Some examples of non-English feature combinations

Voiced aspirated stops (Hindi)

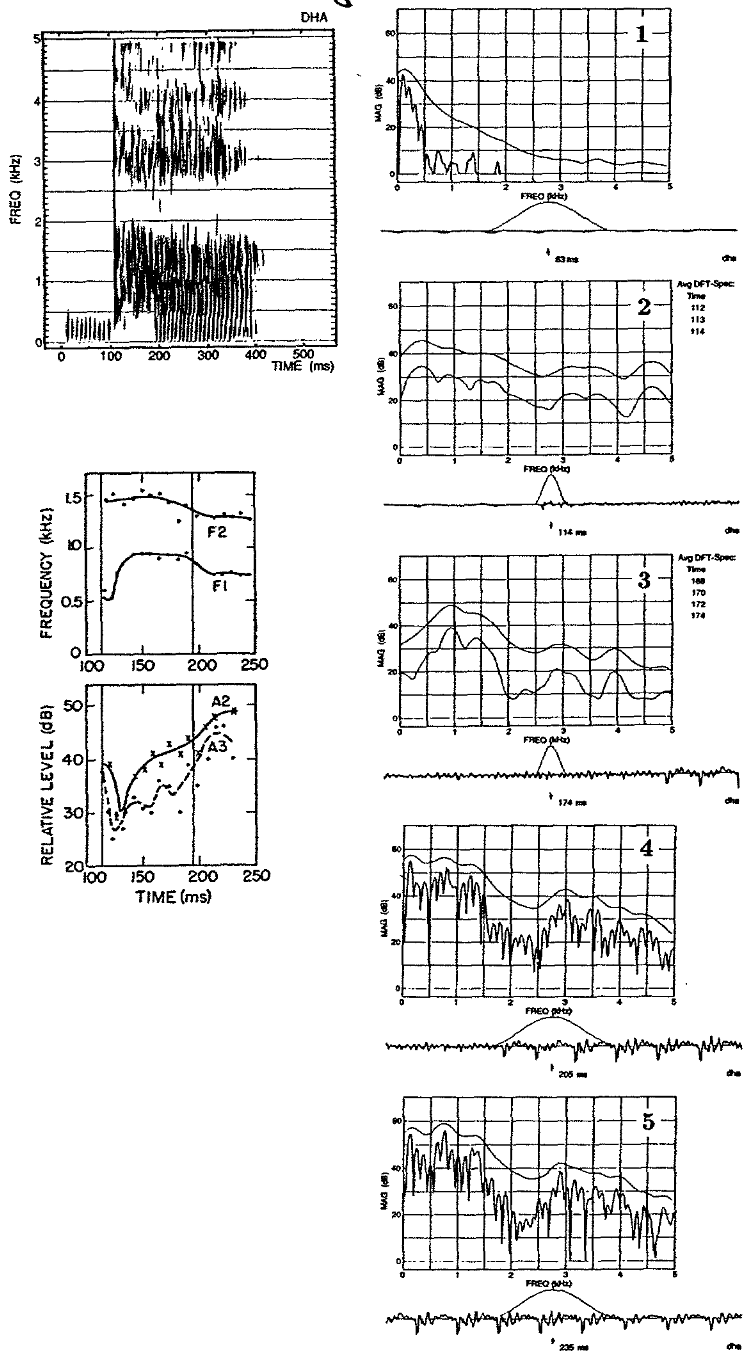


Figure 8.74 Acoustic data from the syllable /dha/ produced by an adult male Bengali speaker. The spectrogram is displayed at the top left. To the right of the spectrogram are spectra sampled at five points throughout the utterance: (1) in the prevoicing, (2) at the consonant release, (3) during the aspiration, (4) near the onset of glottal vibration, and (5) 30 ms after spectrum 4. Different time windows were used to calculate the spectra, as shown on the waveforms, and in the case of (2) and (3) the spectra are averages over the times indicated beside the spectra. Also shown (below the spectrogram) are plots of the first- and second-formant frequencies vs. time and the amplitudes of the peaks in the F2 and F3 regions, for the time interval following the consonant release. The vertical lines indicate the times of release and of onset of glottal vibration.

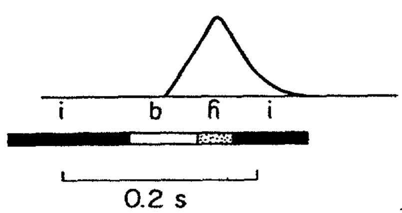


Figure 8.73 The curve gives a measure of the glottal opening (as sensed using a photoelectric glottograph device) during the voiced aspirated stop consonant /bh/ in the context /ibhi/, produced by a Hindi speaker. The lower horizontal bar shows the regions of voicing (solid), consonant closure (open), and frication and aspiration (stippled). (Adapted from Dixit, 1975.)

Clicks

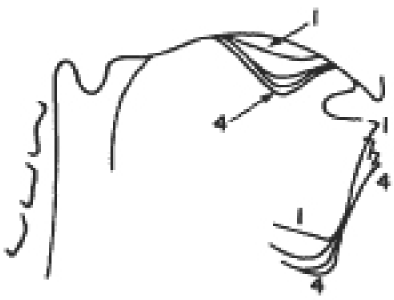


Figure 2.48 Midsagittal section of the vocal tract at four successive points in time as a negative pressure is created in the enclosed volume prior to release of the click /!/. (From Traill, 1985.)

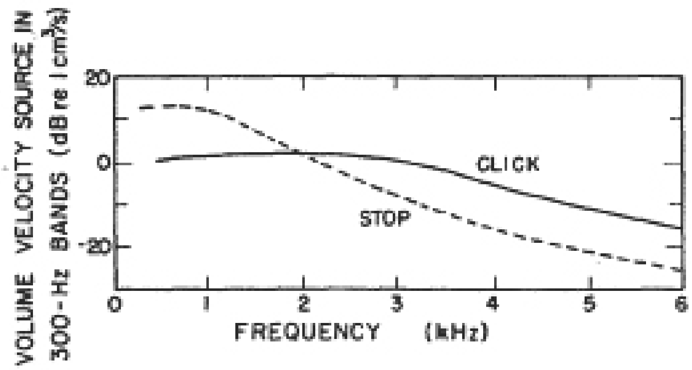
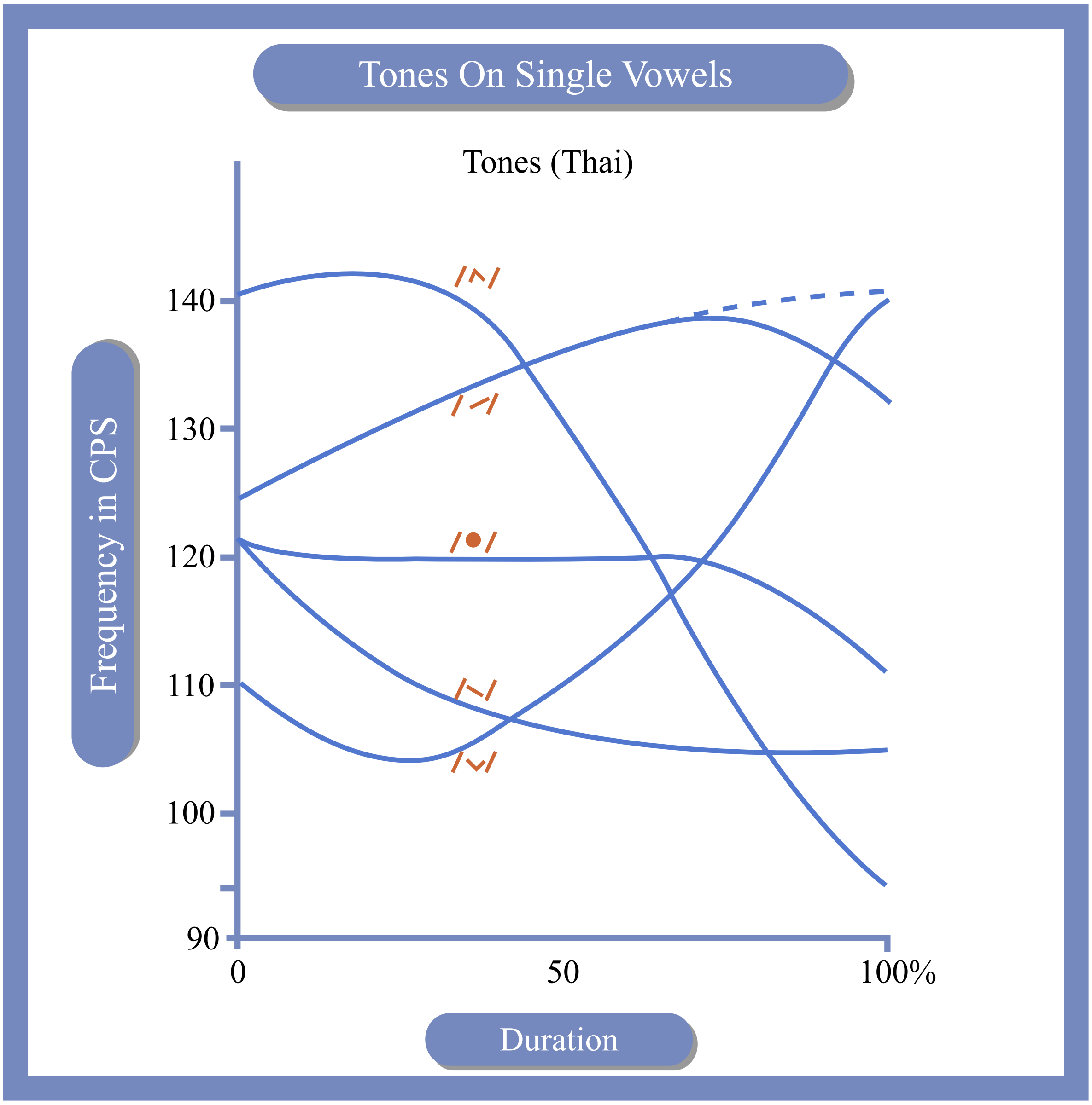
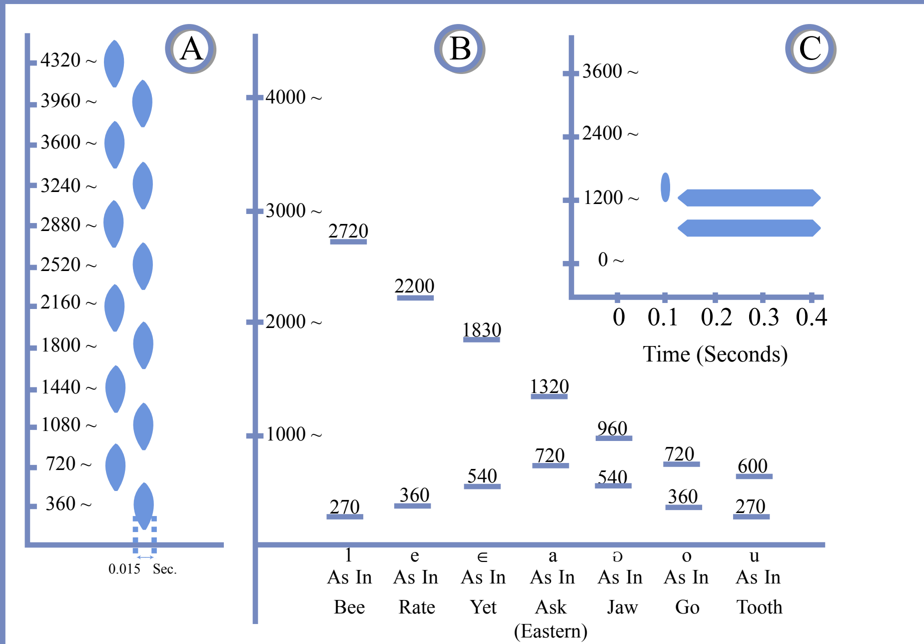


