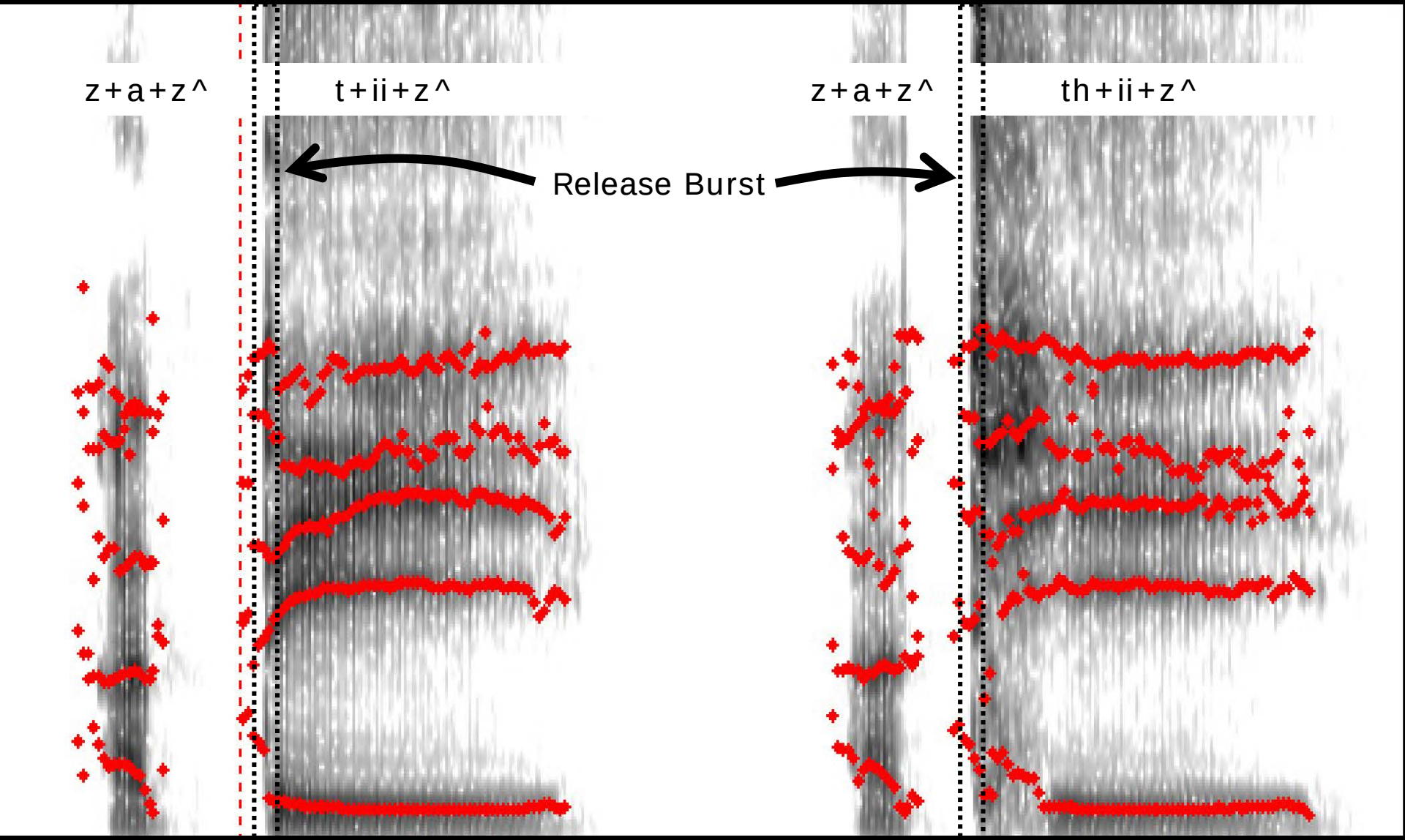
Aspiration

- After the release of the closure of a voiceless stop, if the glottis is widely spread, the air flow rush through the glottis will cause turbulence noise at the glottis.
- spread glottis → aspirated stop consonant
- otherwise → unaspirated stop consonant

Anatomy of Stop Consonants



Anatomy of Stop Consonants



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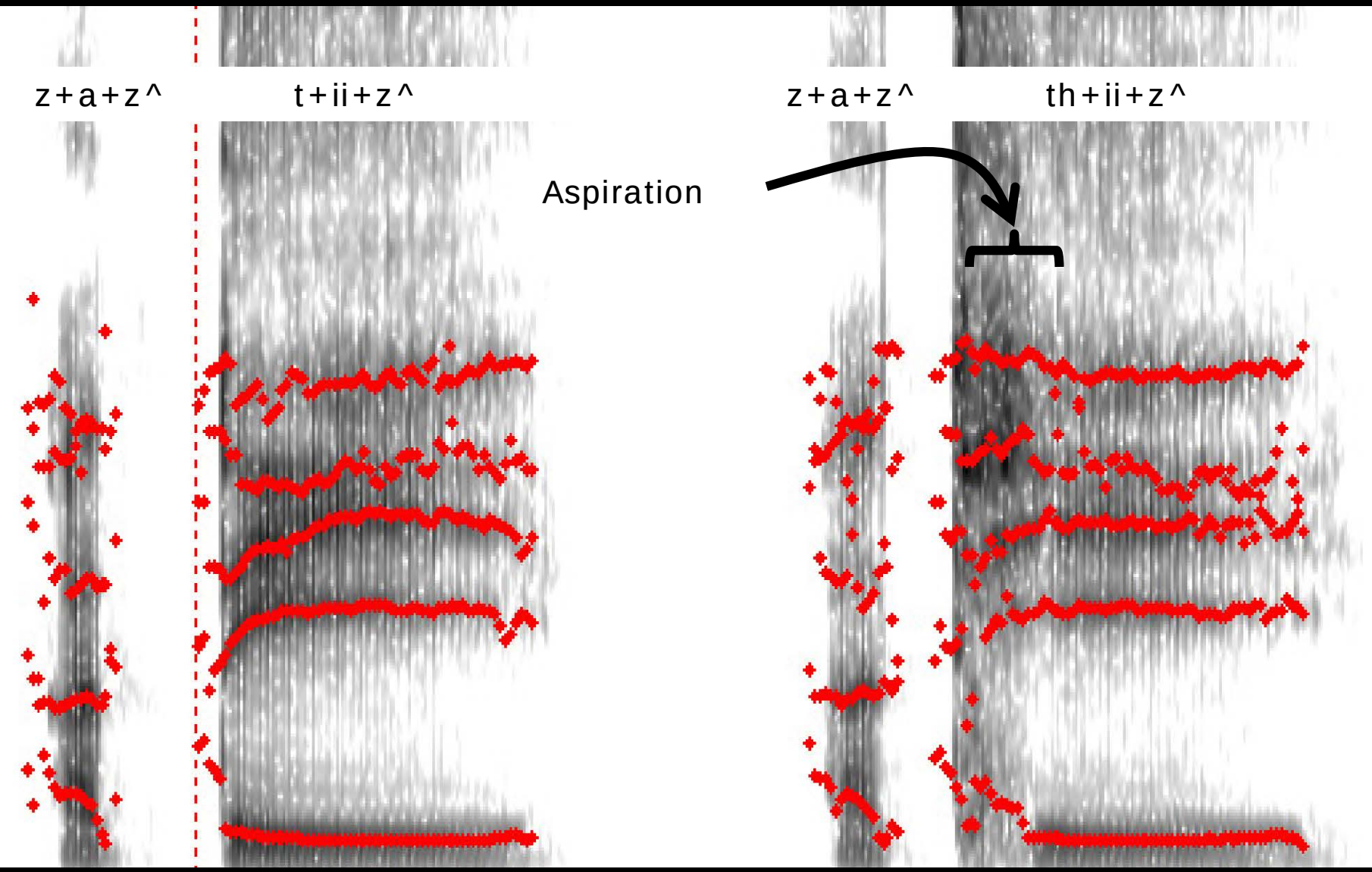


