

Vowel	F1(Hz)	F2(Hz)	F3(Hz)
i:	280	2620	3380
ɪ	360	2220	2960
e	600	2060	2840
æ	800	1760	2500
ʌ	760	1320	2500
ɑ:	740	1180	2640
ɒ	560	920	2560
ɔ:	480	760	2620
ʊ	380	940	2300
u:	320	920	2200
ɜ:	560	1480	2520

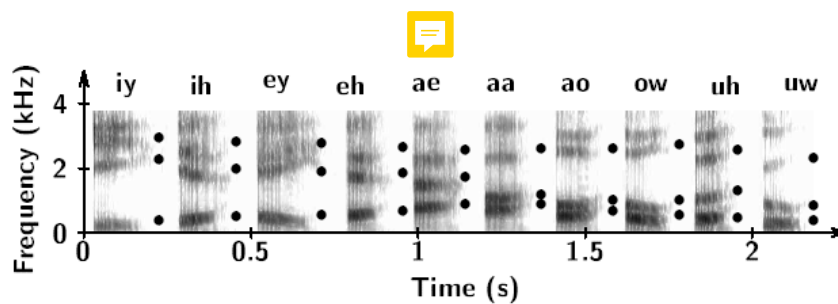
Adult male formant frequencies in Hertz collected by J.C.Wells around 1960.  
Note how F1 and F2 vary more than F3.

		/iy/	/ih/	/eh/	/ae/	/aa/	/ao/	/uh/	/uw/	/ah/	/r/
F1	male	270	390	530	660	730	570	440	300	640	490
	female	310	430	610	860	850	590	470	370	760	500
F2	male	2290	1990	1840	1720	1090	840	1020	870	1190	1350
	female	2790	2480	2330	2050	1220	920	1160	950	1400	1640
F3	male	3010	2550	2480	2410	2440	2410	2240	2240	2390	1690
	female	3310	3070	2990	2850	2810	2710	2680	2670	2780	1960

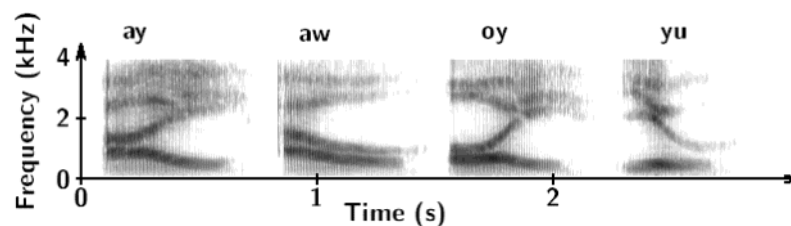
Table 7.2: Average formant frequencies (in Hz) for English vowels by adult male and female speakers from a classic study (see also [Hill 95] for a replication). (after Peterson and Barney [Pet 52], @AIP).

From: Deng and O'Shaughnessy, Speech Processing, Marcel-Dekker Inc.