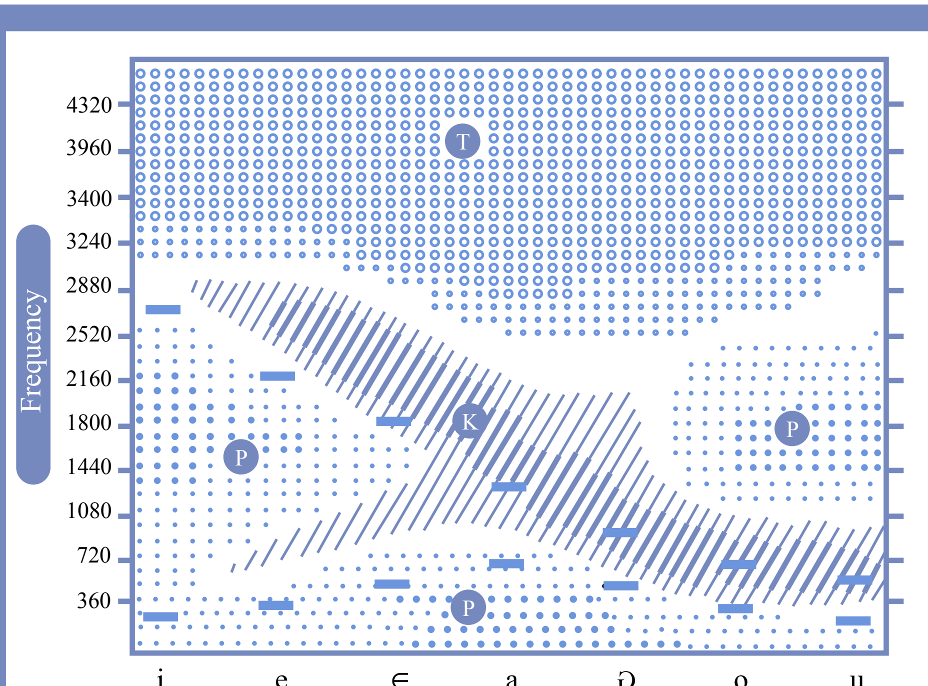
Figure 2.49 The solid line gives the estimated spectrum amplitude (in 300-Hz bands) of the transient source that occurs at the abrupt release of a click, as in figure 2.48. An enclosed volume of air equal to 1.0 cm³ is assumed, with a negative pressure of 100 cm H_2O within this volume at the instant of release. The calculated transient for a release of a pulmonic alveolar or labial stop consonant is shown for comparison, from figure 2.47 (dashed line).


Tones On Single Vowels
Tones (Thai)
Frequency in CPS
140
130
120
110
100
90
0
50
100%
Duration



Perception of Stop Bursts

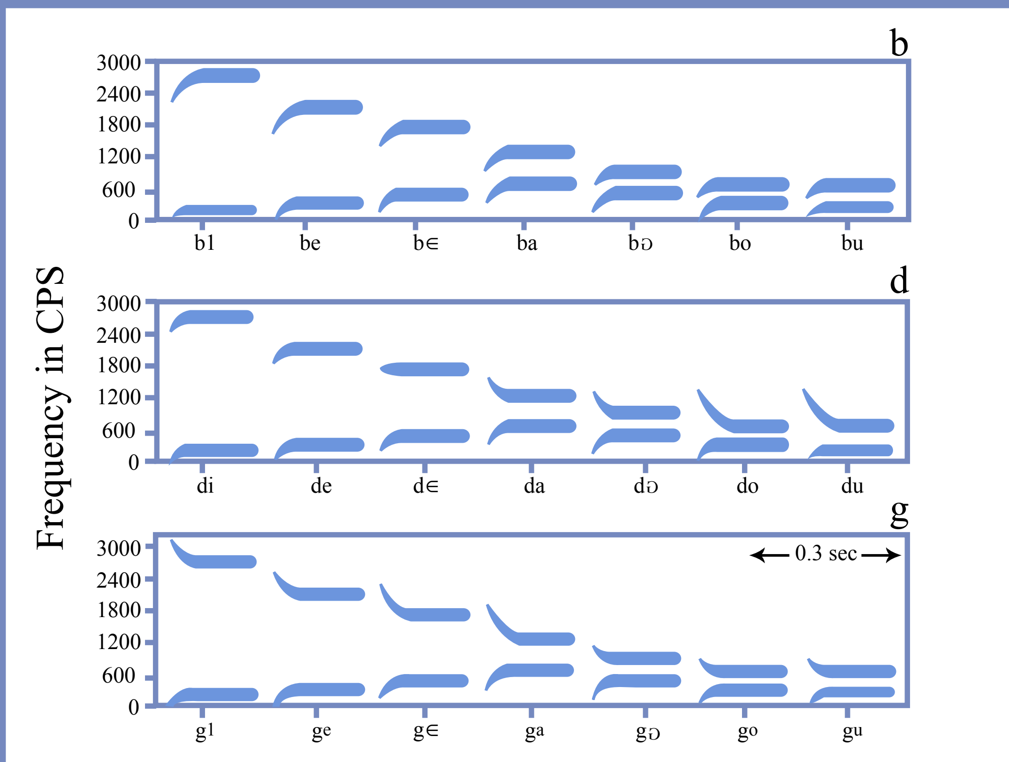
Showing frequency-position (A) of the schematic stops; (B) of the vowel-formats; and (C) one of the schematic syllables.



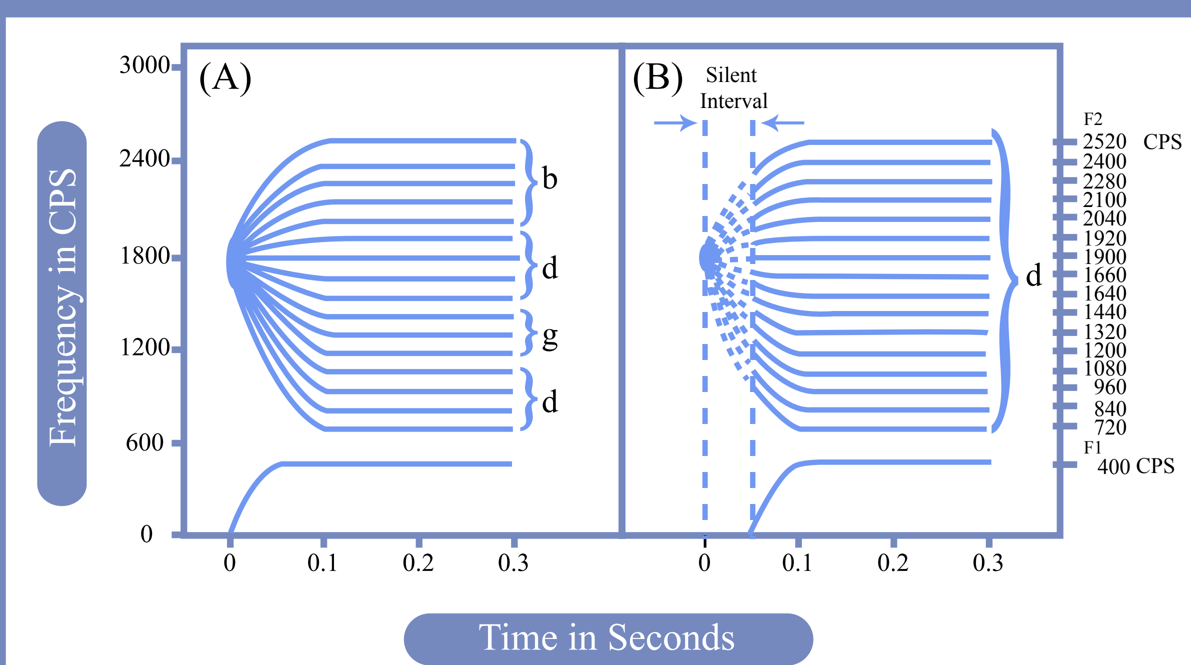
Map of the areas in which the judgment *p*, *t*, or *k* predominates.

Concept of Formant "Locus"

Synthetic spectrograms showing second-formant transitions that produce the voiced stops before various vowels.

