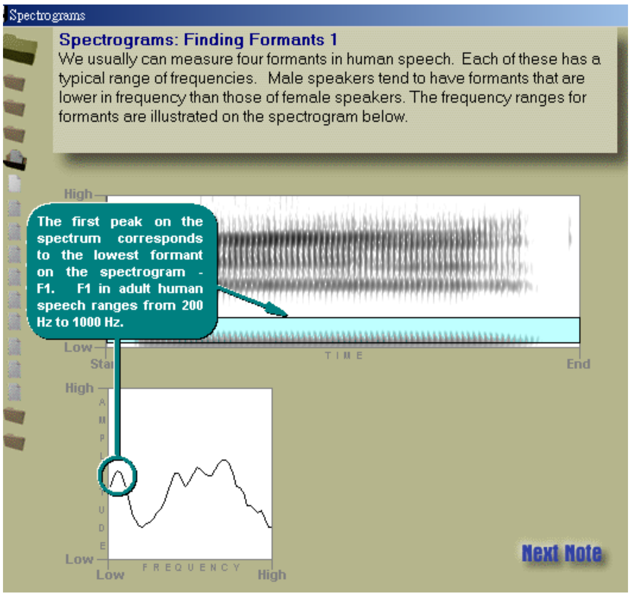
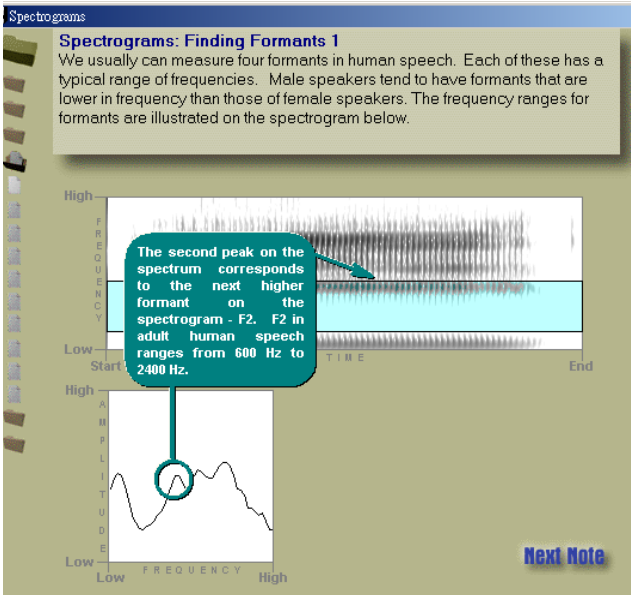
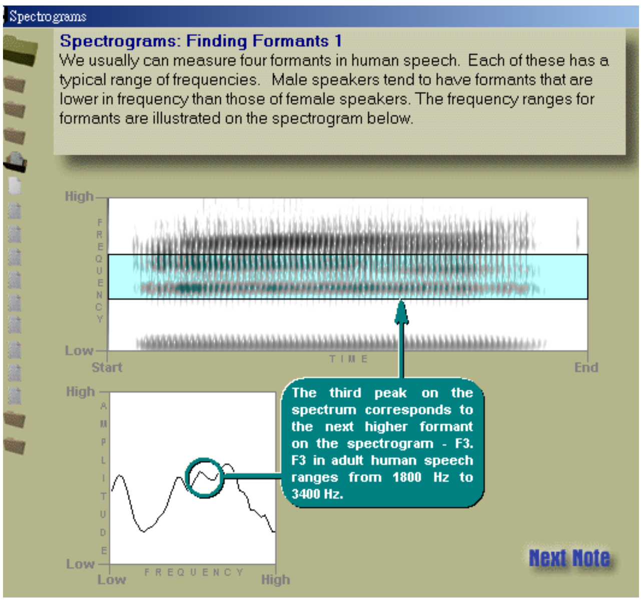
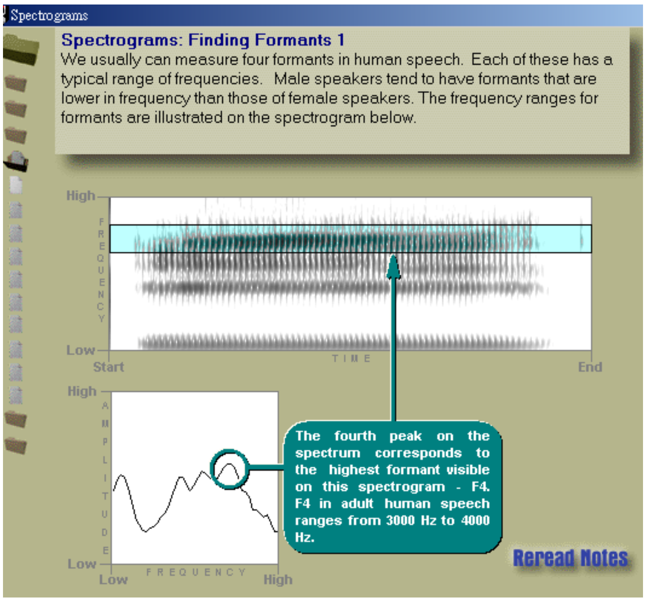
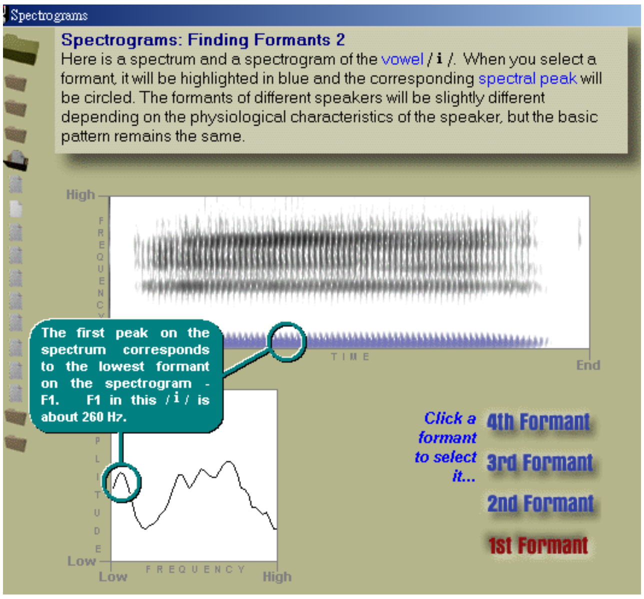
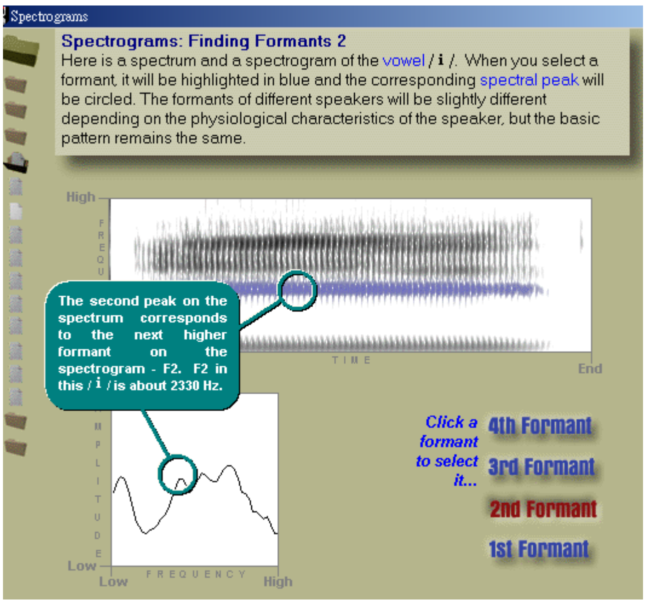