Stop Consonants

voiced labial stop → /b/ in bus, เบา

voiceless unaspirated labial stop → /p/ in spin, ปืน

voiceless aspirated labial stop → /ph/ in pen, พาน

voiced alveolar stop → /d/ in den, เดา

voiceless unaspirated alveolar stop → /t/ in star, ตอน

voiceless aspirated alveolar stop → /th/ in ten, ทาน

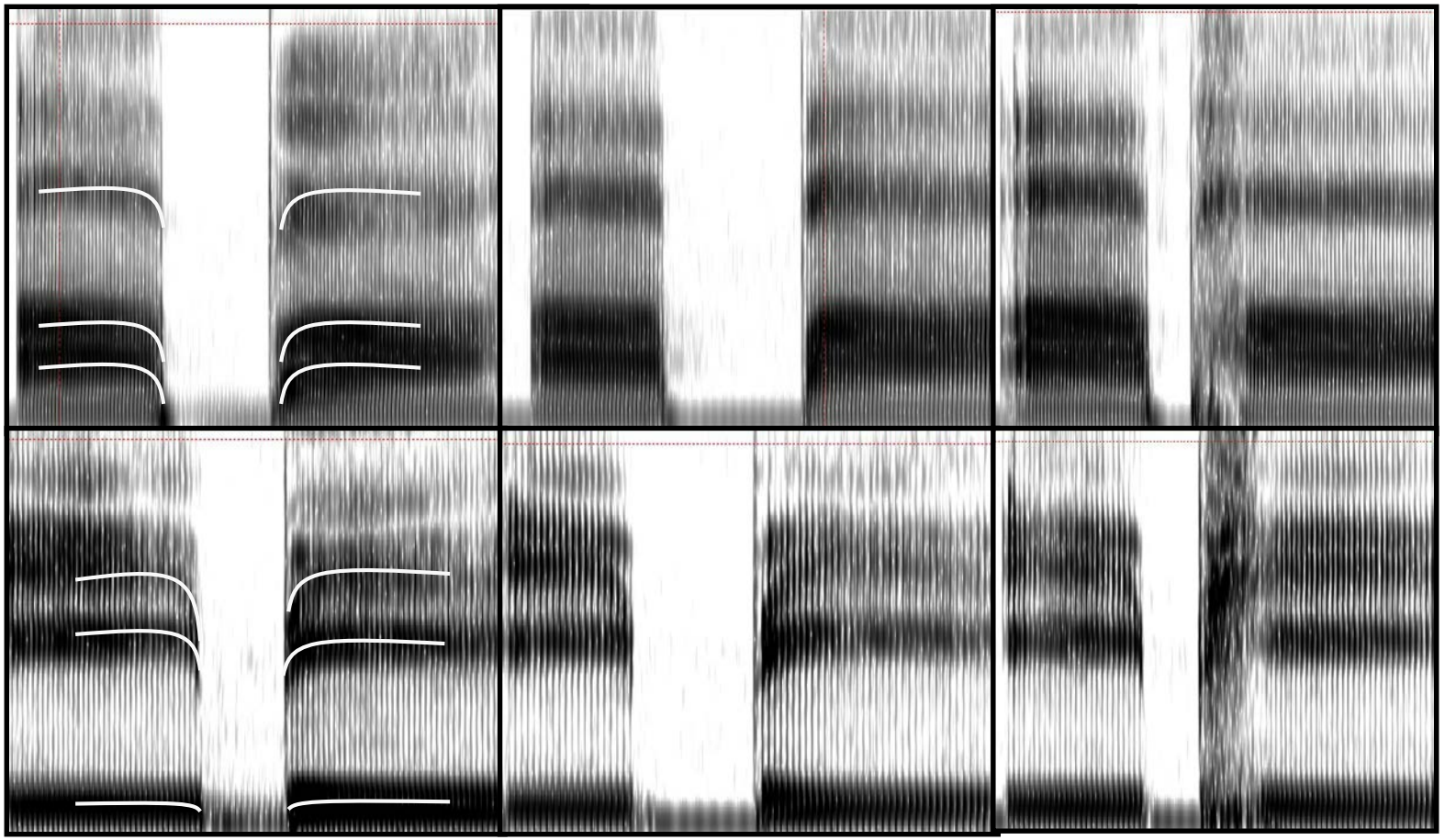
voiced velar stop → /g/ in gun, เกา

voiceless unaspirated velar stop → /k/ in scar

voiceless aspirated velar stop → /kh/ in keep, คาน

Labial Stop Consonants

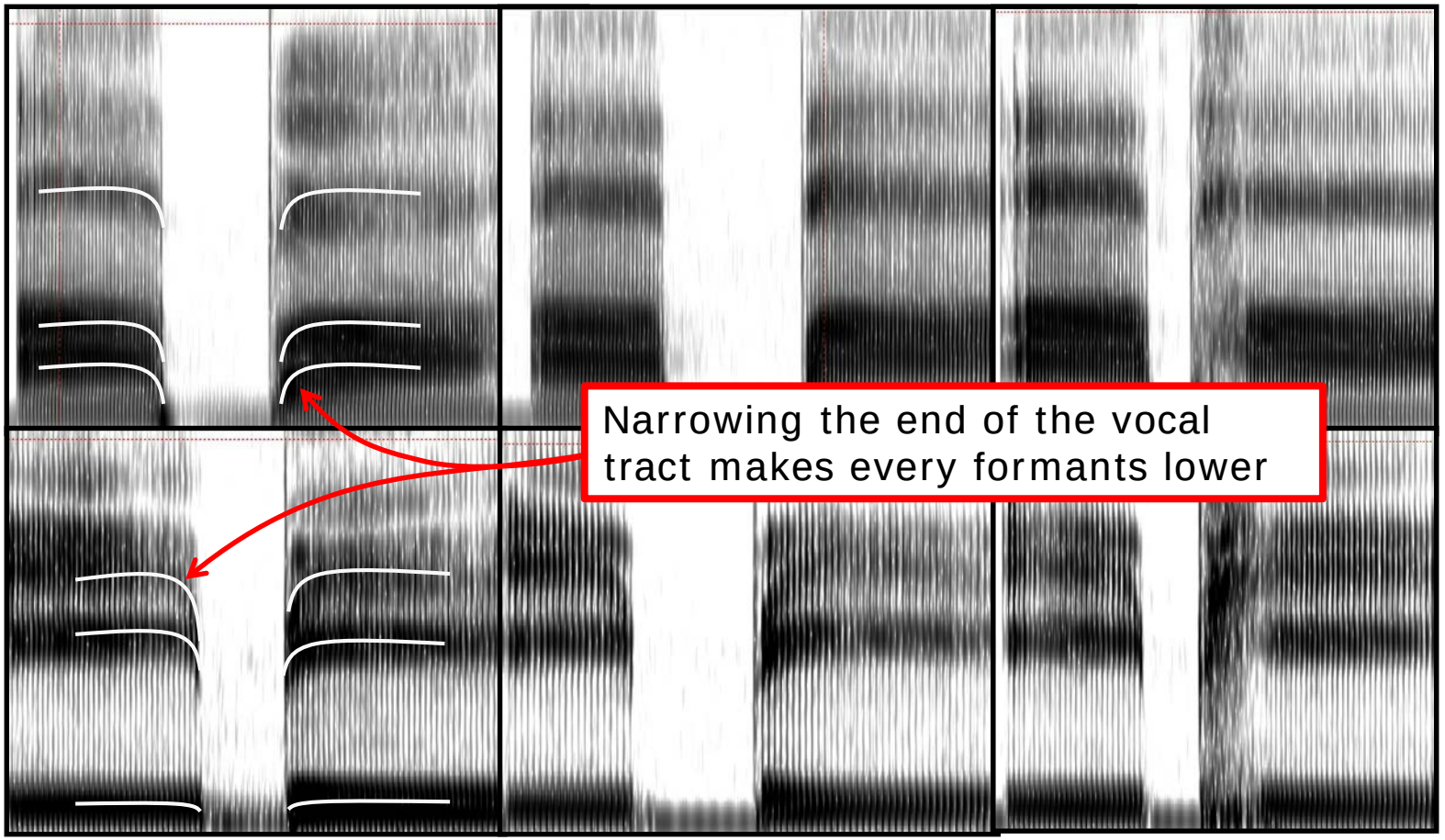
z-aa-z^ **b**-aa-z^ | z-aa-z^ **p**-aa-z^ | z-aa-z^ **ph**-aa-z^



z-ii-z^ **b**-ii-z^ | z-ii-z^ **p**-ii-z^ | z-ii-z^ **ph**-ii-z^

Labial Stop Consonants

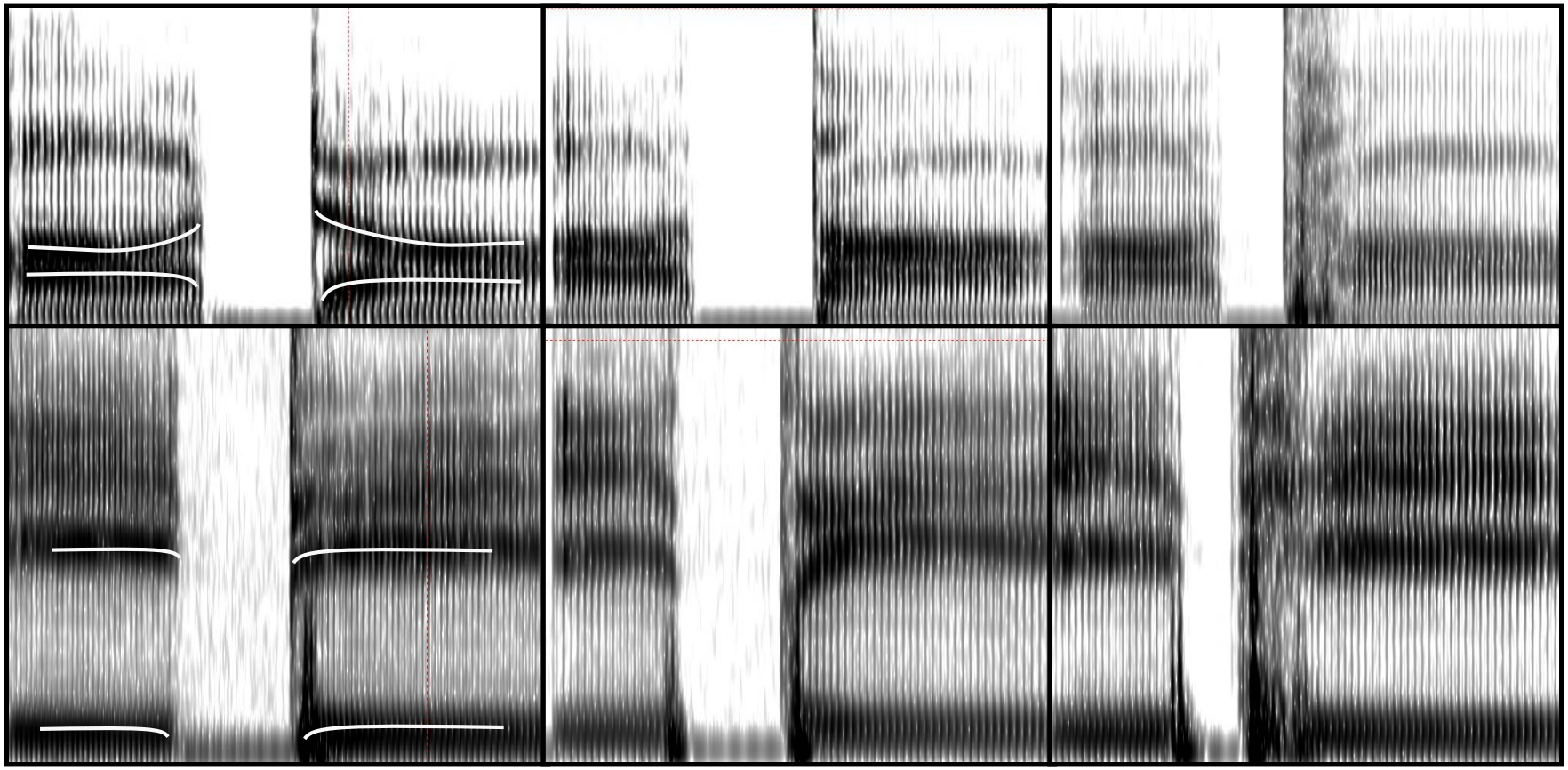
z-aa-z^ **b**-aa-z^ z-aa-z^ **p**-aa-z^ z-aa-z^ **ph**-aa-z^