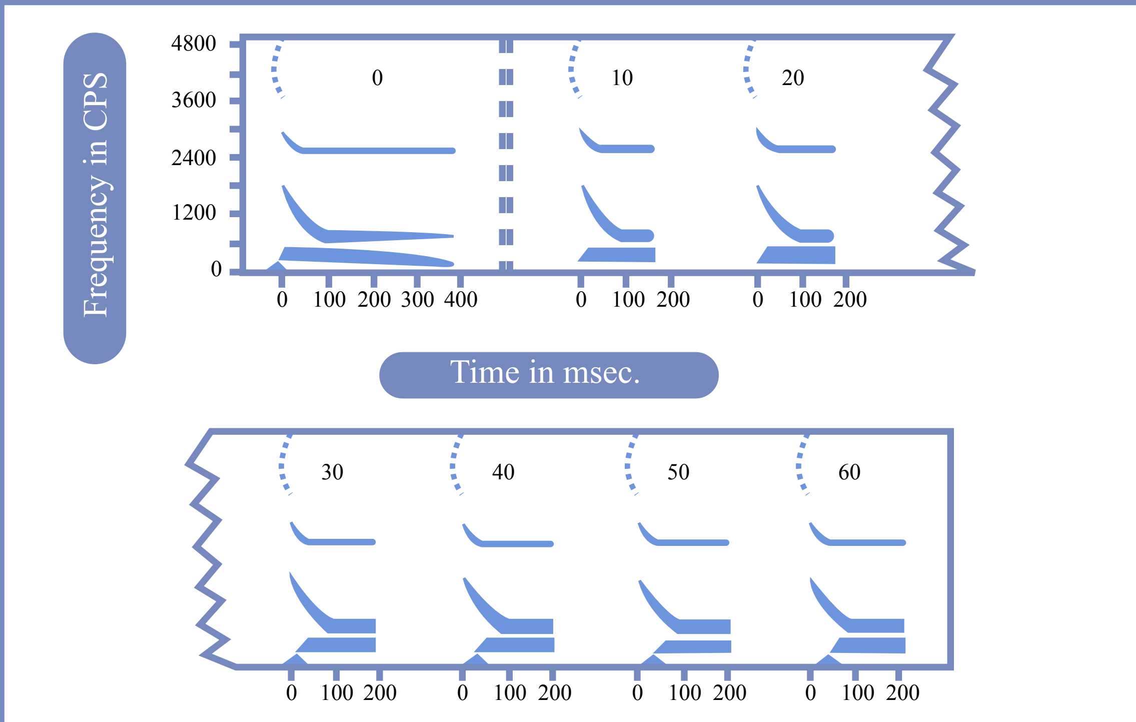


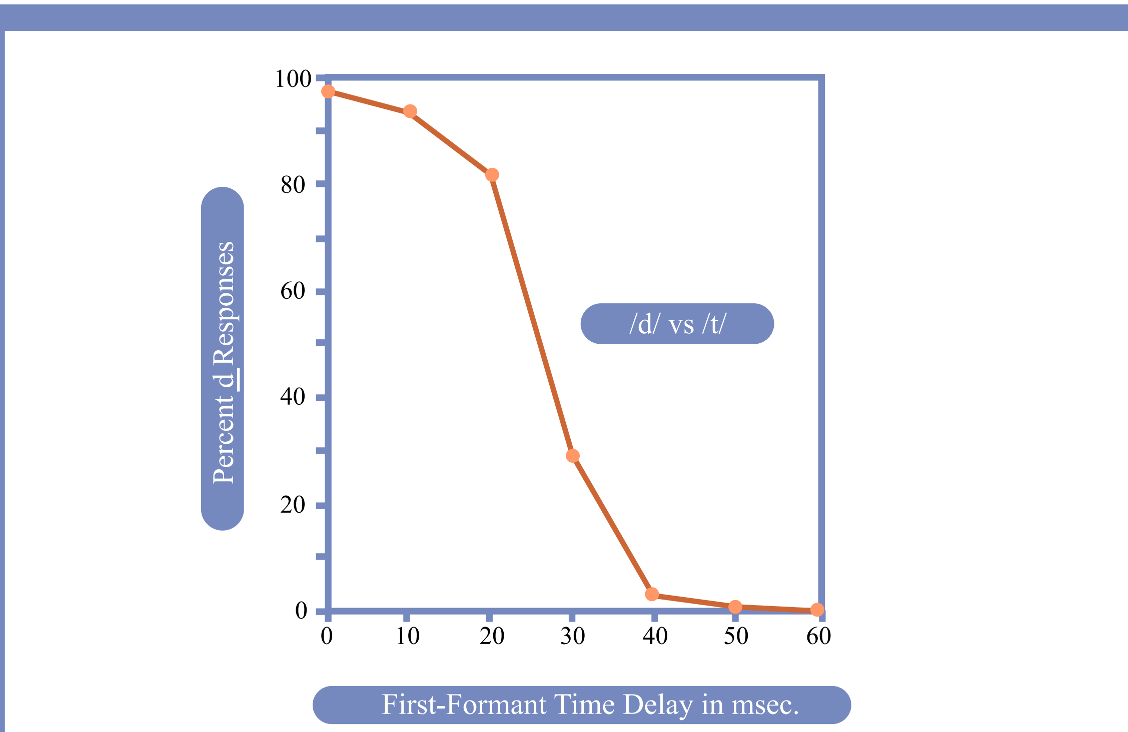
Stimulus patterns (shown schematically) and identifications with and without a silent interval between the second-formant locus and the onset of the transition.



Voice Onset Time (VOT)

Illustrations of the patterns used to study the effects of the first-formant time of onset on the perceived distinction between /d/ and /t/. The numbers above the patterns show the extent of cutback in msec.

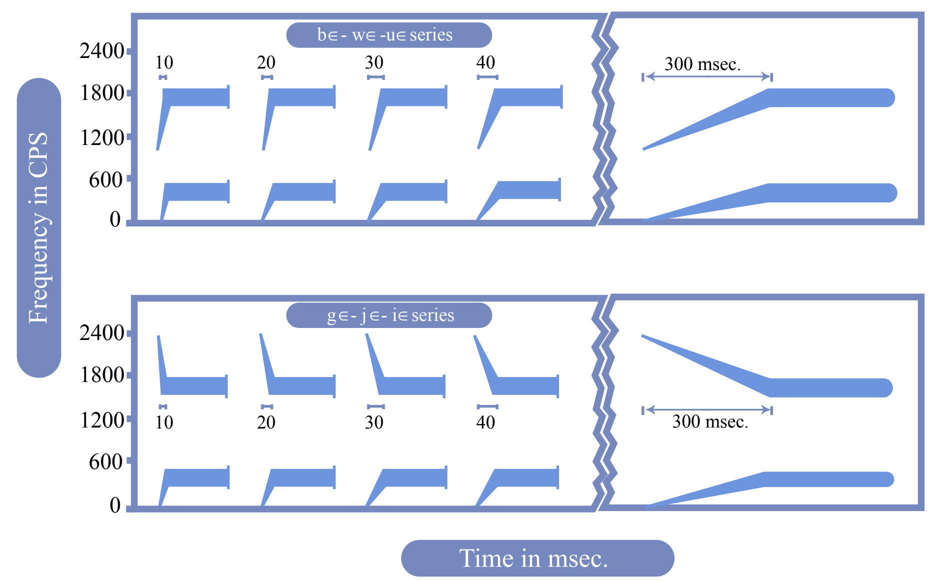


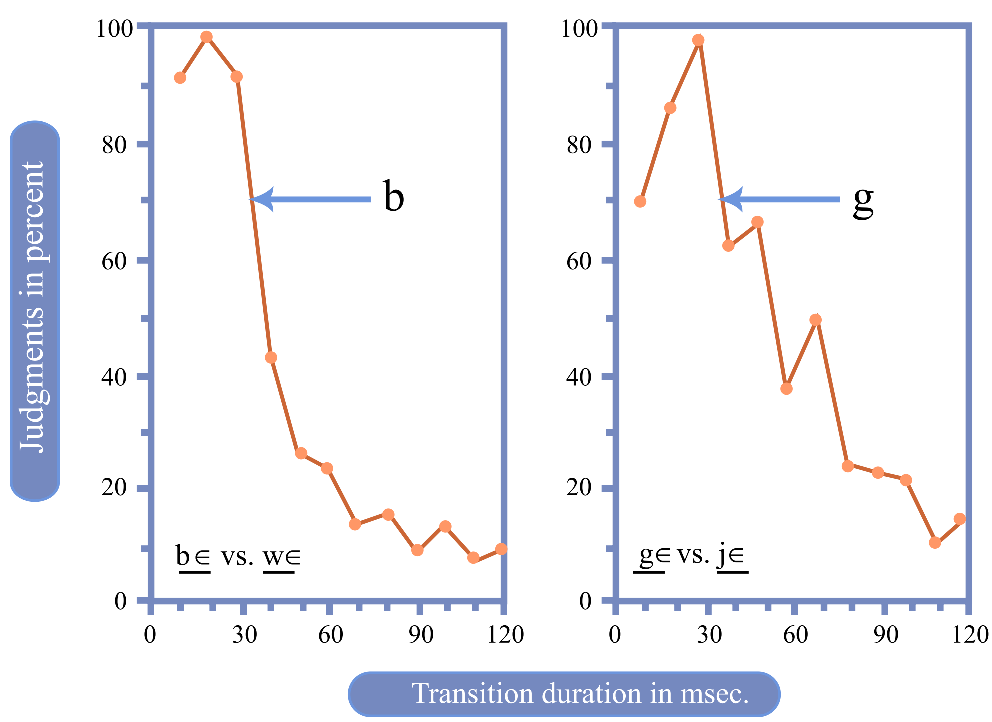


Responses of 27 phonetically naive listeners to the patterns in which time of onset of the first-formant was varied. Each listener judged each stimulus six times, making a total of 162 judgments per stimulus. The data are shown as the percentage of times each stimulus was heard as /d/.

Rate of formant movement /w-b/

Illustrations of the spectrographic patterns used to produce the stimuli of Experiment I. The first four patterns in each row show how the tempo of the transitions was varied. At the extreme right of each row is a complete stimulus pattern, i.e, transition plus steady-state vowel, for the longest duration of transition tested.