Spectrograms
Spectrograms: Finding Formants 1
We usually can measure four formants in human speech. Each of these has a typical range of frequencies. Male speakers tend to have formants that are lower in frequency than those of female speakers. The frequency ranges for formants are illustrated on the spectrogram below.
The first peak on the spectrum corresponds to the lowest formant on the spectrogram - F1. F1 in adult human speech ranges from 200 Hz to 1000 Hz.
High
Low
TIME
End
High
Low
FREQUENCY
Low
High
Next Note

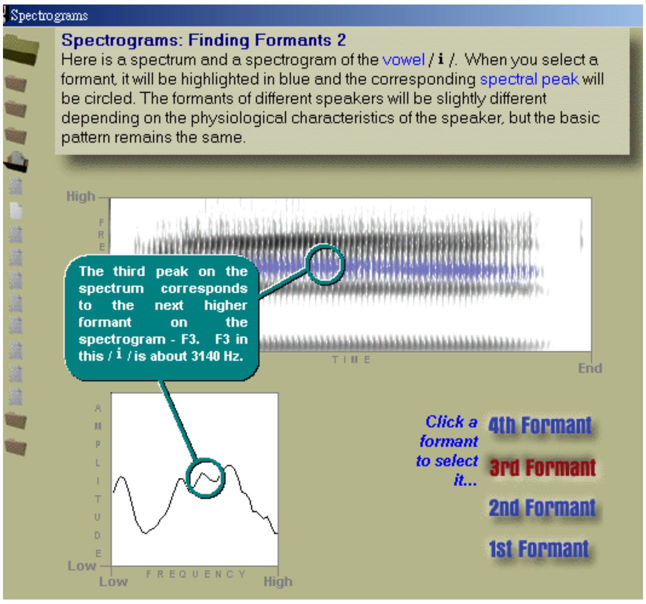

Spectrograms
Spectrograms: Finding Formants 1
We usually can measure four formants in human speech. Each of these has a typical range of frequencies. Male speakers tend to have formants that are lower in frequency than those of female speakers. The frequency ranges for formants are illustrated on the spectrogram below.
The second peak on the spectrum corresponds to the next higher formant on the spectrogram - F2. F2 in adult human speech ranges from 600 Hz to 2400 Hz.
High
FREQUENCY
Low
Start
TIME
End
High
Low
FREQUENCY
Low
High
Next Note