z-ii-z^ **b**-ii-z^ z-ii-z^ **p**-ii-z^ z-ii-z^ **ph**-ii-z^

Alveolar Stop Consonants

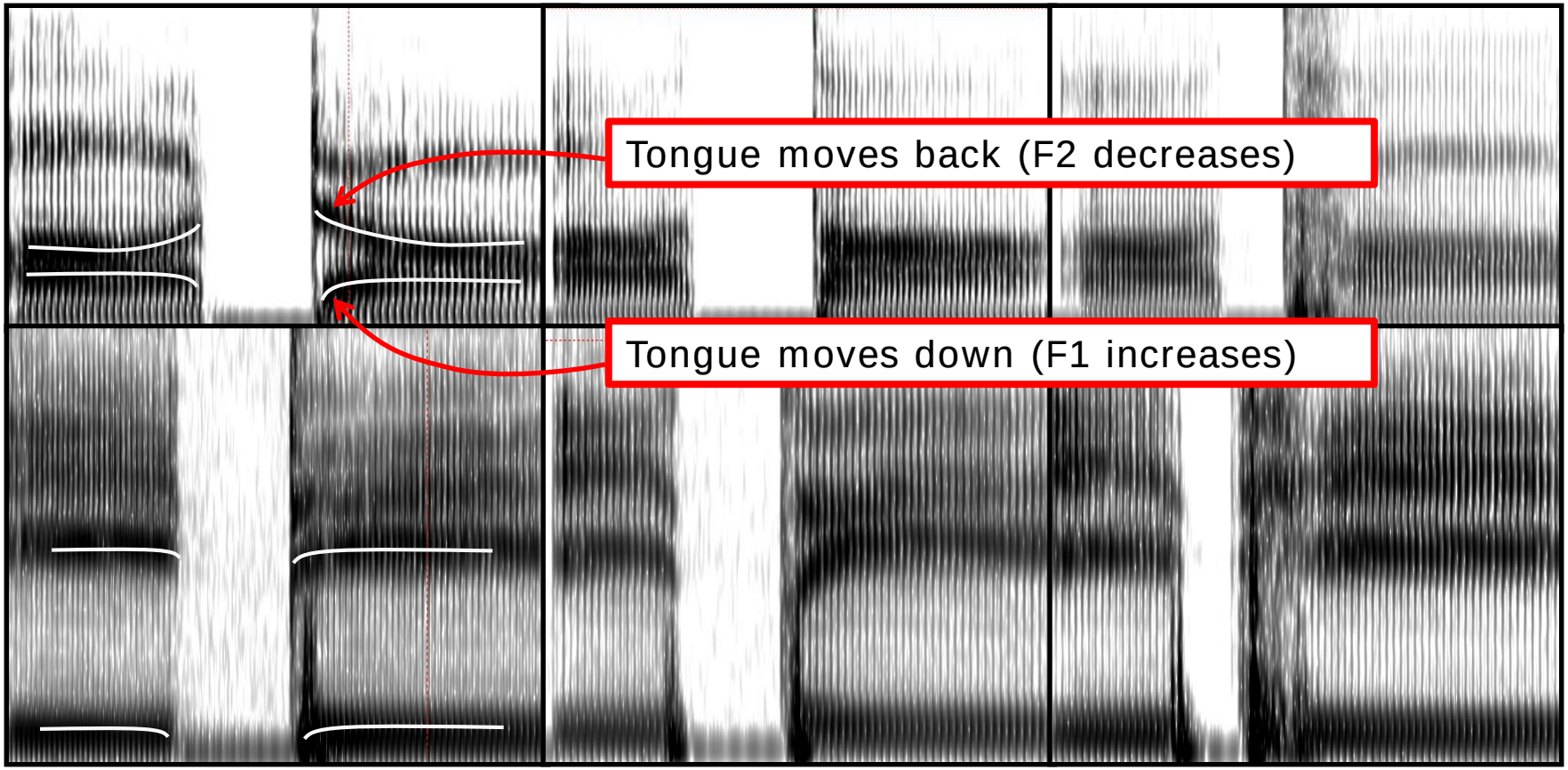
z-aa-z^ **d**-aa-z^ | z-aa-z^ **t**-aa-z^ | z-aa-z^ **th**-aa-z^



z-ii-z^ **d**-ii-z^ | z-ii-z^ **t**-ii-z^ | z-ii-z^ **th**-ii-z^

Alveolar Stop Consonants

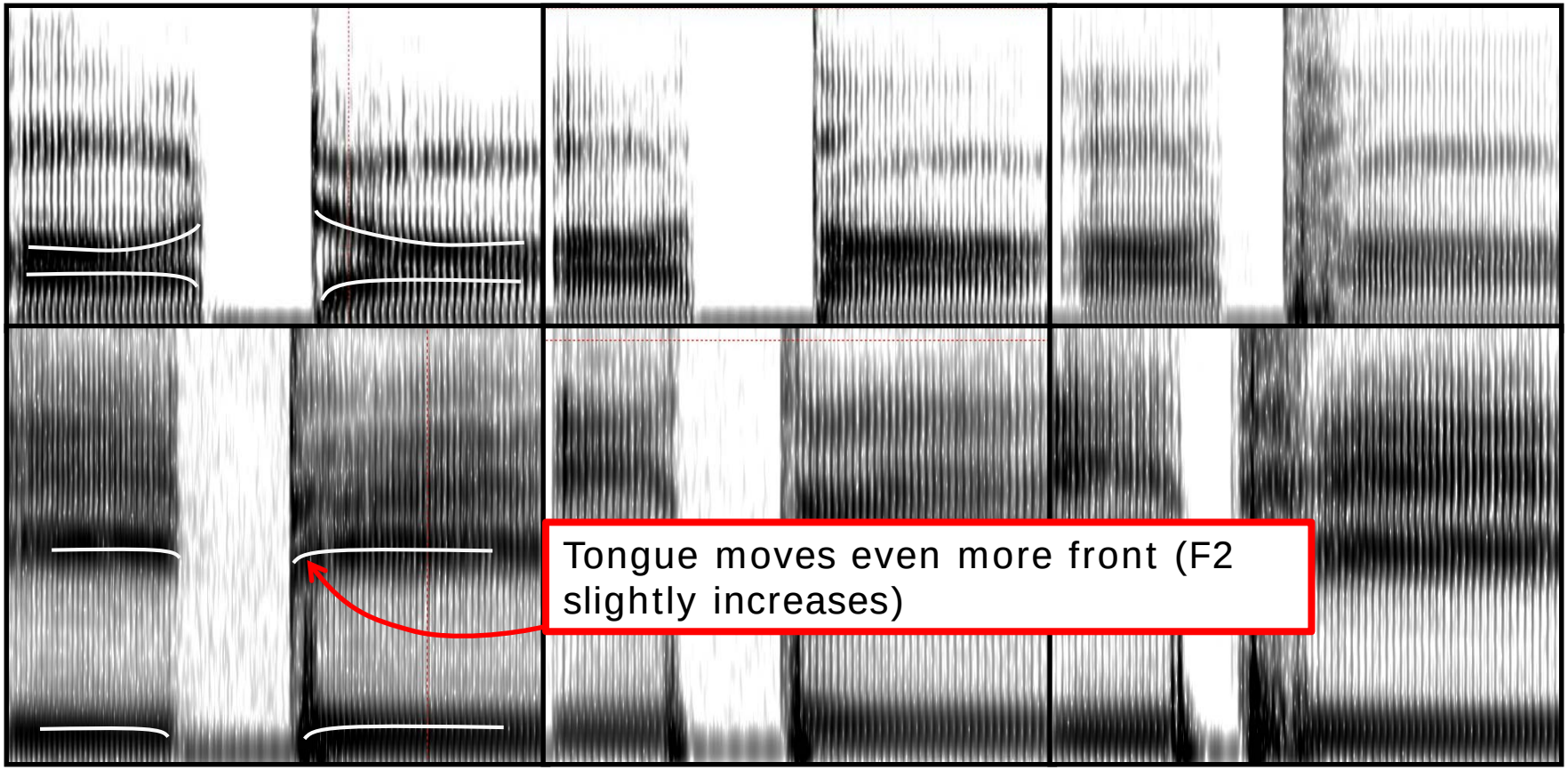
z-aa-z^ **d**-aa-z^ z-aa-z^ **t**-aa-z^ z-aa-z^ **th**-aa-z^