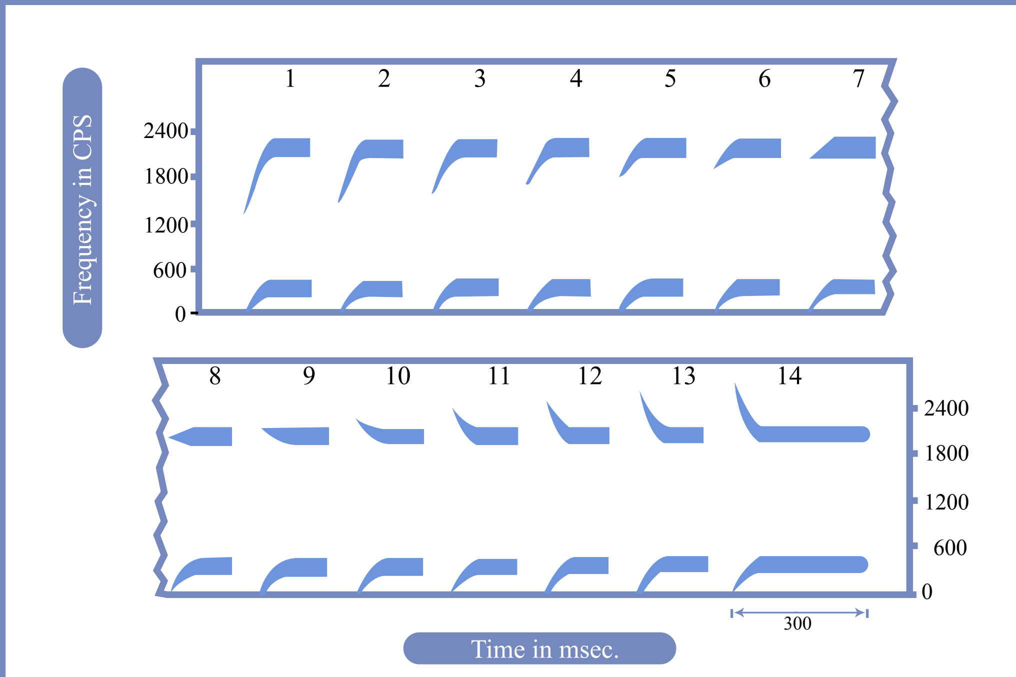


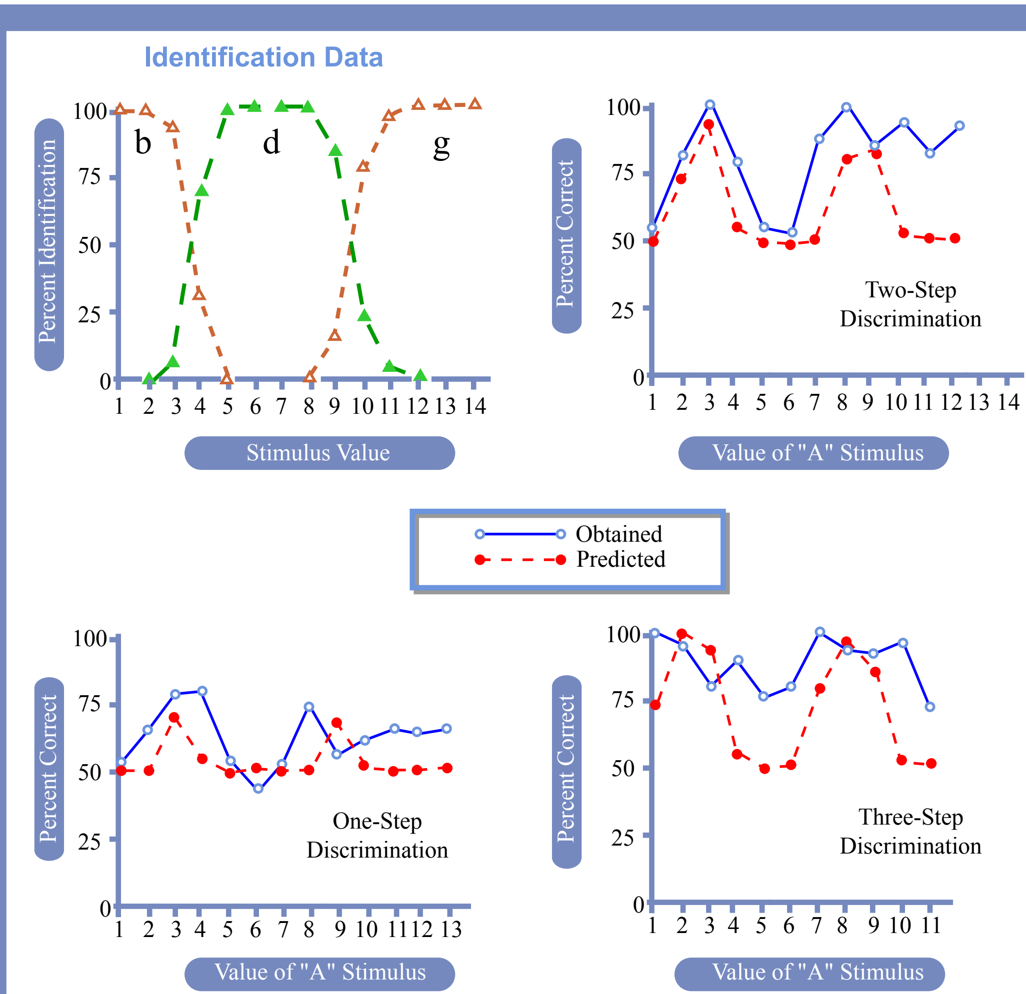


The distinction between stop consonant and semivowel as a function of the tempo of transition. These curves show the percentage of stop consonant responses, and are based on the judgments of separate groups of 59 and 60 listeners for the *b-w* and *g-j* distinctions, respectively. Tempo is here expressed in terms of duration.

Example of categorical perception

Illustrations of the spectrographic patterns from which the stimuli of the experiment were produced. Pattern 14, at the lower right, is complete in all respects.





Labeling and discrimination data for a single S, CD.
The values given on the ordinates in terms of percentage are based on 32 and 42 judgments for the labeling and discrimination data, respectively.

Measure of auditory filter bandwidths

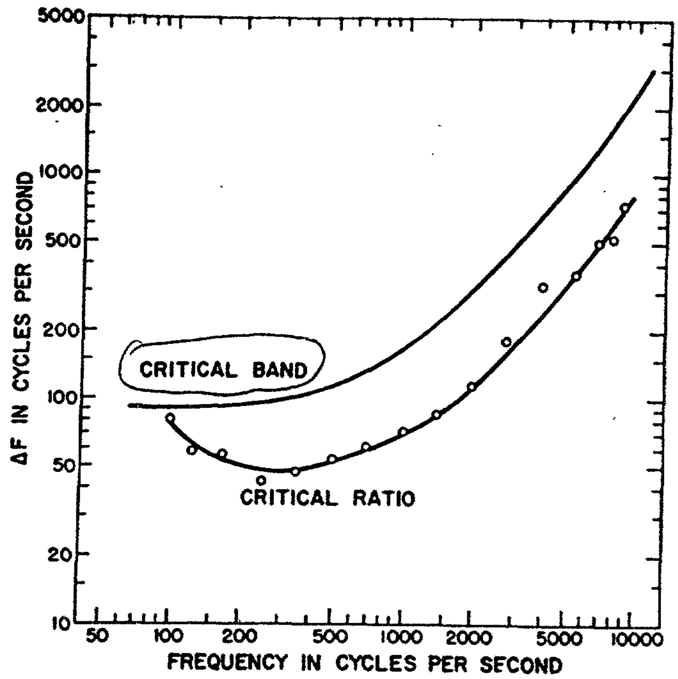


Figure 4.30 The upper curve plots the width ΔF of the critical band as a function of the center frequency of the band, as measured in masking experiments that manipulate the bandwidth of the masker. The lower curve gives the bandwidths calculated from the critical ratio, as in figure 4.25. (From Greenwood, 1961a.)

Matching 2-formant vowels against 4-formant vowels

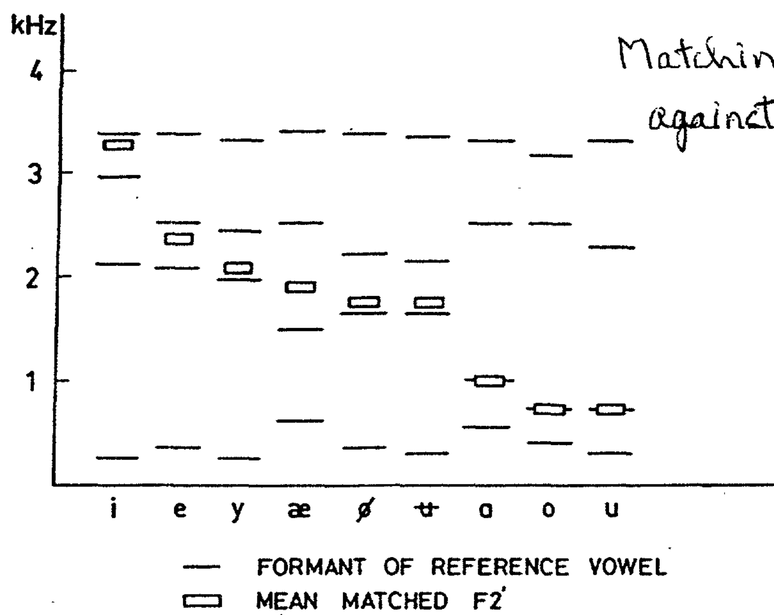


Figure 4.34 The horizontal lines give the first four formant frequencies of a set of Swedish vowels used in a matching experiment. The boxes show the mean frequency of the second formant ($F2'$) of a two-formant stimulus that gave a best match to the full vowel. $F1$ of the two-formant matching stimulus was set to $F1$ of the vowel. (From Carlson et al., 1970.)

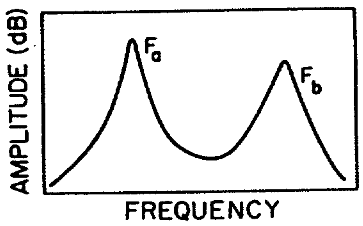


Figure 4.32 Schematization of the spectrum envelope of a two-formant sound used in the matching experiments of Chistovich and Lublinskaya (1979). The frequency spacing $F_b - F_a$ and the relative amplitudes of the spectral prominences were manipulated.