Spectrograms
Spectrograms: Finding Formants 1
We usually can measure four formants in human speech. Each of these has a typical range of frequencies. Male speakers tend to have formants that are lower in frequency than those of female speakers. The frequency ranges for formants are illustrated on the spectrogram below.
High
FREQUENCY
Low
Start
TIME
End
The third peak on the spectrum corresponds to the next higher formant on the spectrogram - F3. F3 in adult human speech ranges from 1800 Hz to 3400 Hz.
High
Low
FREQUENCY
Low
High
Next Note


Spectrograms
Spectrograms: Finding Formants 1
We usually can measure four formants in human speech. Each of these has a typical range of frequencies. Male speakers tend to have formants that are lower in frequency than those of female speakers. The frequency ranges for formants are illustrated on the spectrogram below.
High
FREQUENCY
Low
Start
TIME
End
High
AMPLITUDE
Low
Low
FREQUENCY
High
The fourth peak on the spectrum corresponds to the highest formant visible on this spectrogram - F4. F4 in adult human speech ranges from 3000 Hz to 4000 Hz.
Reread Notes


Spectrograms
Spectrograms: Finding Formants 2
Here is a spectrum and a spectrogram of the vowel / i /. When you select a formant, it will be highlighted in blue and the corresponding spectral peak will be circled. The formants of different speakers will be slightly different depending on the physiological characteristics of the speaker, but the basic pattern remains the same.
High
TIME
End
The first peak on the spectrum corresponds to the lowest formant on the spectrogram - F1. F1 in this / i / is about 260 Hz.
Click a formant to select it...
4th Formant
3rd Formant
2nd Formant
1st Formant
Low
Low
FREQUENCY
High


Spectrograms
Spectrograms: Finding Formants 2
Here is a spectrum and a spectrogram of the vowel / i /. When you select a formant, it will be highlighted in blue and the corresponding spectral peak will be circled. The formants of different speakers will be slightly different depending on the physiological characteristics of the speaker, but the basic pattern remains the same.
High
TIME
End
The second peak on the spectrum corresponds to the next higher formant on the spectrogram - F2. F2 in this / i / is about 2330 Hz.
Click a formant to select it...
4th Formant
3rd Formant
2nd Formant
1st Formant
Low
Low
FREQUENCY
High


Spectrograms
Spectrograms: Finding Formants 2
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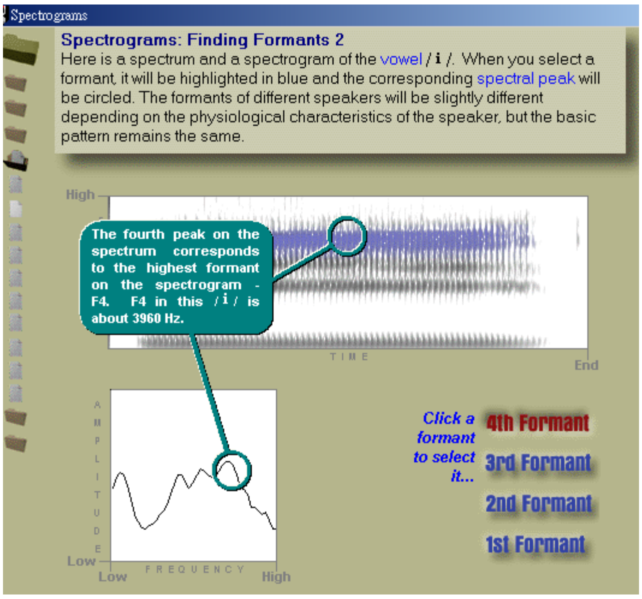
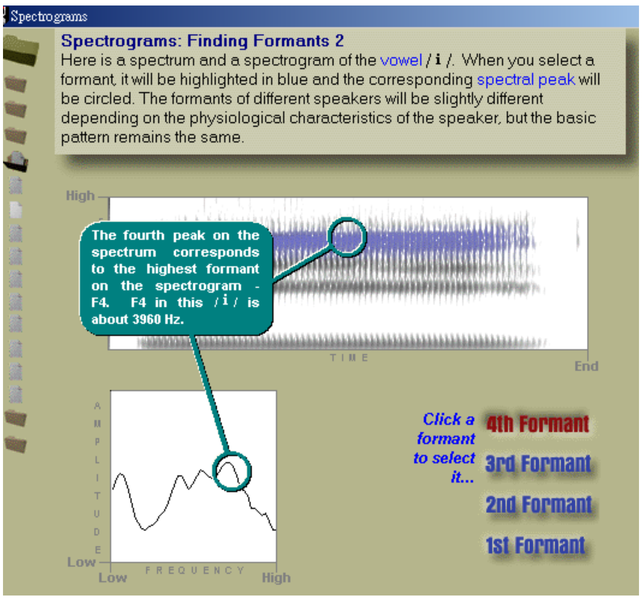
High
FREQUENCY
TIME
End
The third peak on the spectrum corresponds to the next higher formant on the spectrogram - F3. F3 in this / i / is about 3140 Hz.
AMPLITUDE
Low
Low
FREQUENCY
High
Click a formant to select it...
4th Formant
3rd Formant
2nd Formant
1st Formant