z-ii-z^ **d**-ii-z^ z-ii-z^ **t**-ii-z^ z-ii-z^ **th**-ii-z^

Alveolar Stop Consonants

z-aa-z^ **d**-aa-z^ z-aa-z^ **t**-aa-z^ z-aa-z^ **th**-aa-z^

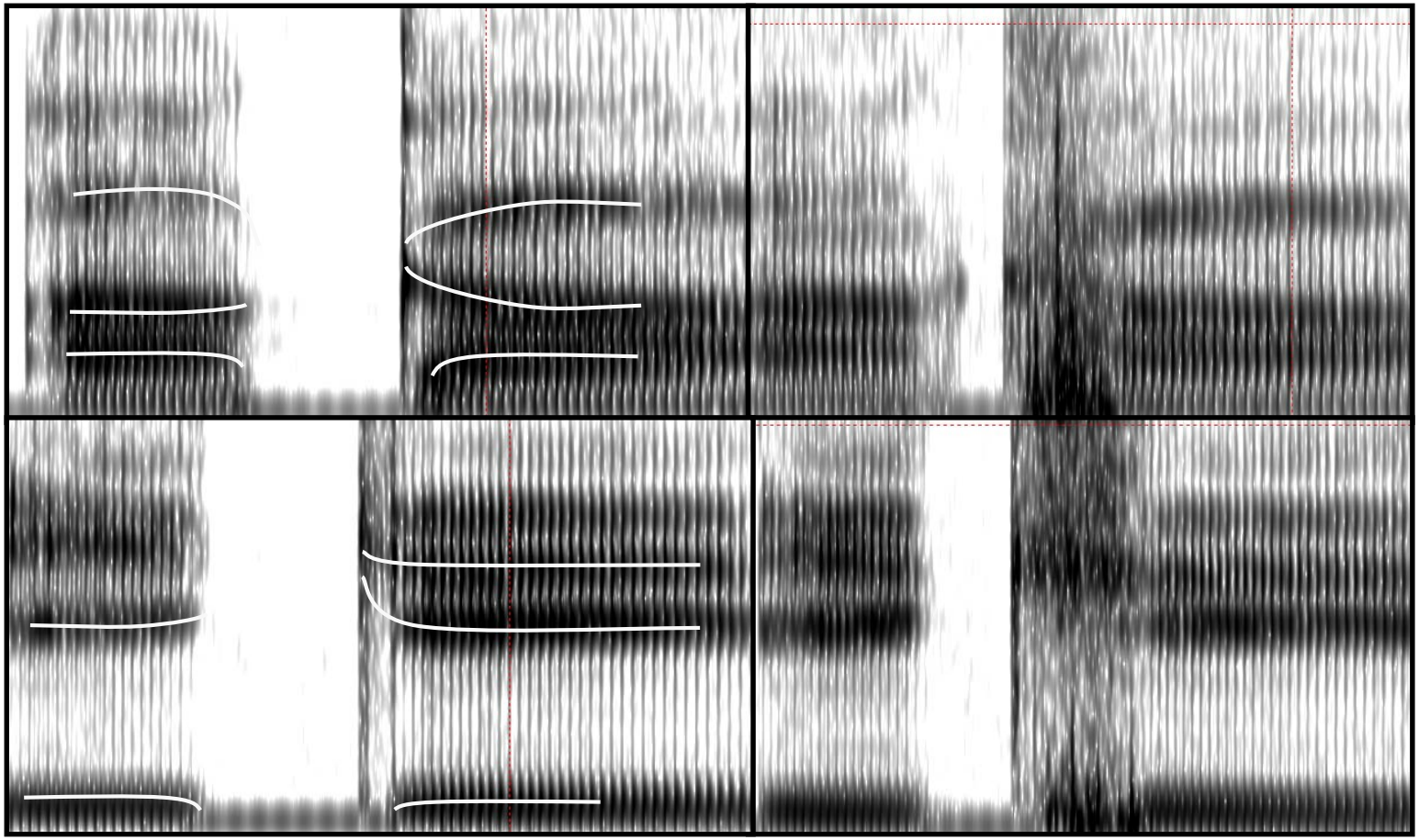


z-ii-z^ **d**-ii-z^ z-ii-z^ **t**-ii-z^ z-ii-z^ **th**-ii-z^

Velar Stop Consonants

z-aa-z^ **k**-aa-z^

z-aa-z^ **kh**-aa-z^



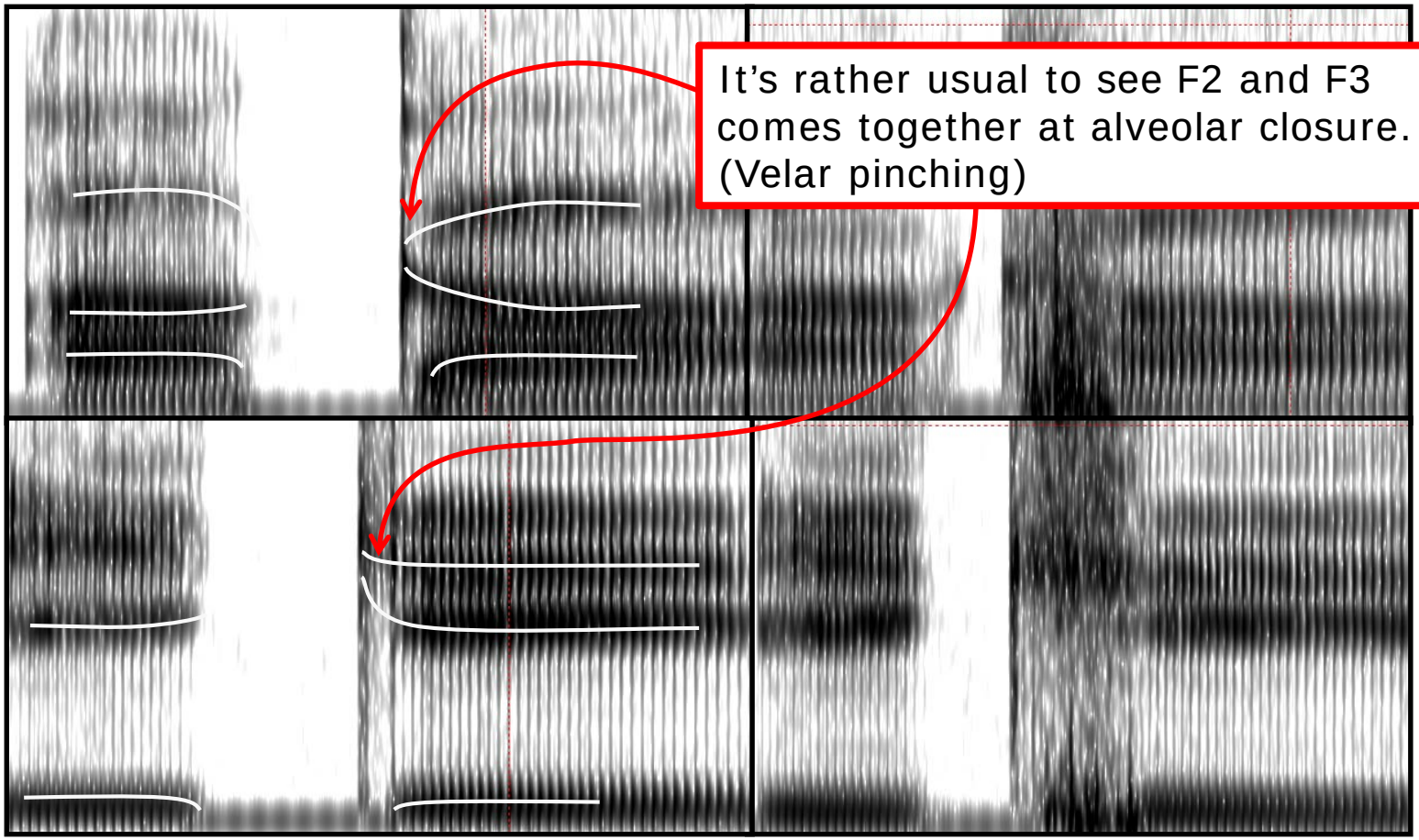
z-ii-z^ **k**-ii-z^

z-ii-z^ **kh**-ii-z^

Velar Stop Consonants

z-aa-z^ **k**-aa-z^

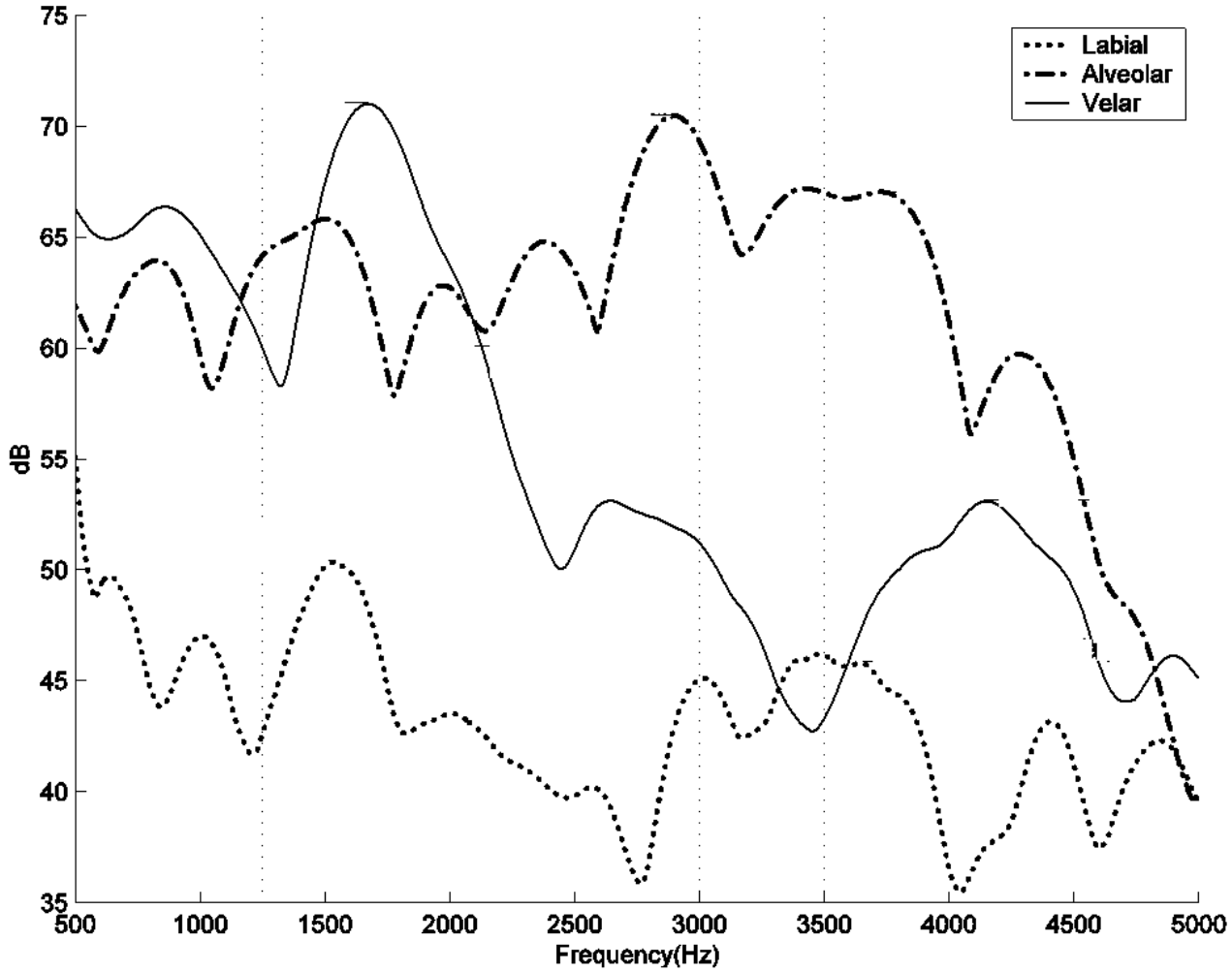
z-aa-z^ **kh**-aa-z^



z-ii-z^ **k**-ii-z^

z-ii-z^ **kh**-ii-z^

Burst Spectra



Picture from Suchato 2004

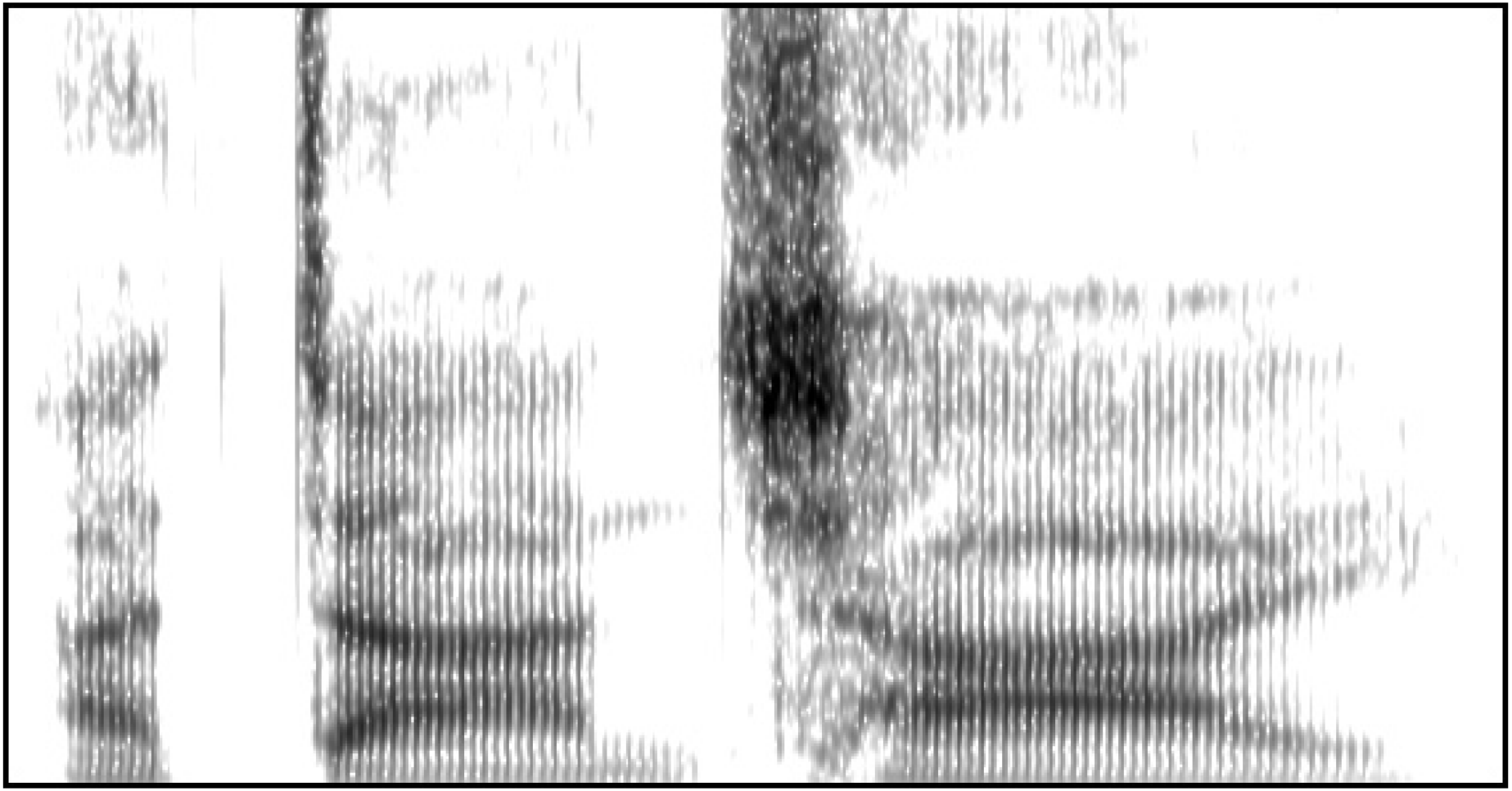
Affricates