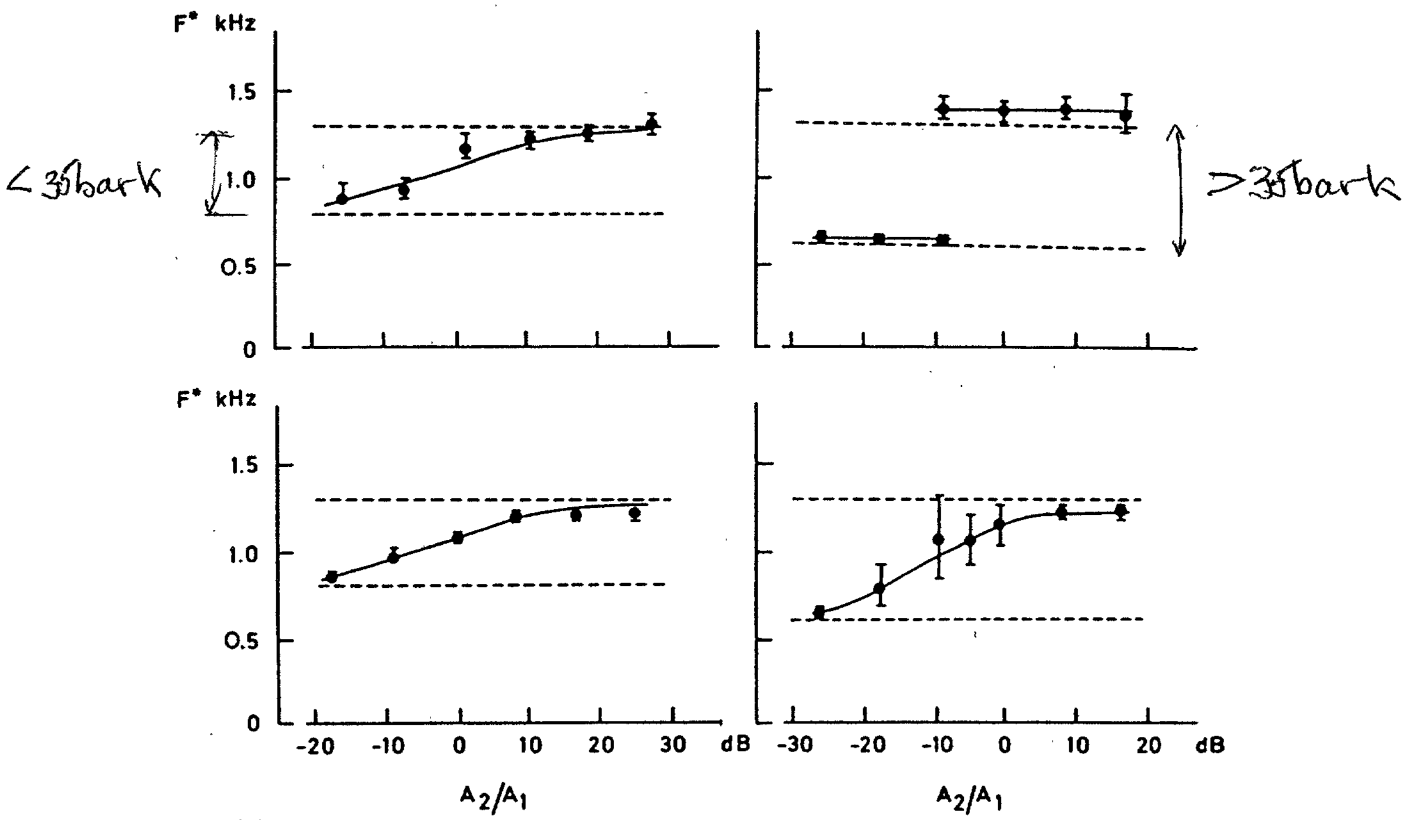
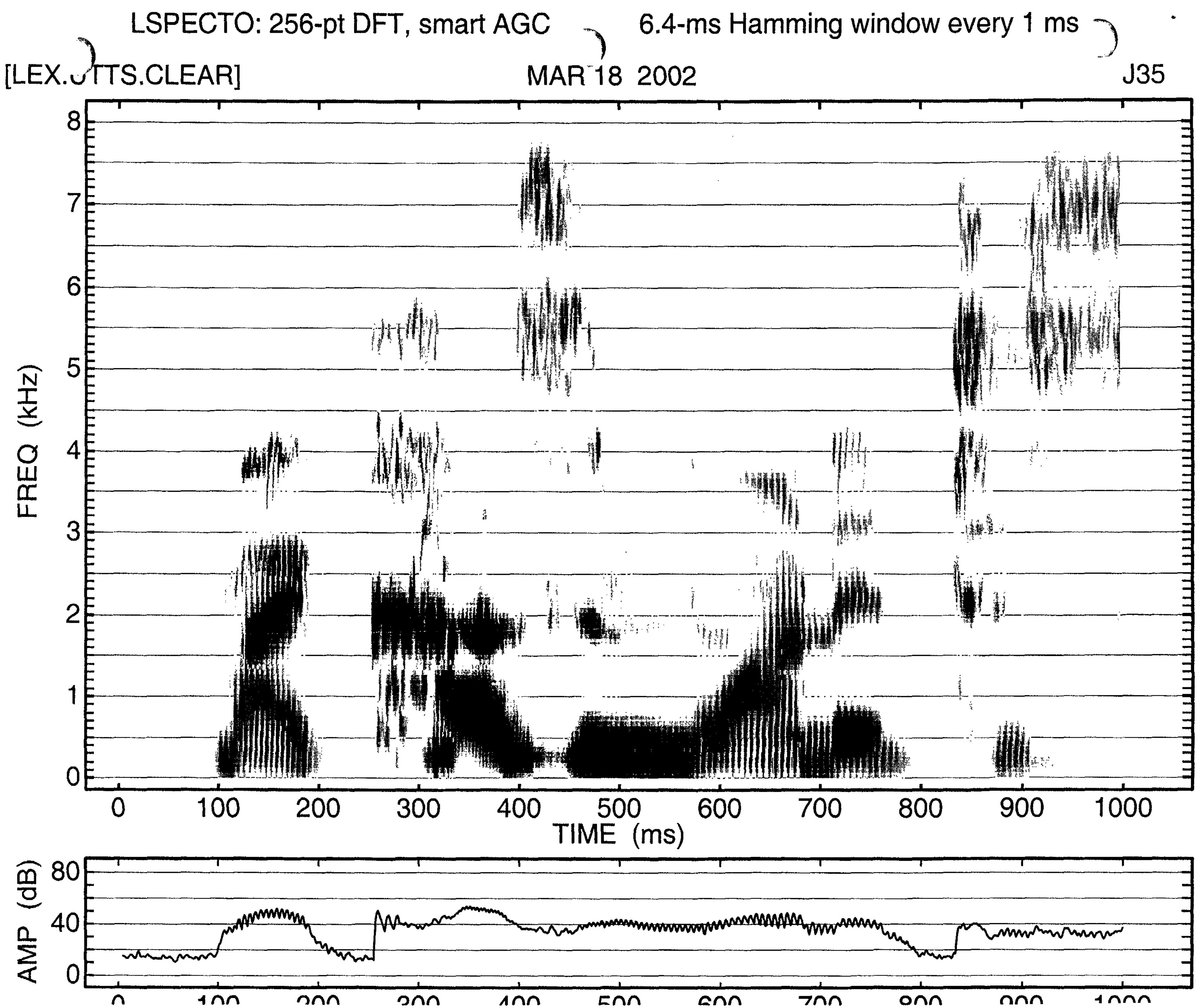
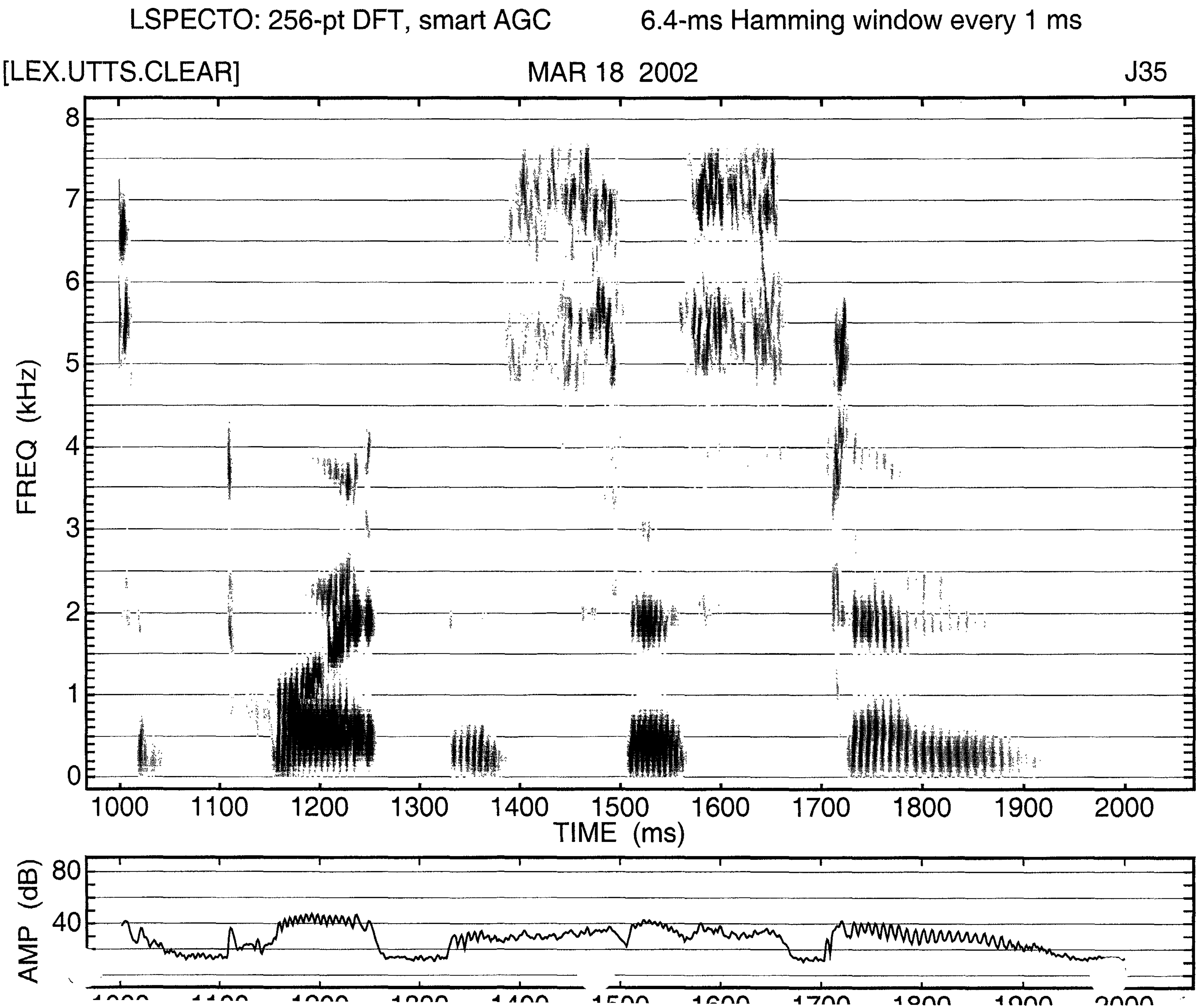
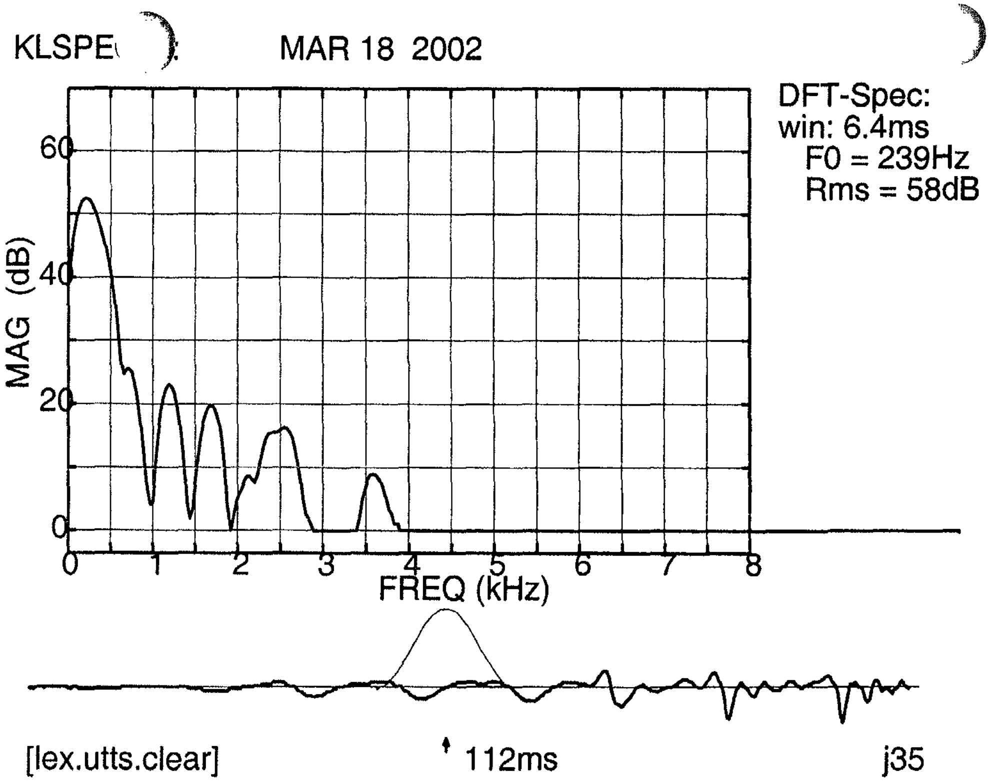
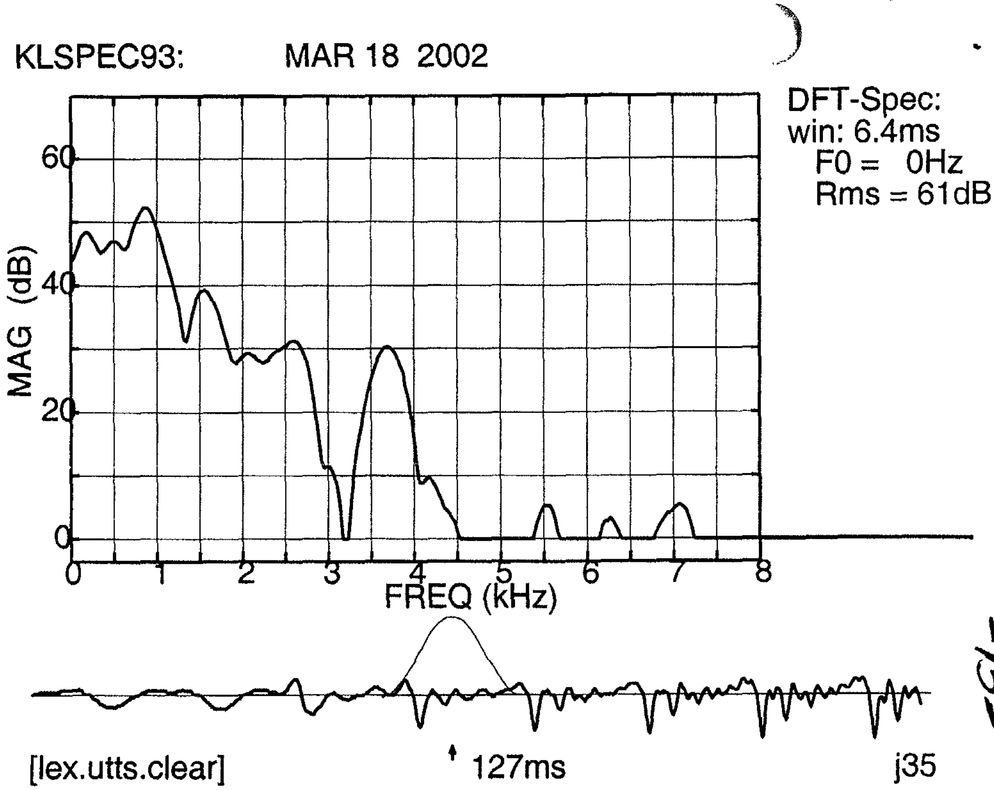