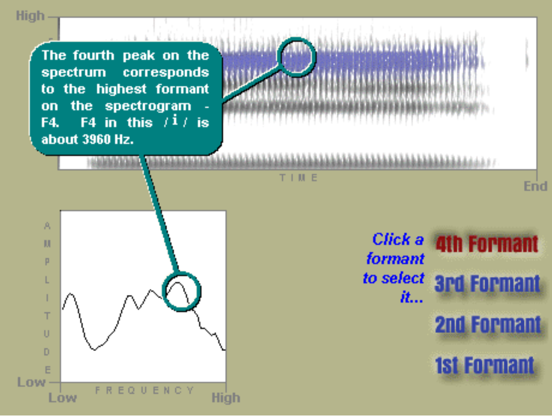

Spectrograms
Spectrograms: Finding Formants 2
Here is a spectrum and a spectrogram of the vowel / i /. When you select a formant, it will be highlighted in blue and the corresponding spectral peak will be circled. The formants of different speakers will be slightly different depending on the physiological characteristics of the speaker, but the basic pattern remains the same.
High
TIME
End
The fourth peak on the spectrum corresponds to the highest formant on the spectrogram - F4. F4 in this / i / is about 3960 Hz.
AMPLITUDE
Low
Low
FREQUENCY
High
Click a formant to select it...
4th Formant
3rd Formant
2nd Formant
1st Formant


Spectrograms
Spectrograms: Finding Formants 2
Here is a spectrum and a spectrogram of the vowel / i /. When you select a formant, it will be highlighted in blue and the corresponding spectral peak will be circled. The formants of different speakers will be slightly different depending on the physiological characteristics of the speaker, but the basic pattern remains the same.
High
TIME
End
The fourth peak on the spectrum corresponds to the highest formant on the spectrogram - F4. F4 in this / i / is about 3960 Hz.
AMPLITUDE
Low
Low
FREQUENCY
High
Click a formant to select it...
4th Formant
3rd Formant
2nd Formant
1st Formant

Spectrograms

Spectrograms: Finding Formants 2

Here is a spectrum and a spectrogram of the vowel / i /. When you select a formant, it will be highlighted in blue and the corresponding spectral peak will be circled. The formants of different speakers will be slightly different depending on the physiological characteristics of the speaker, but the basic pattern remains the same.



Click a formant to select it...

4th Formant

3rd Formant

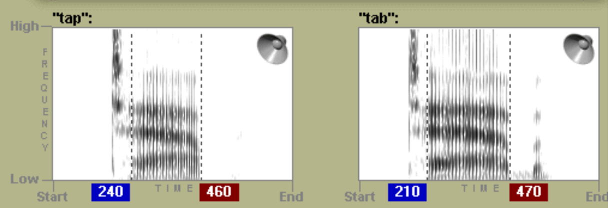
2nd Formant

1st Formant

Spectrograms

Spectrograms: How we use spectrograms (Durational differences) 6

Vowels often indicate important consonant differences, for example, between final consonants. What is the duration of the vowel in "tap"? What is the duration of the vowel in "tab"? Which word has a longer vowel?

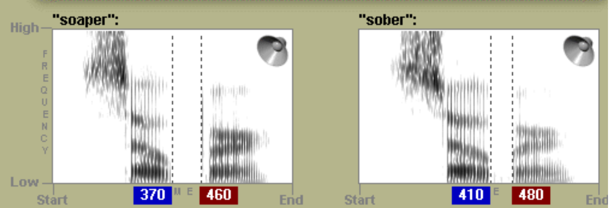


Spectrograms

Spectrograms: How we use spectrograms (Durational differences) 7

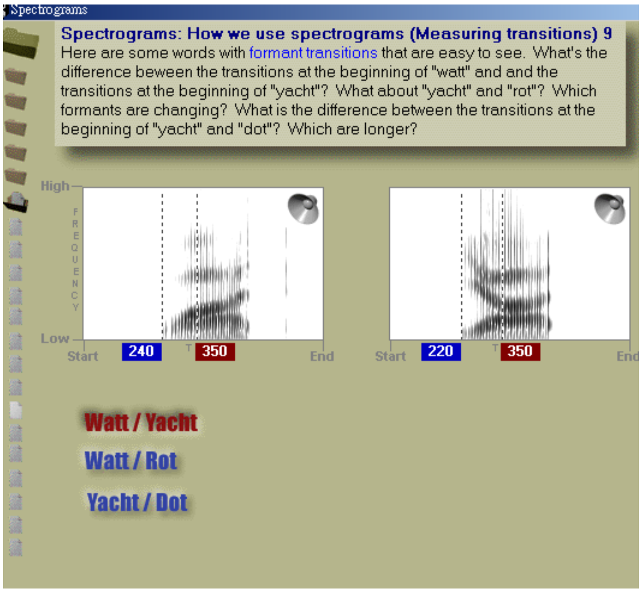
Another durational difference between consonants occurs while the articulators are closed. Compare the durations of the / p /-closure in "soaper" with the duration of the / b /-closure in "sober". Which is longer?