- make complete closure like stop consonants
- release the closure and generate the turbulence noise like fricatives

voiceless palatoalveolar affricate →/ch/ in church, ชาน

voiced palatoalveolar affricate → /c/ in judge , จิก

Affricates



Nasal Consonants

- Form a complete closure at some point along the oral cavity
- “Velopharyngeal port” opens during the closure
  - connecting the nasal cavity
  - Forming side-branch (More complicated tube)
- No pressure increase behind the closure
- Signal amplitude decreases due to loss in the nasal cavity

Nasal Consonants

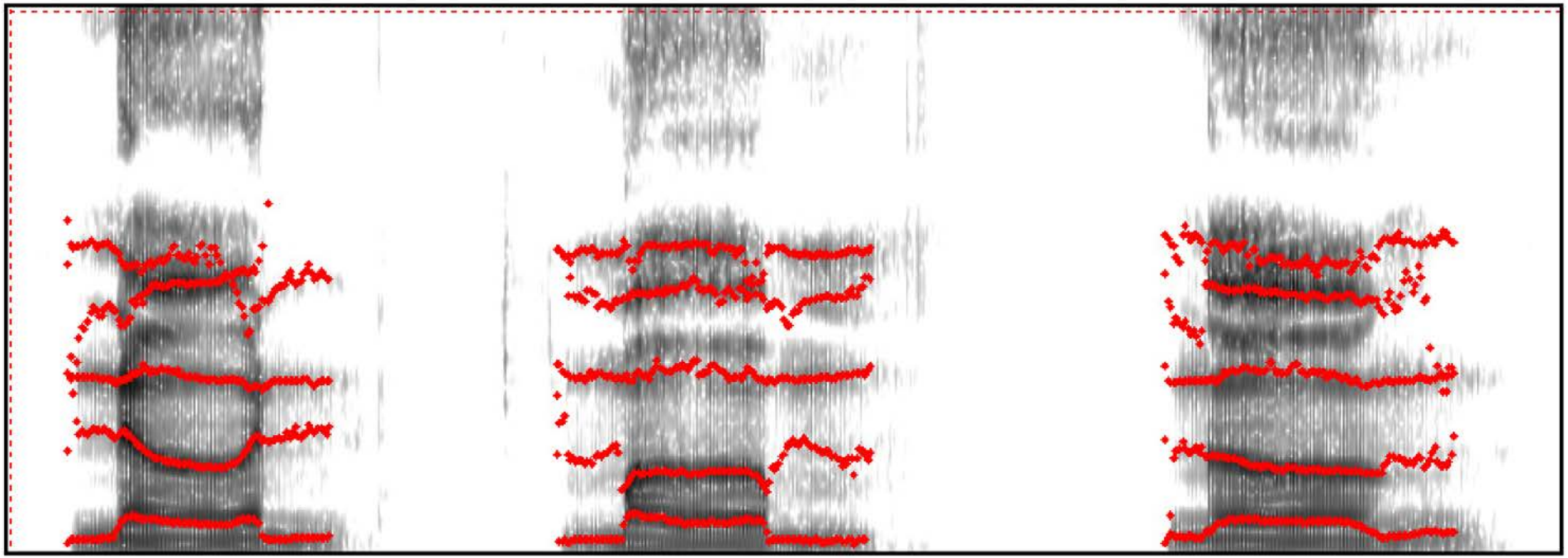
- 3 places of articulations (similar to stops)