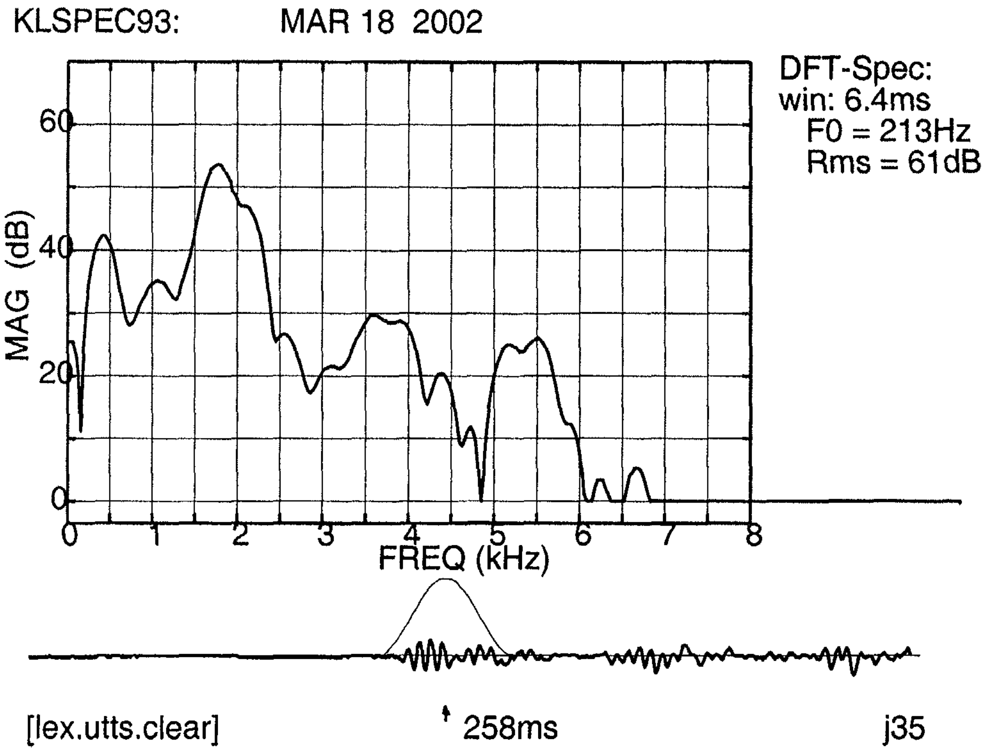
Figure 4.33 Results of the matching experiments in which the frequency F^* of a one-formant vowel is adjusted to match a two-formant vowel. The spacing between the two formant frequencies (shown by dashed lines) is less than 3.5 bark for the left column and more than 3.5 bark for the right column. The points give the mean and a measure of variability for the judgments as a function of the relative amplitude A_2/A_1 of the formant peaks for two subjects: L.C. (top) and V.L. (bottom). (From Chistovich and Lublinskaya, 1979.)