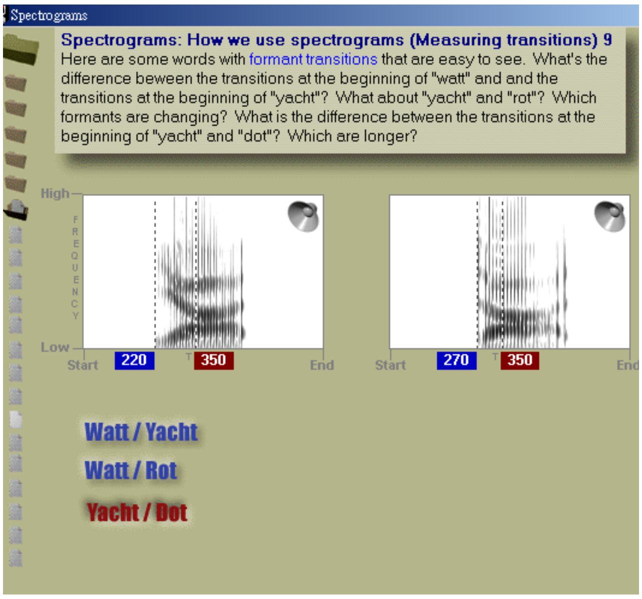
Notice that the durations of the vowels in these words are the same.



Consonant Durations

Vowel Durations


Spectrograms
Spectrograms: How we use spectrograms (Measuring transitions) 9
Here are some words with formant transitions that are easy to see. What's the difference beween the transitions at the beginning of "watt" and and the transitions at the beginning of "yacht"? What about "yacht" and "rot"? Which formants are changing? What is the difference between the transitions at the beginning of "yacht" and "dot"? Which are longer?
High
FREQUENCY
Low
Start
240
350
End
Start
220
350
End
Watt / Yacht
Watt / Rot
Yacht / Dot


Spectrograms
Spectrograms: How we use spectrograms (Measuring transitions) 9
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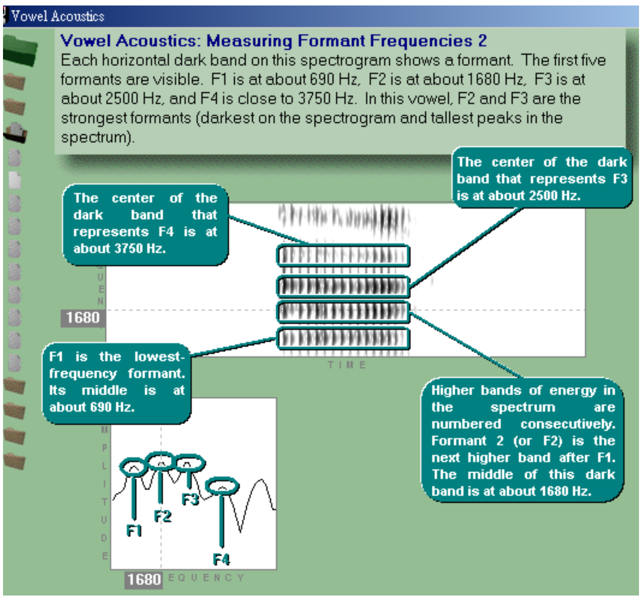
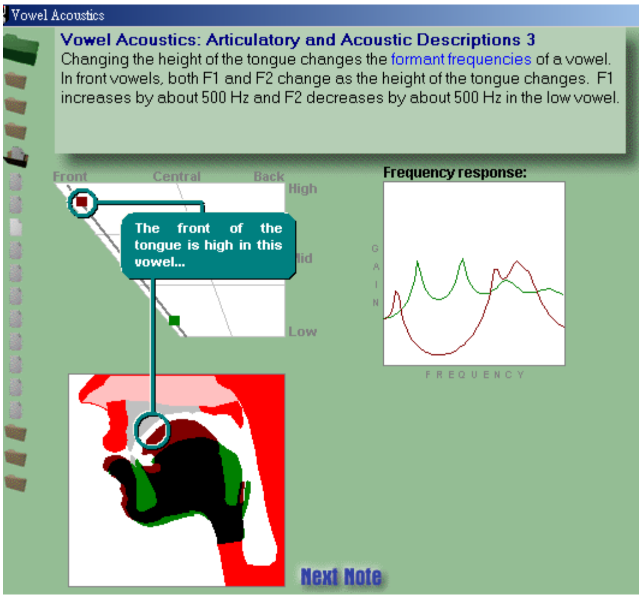
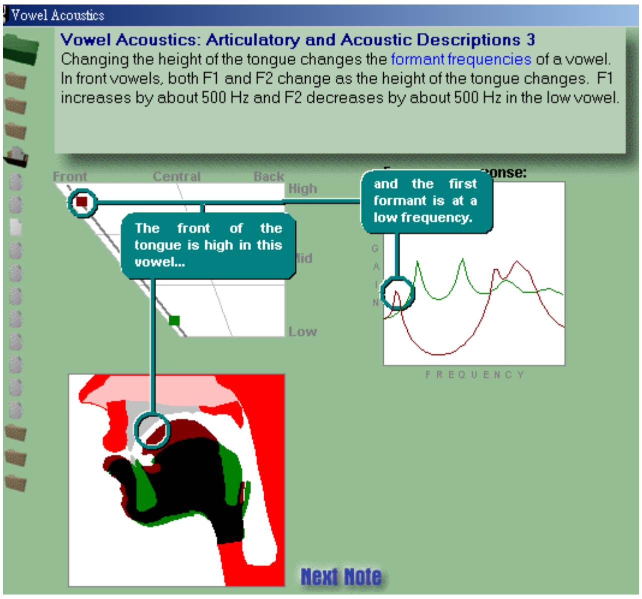
High
FREQUENCY
Low
Start
220
350
End
Start
270
350
End
Watt / Yacht
Watt / Rot
Yacht / Dot