labial nasal → /m/ in <u>m</u>an, <u>ม</u>าก

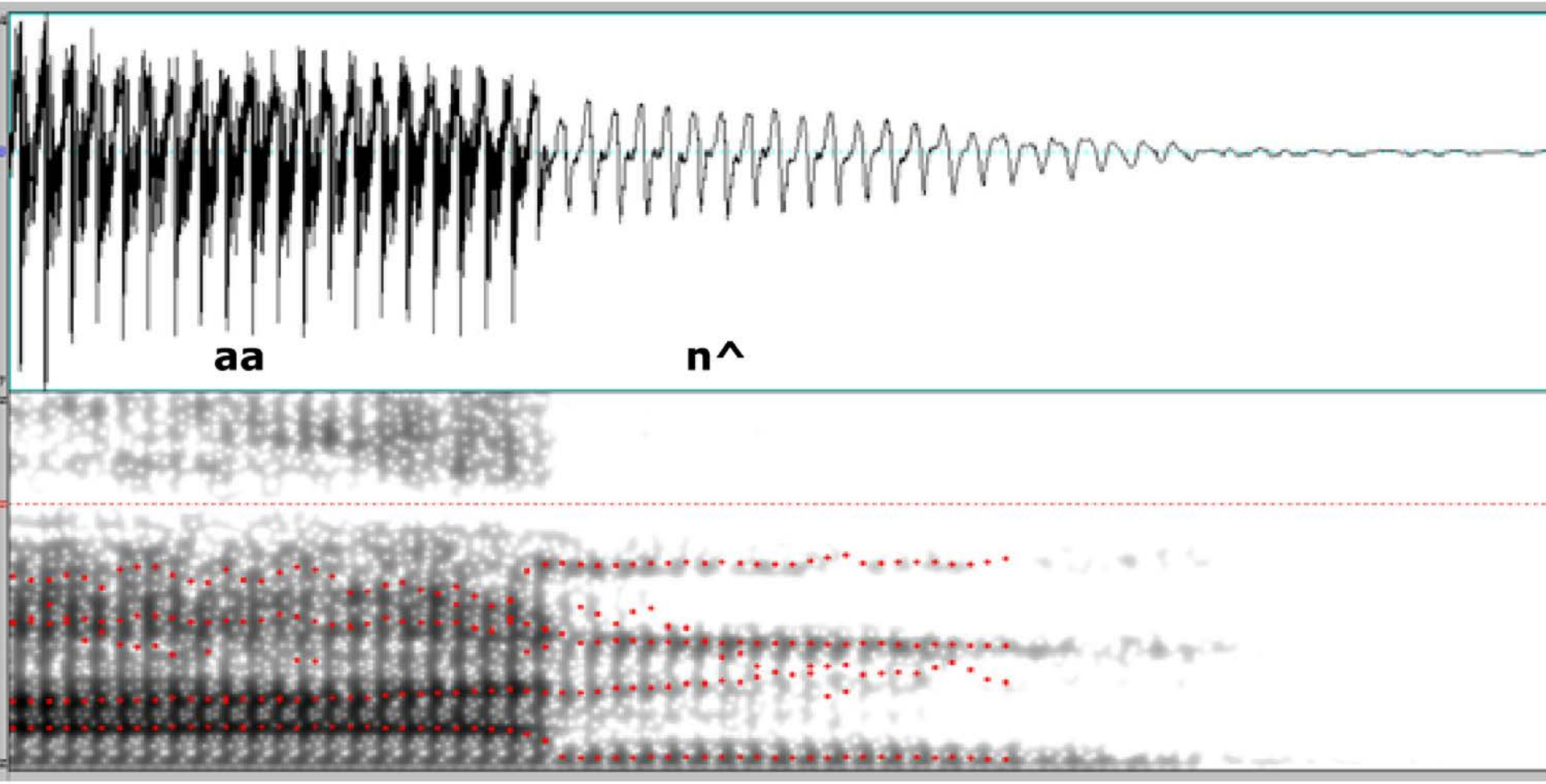
alveolar nasal → /n/ in <u>n</u>ot, <u>น</u>าน

velar nasal → /ng/ in si<u>ng</u>, เ<u>ง</u>า

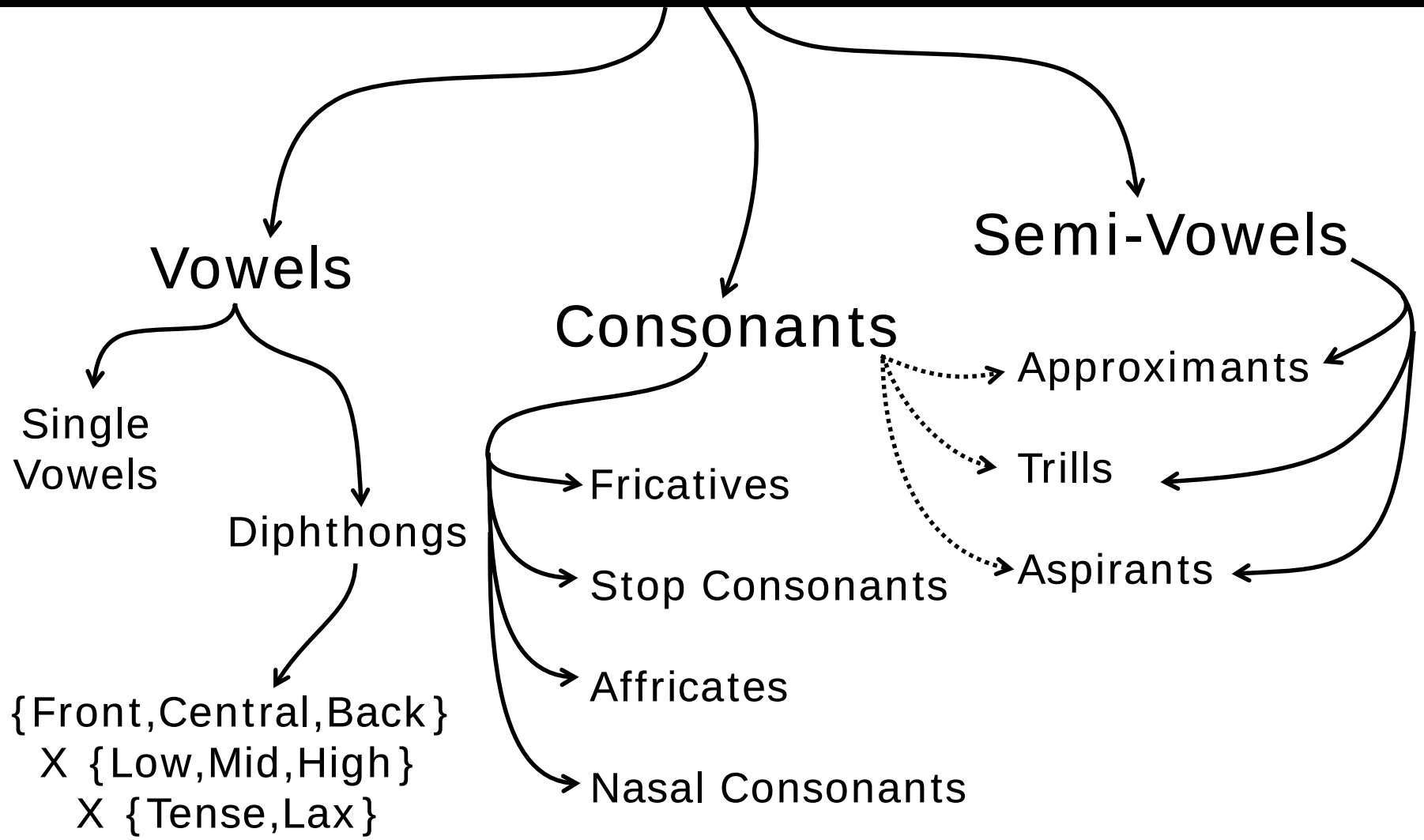
Nasal Consonants



Nasal Consonants

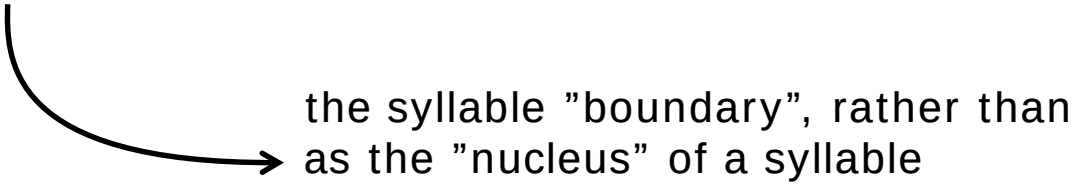


Classes of Sounds



Semi-Vowels

A Semi-vowel is phonetically similar to a vowel but functions as a consonant.