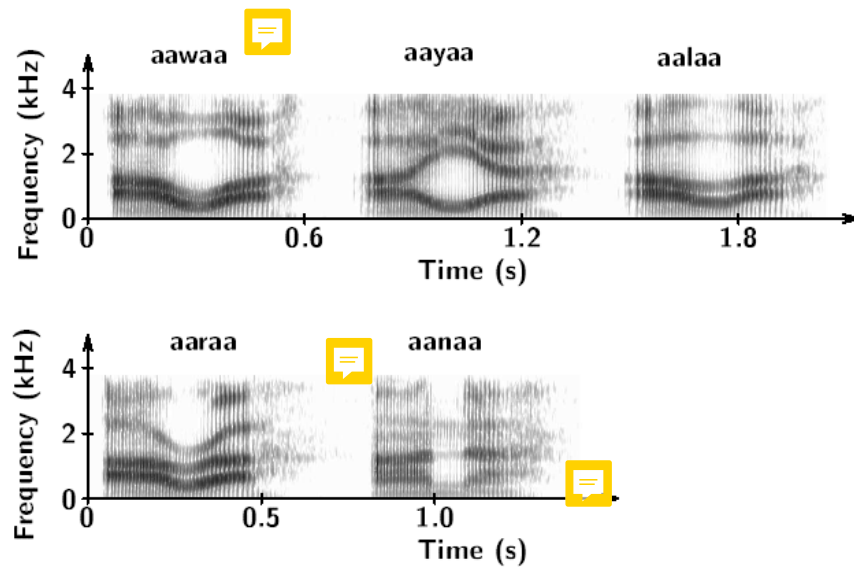
English **vowels** from male speaker



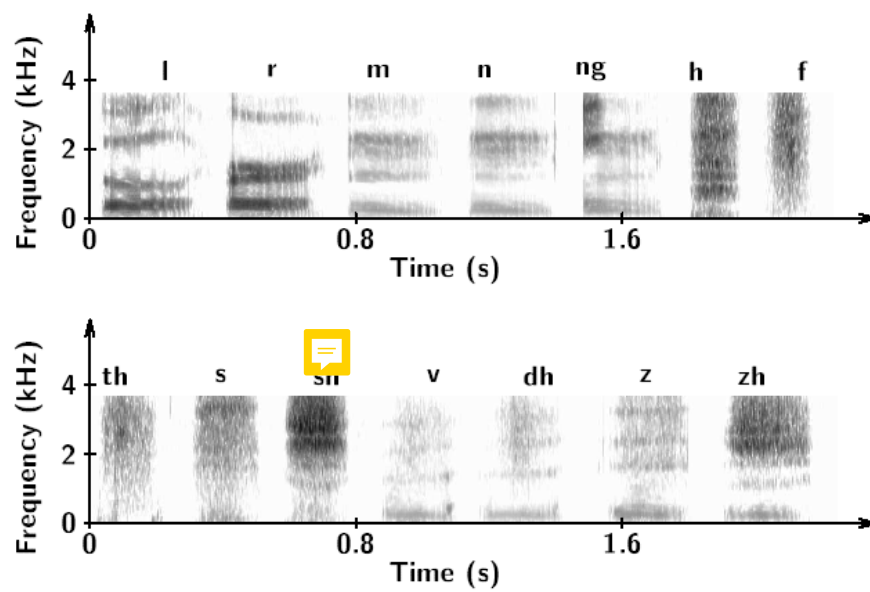
English **diphthongs** from male speaker



Sonorants in **vocalic context** (see also hindiCVC wav)

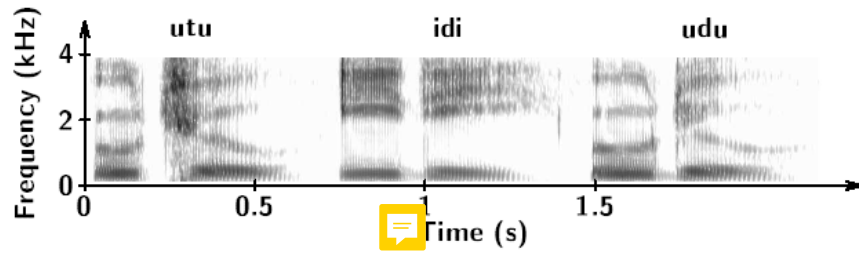
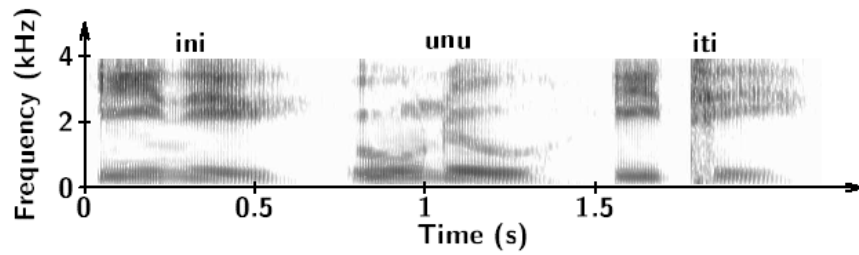


English consonants



Stops in vocalic context (stops\*.wav)

Compare /utu/, /udu/:  
 -sil vs voice bar  
 -burst (vot) duration  
 -F2 transition



### Transitions into Obstruction

- F2 transition is towards different frequencies depending on place of obstruction
  - an indicator *where* the obstruction is occurring
  - a cue to help identify the *place* of the consonant

Bilabial

Alveolar

Velar

### Transitions from Obstructions

- Mirror image of pattern of transitions into obstruction
  - F1 moves from low frequency into vowel
  - F2 moves from position determined by place of consonant into vowel

Bilabial

Alveolar

Velar