Vowel Acoustics
Vowel Acoustics: Measuring Formant Frequencies 2
Each horizontal dark band on this spectrogram shows a formant. The first five formants are visible. F1 is at about 690 Hz, F2 is at about 1680 Hz, F3 is at about 2500 Hz, and F4 is close to 3750 Hz. In this vowel, F2 and F3 are the strongest formants (darkest on the spectrogram and tallest peaks in the spectrum).
The center of the dark band that represents F3 is at about 2500 Hz.
The center of the dark band that represents F4 is at about 3750 Hz.
1680
TIME
F1 is the lowest-frequency formant. Its middle is at about 690 Hz.
Higher bands of energy in the spectrum are numbered consecutively. Formant 2 (or F2) is the next higher band after F1. The middle of this dark band is at about 1680 Hz.
F1
F2
F3
F4
1680
EQUENCY


Vowel Acoustics
Vowel Acoustics: Articulatory and Acoustic Descriptions 3
Changing the height of the tongue changes the formant frequencies of a vowel. In front vowels, both F1 and F2 change as the height of the tongue changes. F1 increases by about 500 Hz and F2 decreases by about 500 Hz in the low vowel.
Front
Central
Back
High
Mid
Low
The front of the tongue is high in this vowel...
Frequency response:
GAIN
FREQUENCY
Next Note


Vowel Acoustics
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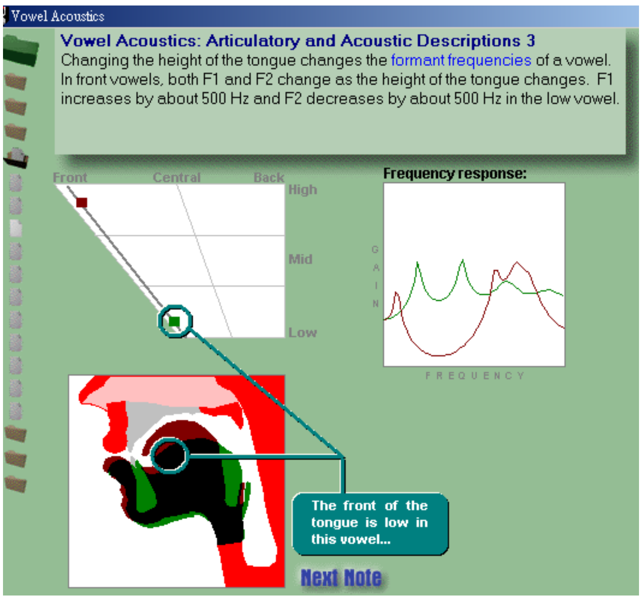
Front
Central
Back
High
Low
The front of the tongue is high in this vowel...
and the first formant is at a low frequency.
FREQUENCY
Next Note