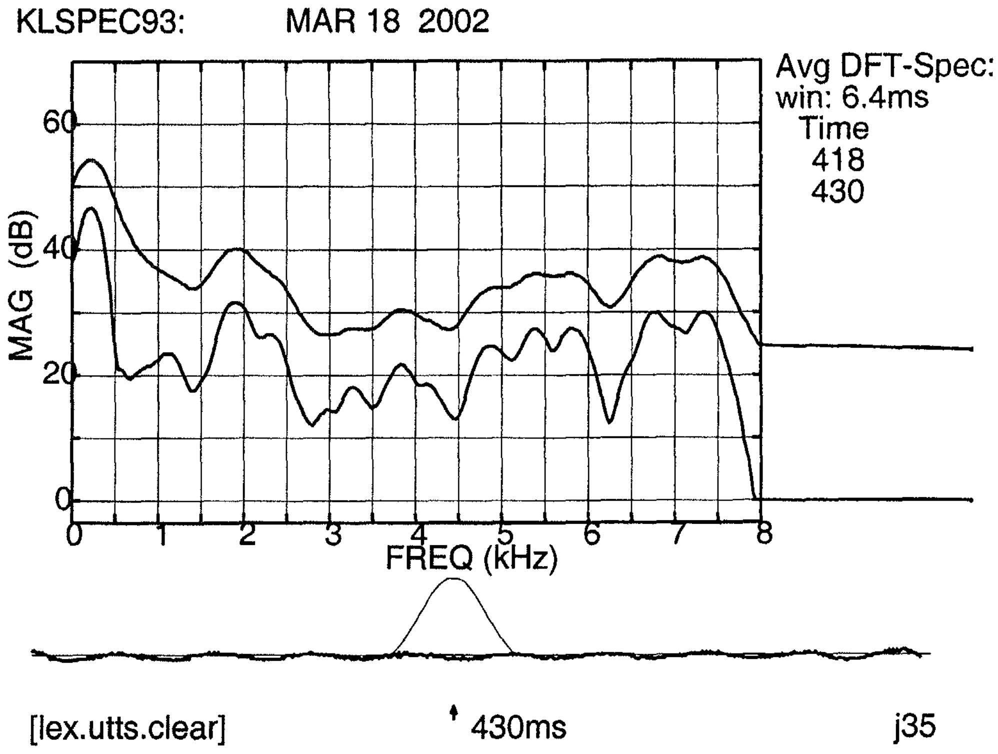

LSPECTO: 256-pt DFT, smart AGC
6.4-ms Hamming window every 1 ms
[LEX.JTTS.CLEAR]
MAR 18 2002
J35
FREQ (kHz)
TIME (ms)
AMP (dB)

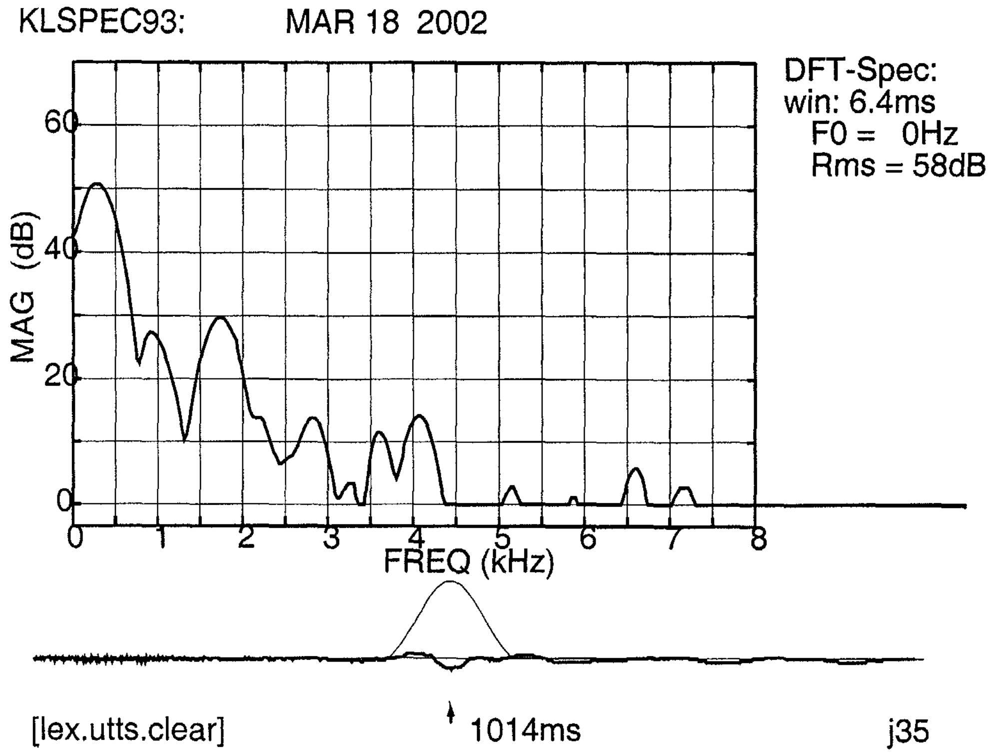

LSPECTO: 256-pt DFT, smart AGC
6.4-ms Hamming window every 1 ms
[LEX.UTTS.CLEAR]
MAR 18 2002
J35
FREQ (kHz)
8
7
6
5
4
3
2
1
0
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
TIME (ms)
AMP (dB)
80
40

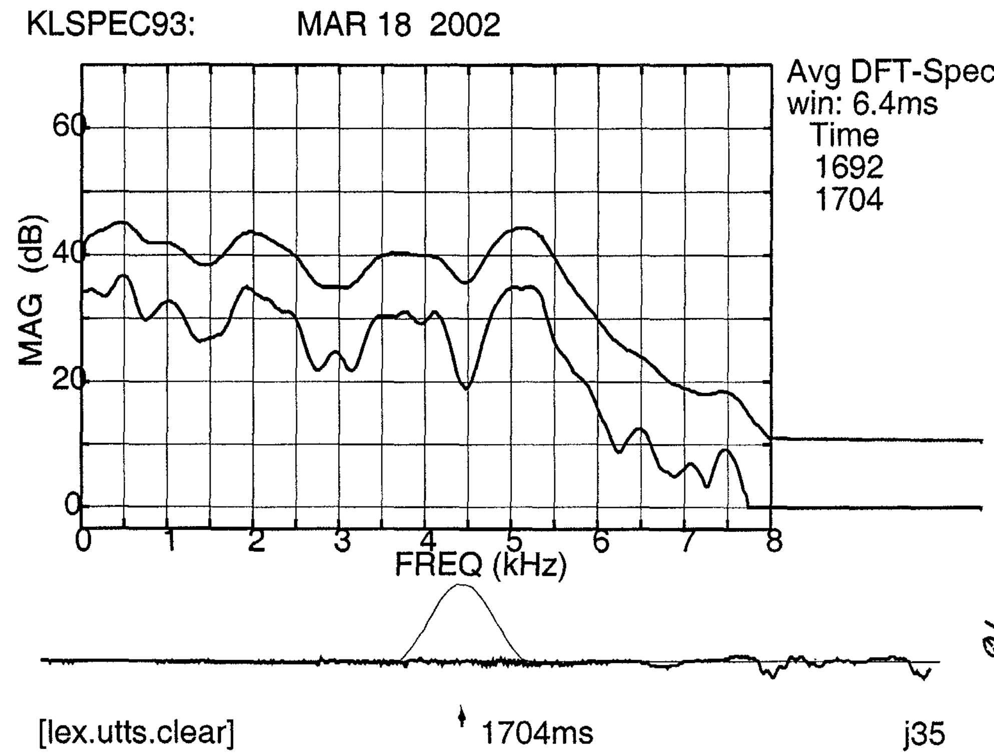

KLSPE
MAR 18 2002
DFT-Spec:
win: 6.4ms
F0 = 239Hz
Rms = 58dB
MAG (dB)
60
40
20
0
0
1
2
3
4
5
6
7
8
FREQ (kHz)
[lex.utts.clear]
112ms
j35

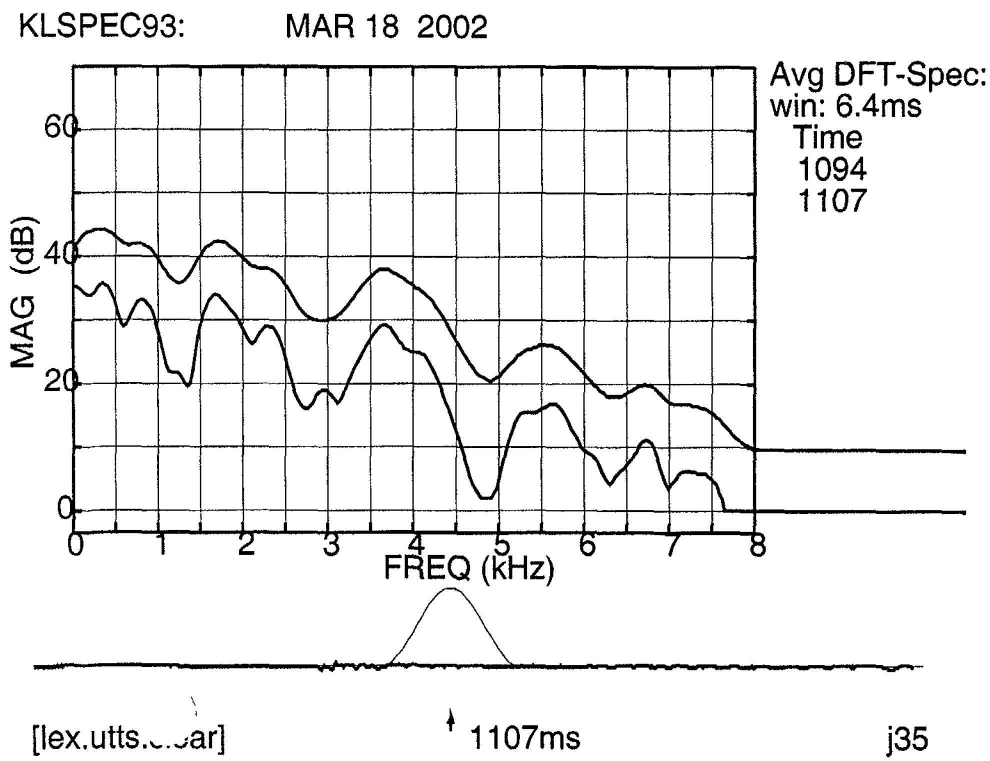

KLSPEC93:
MAR 18 2002
DFT-Spec:
win: 6.4ms
F0 = 0Hz
Rms = 61dB
MAG (dB)
60
40
20
0
0
1
2
3
4
5
6
7
8
FREQ (kHz)
[lex.utts.clear]
127ms
j35


KLSPEC93:
MAR 18 2002
DFT-Spec:
win: 6.4ms
F0 = 213Hz
Rms = 61dB
MAG (dB)
60
40
20
0
0
1
2
3
4
5
6
7
8
FREQ (kHz)
[lex.utts.clear]
258ms
j35