- Higher degree of constriction in the vocal tract
- Slower articulatory movement than consonants

Approximants

- Articulators approaching each other

Not narrowly enough to create turbulence
(I.e. like in the fricative case)

Spectrogram

- Movement of Formants is more extreme than vowels

voiced labial approximant → /w/ in weep, วาด

voiced alveolar lateral approximant → /l/ in lay, ลา

voiced palatal approximant → /j/ in year, ยาน

voiced retroflex approximant → read

Voiced Labial/Palatal Approximant

Voiced Labial Approximant

- “Constriction” is produced by “Rounded Lips”
- Extreme version of /uu/

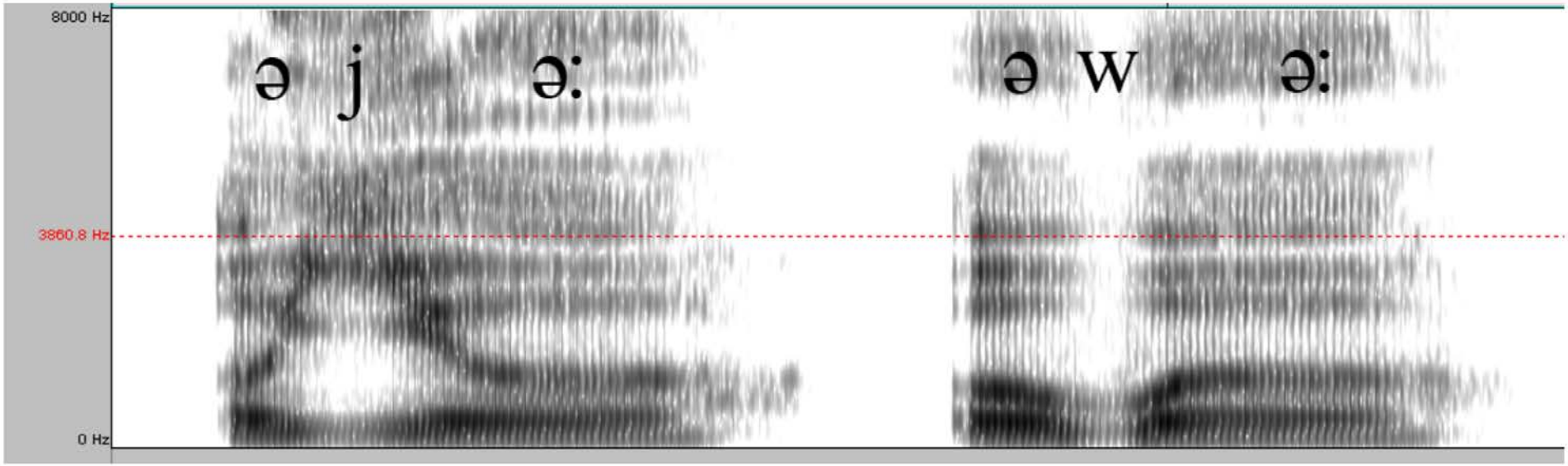
voiced labial approximant → /w/ in weep, วาด

Voiced Palatal Approximant

- “Constriction” is produced by “Tongue body” and “hard palate”
- Extreme version of /ii/

voiced palatal approximant → /j/ in year, ยาน

Voiced Labial/Palatal Approximant



z a j qq

z a w qq

Very low F1
Very high F2

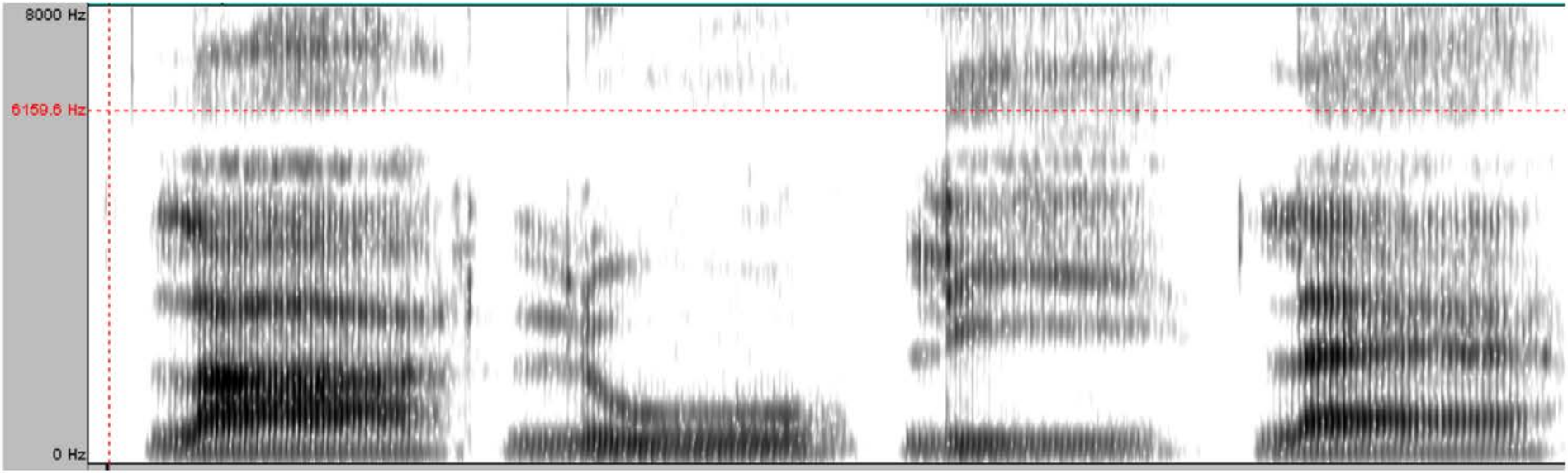
F1, F2 low

Alveolar Lateral Approximant

- “Constriction” is produced with the tongue blade in contact with alveolar ridge in the midline → Forming side branches

voiced alveolar lateral approximant → /l/ in lay, ลา

Alveolar Lateral Approximants

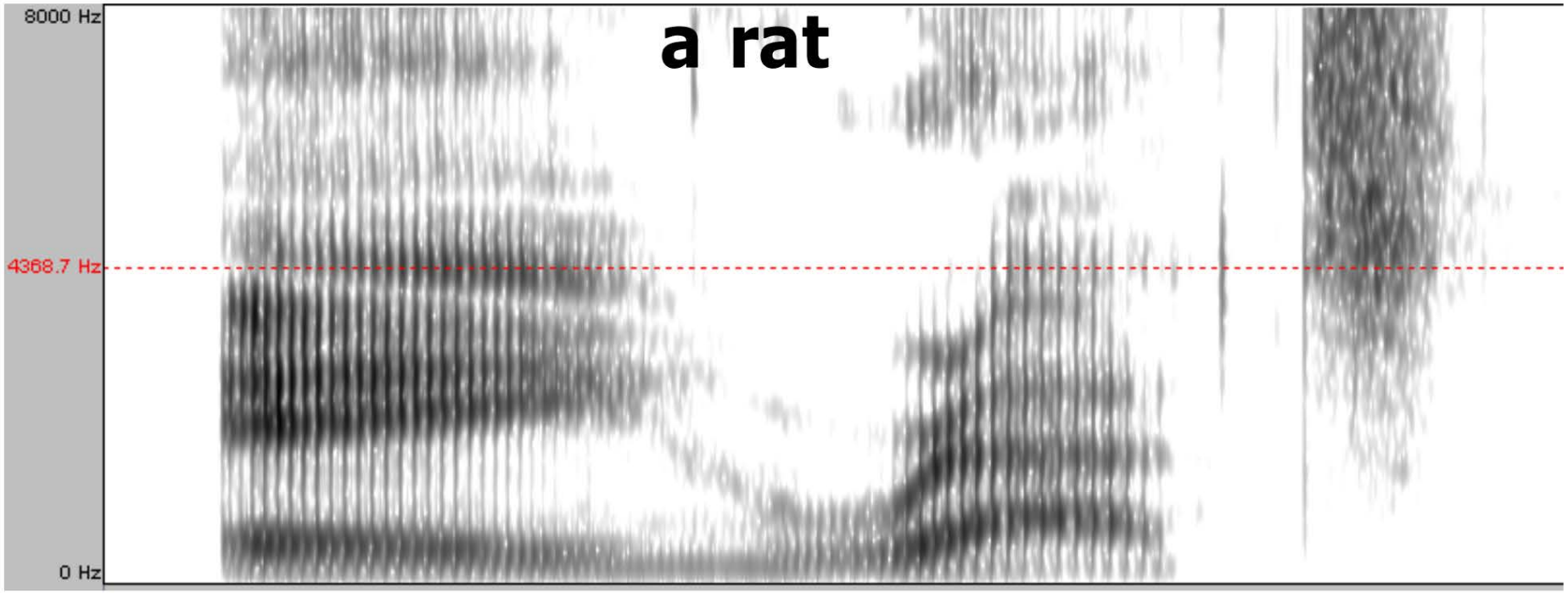


l aa l uu l ii l xx

Low F1, Mid to Low F2
Abrupt change in amplitude

Retroflex Approximants

- Articulated with the tip of the tongue “curled up”