Vowel Acoustics
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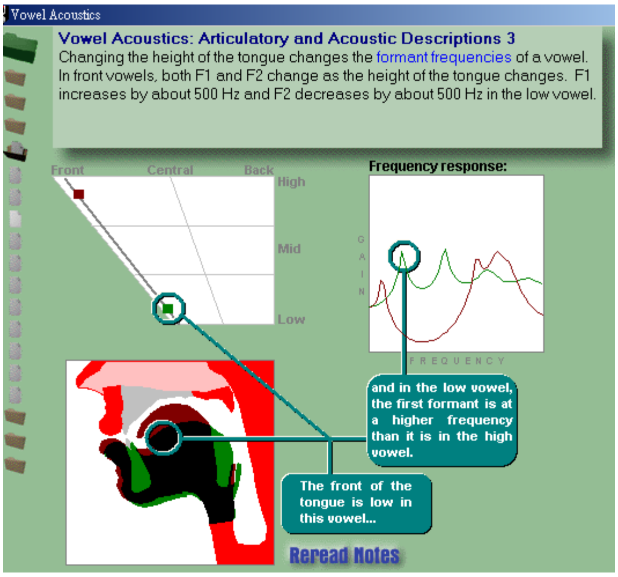
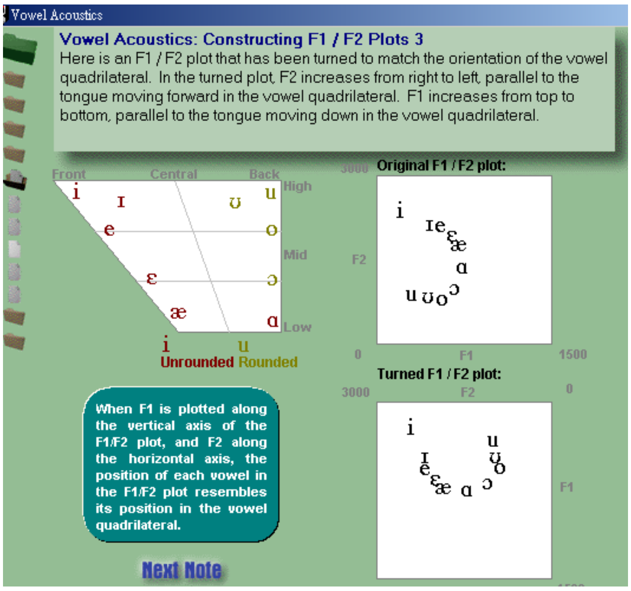
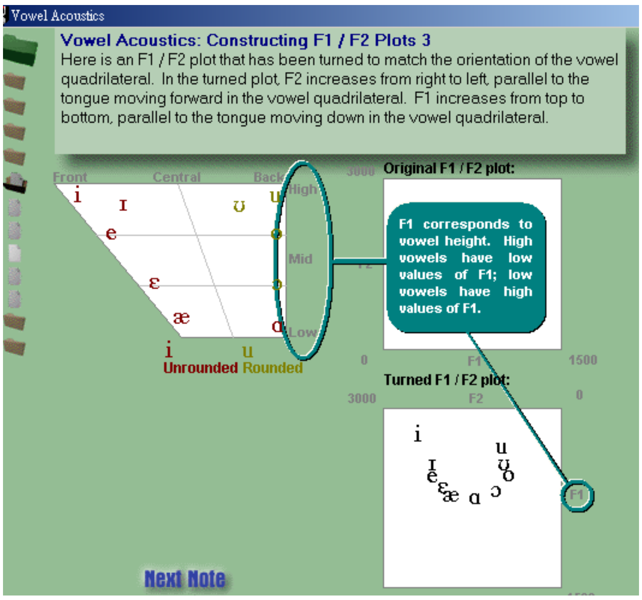
Front
Central
Back
High
Mid
Low
Frequency response:
GAIN
FREQUENCY
The front of the tongue is low in this vowel...
Next Note


Vowel Acoustics
Vowel Acoustics: Articulatory and Acoustic Descriptions 3
Changing the height of the tongue changes the formant frequencies of a vowel. In front vowels, both F1 and F2 change as the height of the tongue changes. F1 increases by about 500 Hz and F2 decreases by about 500 Hz in the low vowel.
Front
Central
Back
High
Mid
Low
Frequency response:
GAIN
FREQUENCY
and in the low vowel, the first formant is at a higher frequency than it is in the high vowel.
The front of the tongue is low in this vowel...
Reread Notes