KLSPEC93:
MAR 18 2002
Avg DFT-Spec:
win: 6.4ms
Time
418
430
MAG (dB)
60
40
20
0
0
1
2
3
4
5
6
7
8
FREQ (kHz)
[lex.utts.clear]
430ms
j35

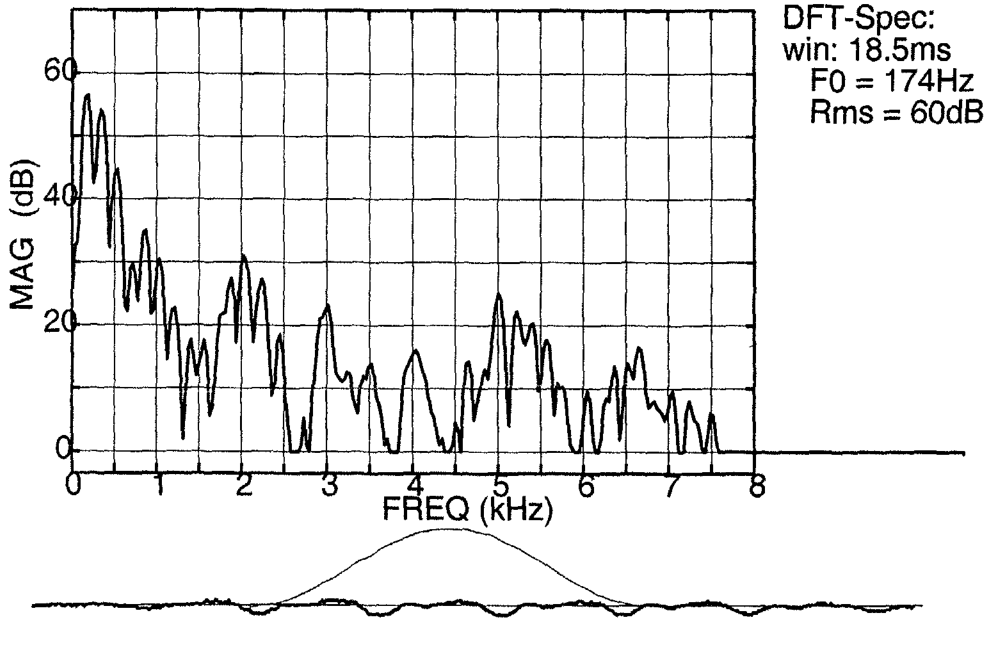

KLSPEC93: MAR 18 2002
DFT-Spec:
win: 6.4ms
F0 = 0Hz
Rms = 58dB
MAG (dB)
60
40
20
0
0 1 2 3 4 5 6 7 8
FREQ (kHz)
[lex.utts.clear]
1014ms
j35


KLSPEC93: MAR 18 2002
Avg DFT-Spec:
win: 6.4ms
Time
1692
1704
MAG (dB)
60
40
20
0
0 1 2 3 4 5 6 7 8
FREQ (kHz)
[lex.utts.clear]
1704ms
j35


KLSPEC93: MAR 18 2002
Avg DFT-Spec:
win: 6.4ms
Time
1094
1107
MAG (dB)
60
40
20
0
0 1 2 3 4 5 6 7 8
FREQ (kHz)
1107ms
j35

KLSPEC93: MAR 19 2002

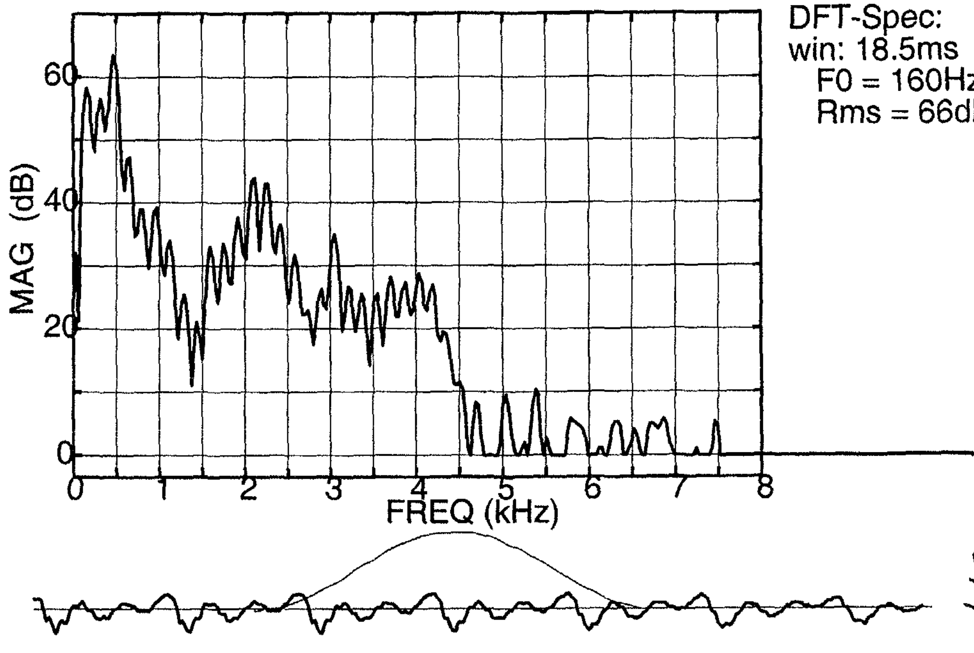
DFT-Spec:
win: 18.5ms
F0 = 174Hz
Rms = 60dB



[lex.utts.clear] 882ms j35

KLSPEC93: MAR 19 2002

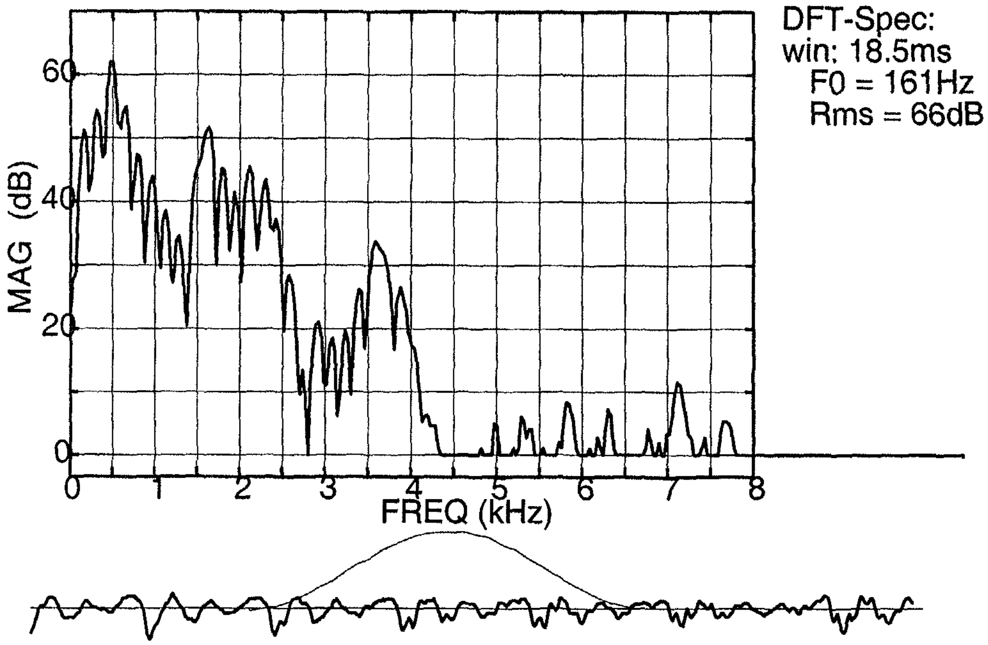
DFT-Spec:
win: 18.5ms
F0 = 160Hz
Rms = 66dB



[lex.utts.clear] 735ms j35

KLSPEC93: MAR 19 2002

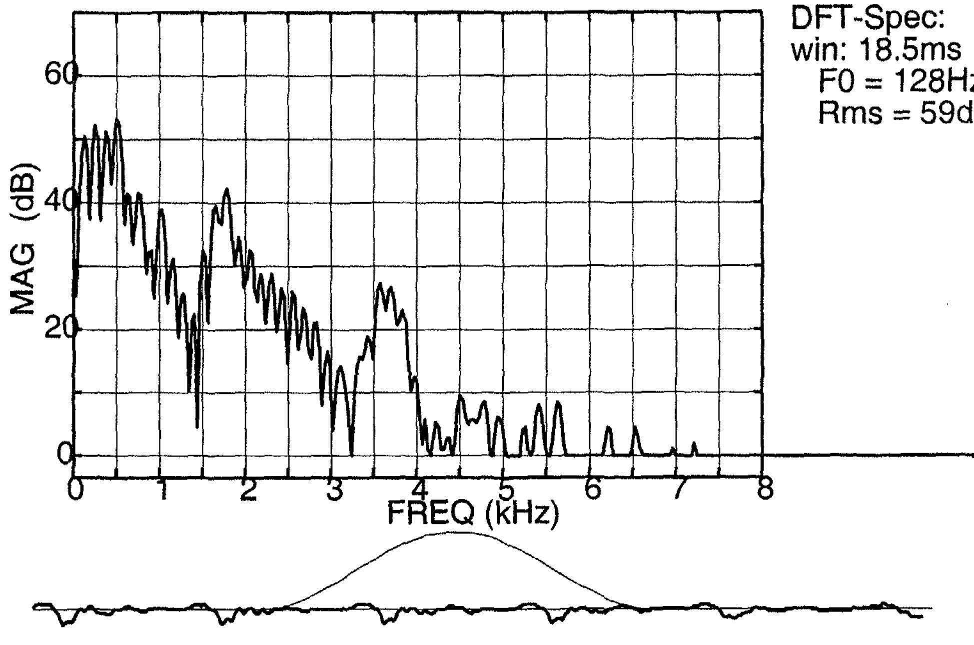
DFT-Spec:
win: 18.5ms
F0 = 161Hz
Rms = 66dB



[lex.utts.clear] 1208ms j35

KLSPEC93: MAR 19 2002

DFT-Spec:
win: 18.5ms
F0 = 128Hz
Rms = 59dB



[lex.utts.clear] 1759ms j35