Very low F3

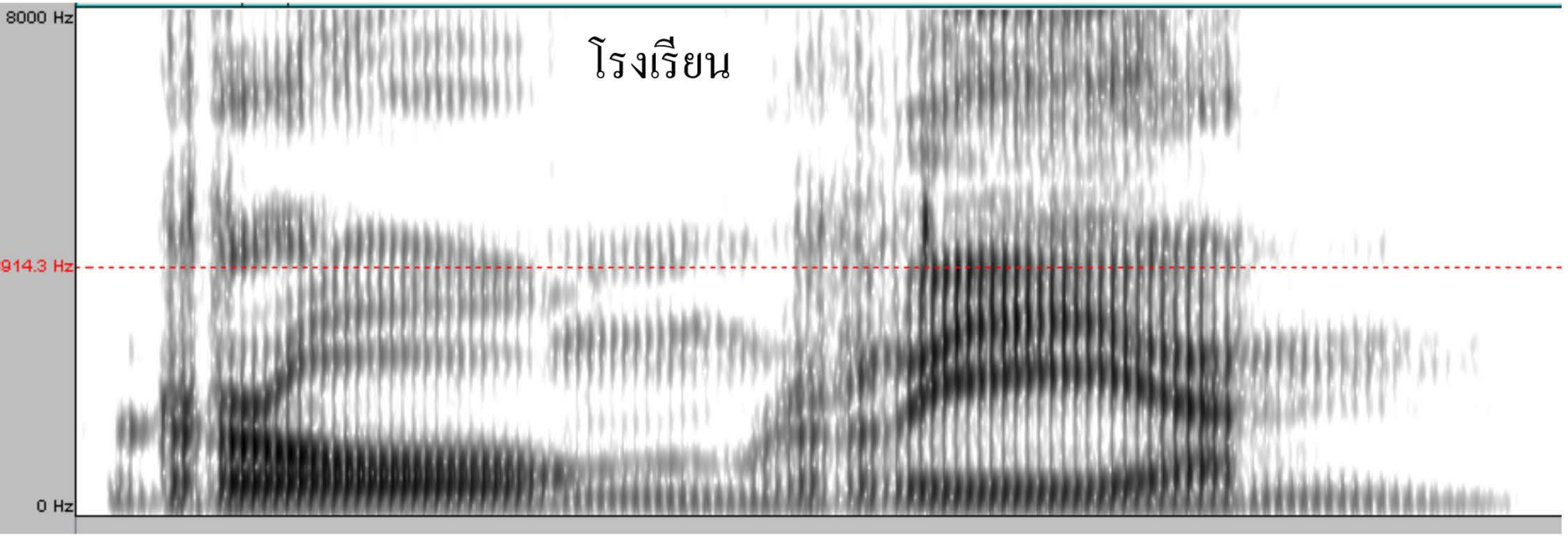
Voiced Alveolar Trills

- Sounds produced by vibrations between the active articulator and passive articulator

Alveolar ridge Vs. Tip of the tongue

voiced alveolar trill → /r/ in รา

Voiced Alveolar Trills



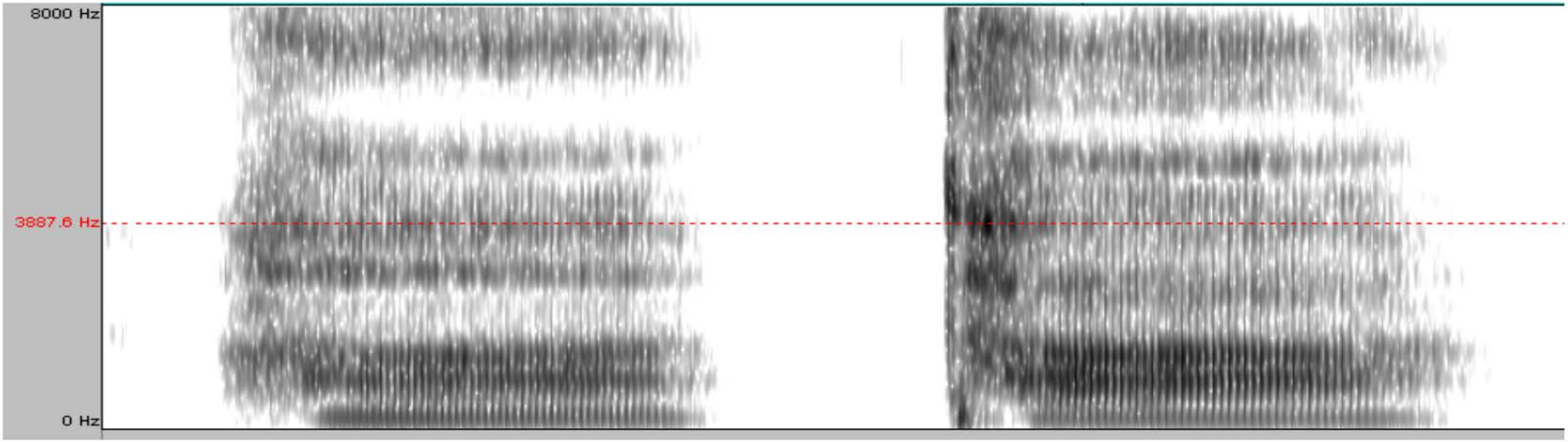
On-off energy
Very low F3

Aspirants

- Airflow through “spread” glottis
- Rapid airflow generates turbulence noise at the glottis

} Voiceless Glottal Fricative

aspirant → /h/ in hair, หอน



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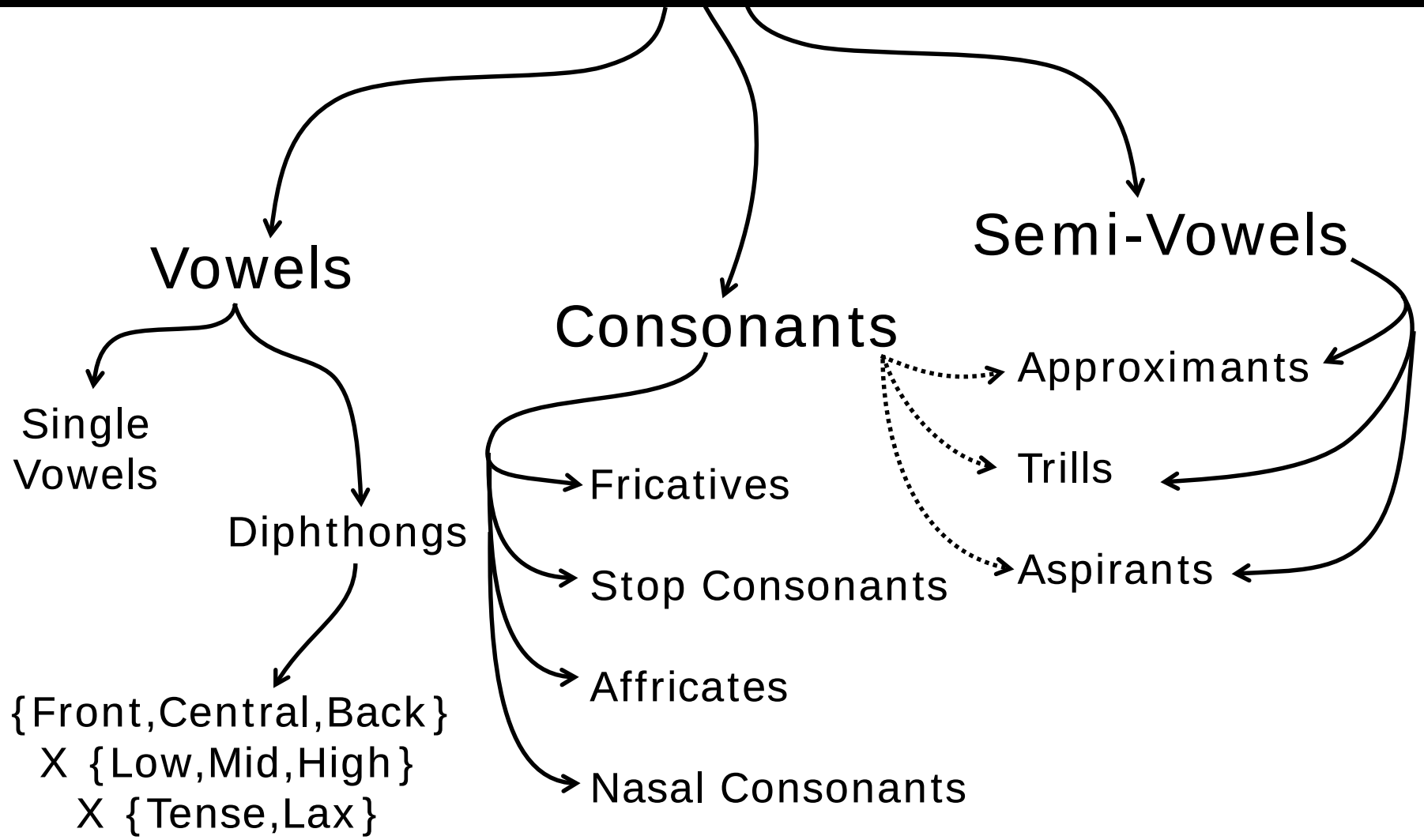

Spectrogram Reading Exercises