Vowel Acoustics
Vowel Acoustics: Constructing F1 / F2 Plots 3
Here is an F1 / F2 plot that has been turned to match the orientation of the vowel quadrilateral. In the turned plot, F2 increases from right to left, parallel to the tongue moving forward in the vowel quadrilateral. F1 increases from top to bottom, parallel to the tongue moving down in the vowel quadrilateral.
Front
Central
Back
High
Mid
Low
Unrounded
Rounded
Original F1 / F2 plot:
F2
0
F1
1500
Turned F1 / F2 plot:
3000
F2
0
F1
When F1 is plotted along the vertical axis of the F1/F2 plot, and F2 along the horizontal axis, the position of each vowel in the F1/F2 plot resembles its position in the vowel quadrilateral.
Next Note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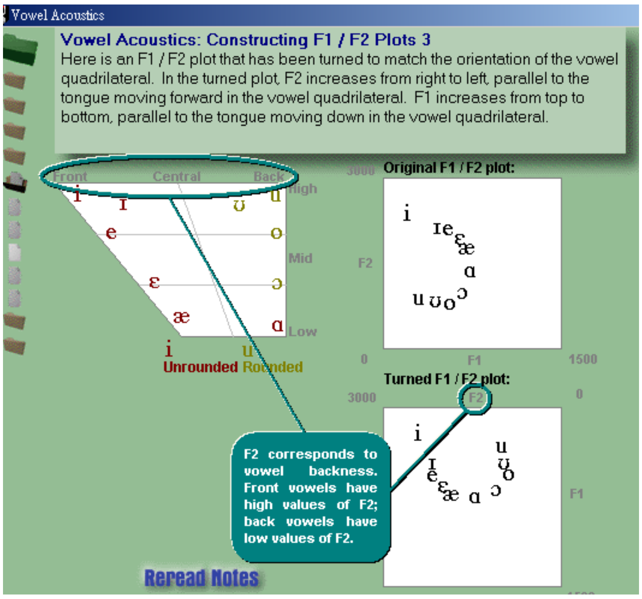
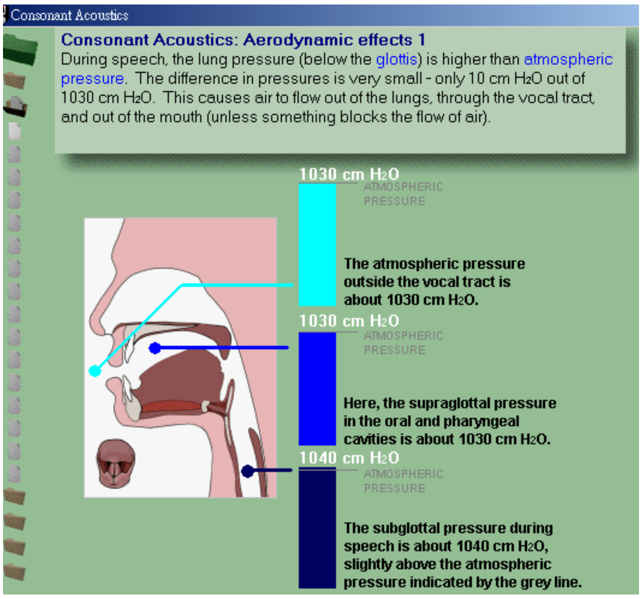
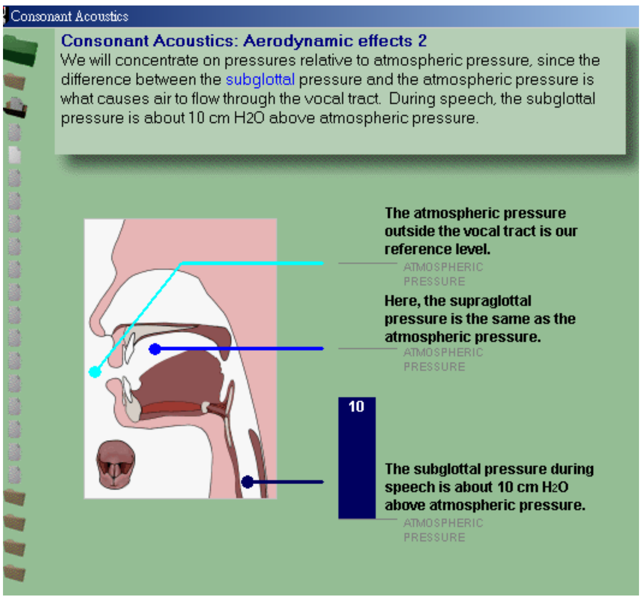
Front
Central
Back
High
Mid
Low
Unrounded
Rounded
Original F1 / F2 plot:
F1 corresponds to vowel height. High vowels have low values of F1; low vowels have high values of F1.
0
F1
1500
Turned F1 / F2 plot:
3000
F2
0
F1
Next Note


Vowel Acoustics
Vowel Acoustics: Constructing F1 / F2 Plots 3
Here is an F1 / F2 plot that has been turned to match the orientation of the vowel quadrilateral. In the turned plot, F2 increases from right to left, parallel to the tongue moving forward in the vowel quadrilateral. F1 increases from top to bottom, parallel to the tongue moving down in the vowel quadrilateral.
Front
Central
Back
High
Mid
Low
Unrounded
Rounded
Original F1 / F2 plot:
3000
F2
0
F1
1500
Turned F1 / F2 plot:
3000
0
F2
F1
F2 corresponds to vowel backness. Front vowels have high values of F2; back vowels have low values of F2.
Reread Notes

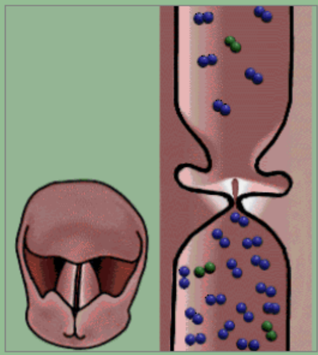

Consonant Acoustics
Consonant Acoustics: Aerodynamic effects 1
During speech, the lung pressure (below the glottis) is higher than atmospheric pressure. The difference in pressures is very small - only 10 cm H2O out of 1030 cm H2O. This causes air to flow out of the lungs, through the vocal tract, and out of the mouth (unless something blocks the flow of air).
1030 cm H2O
ATMOSPHERIC PRESSURE
The atmospheric pressure outside the vocal tract is about 1030 cm H2O.
1030 cm H2O
ATMOSPHERIC PRESSURE
Here, the supraglottal pressure in the oral and pharyngeal cavities is about 1030 cm H2O.
1040 cm H2O
ATMOSPHERIC PRESSURE
The subglottal pressure during speech is about 1040 cm H2O, slightly above the atmospheric pressure indicated by the grey line.


Consonant Acoustics
Consonant Acoustics: Aerodynamic effects 2
We will concentrate on pressures relative to atmospheric pressure, since the difference between the subglottal pressure and the atmospheric pressure is what causes air to flow through the vocal tract. During speech, the subglottal pressure is about 10 cm H2O above atmospheric pressure.
The atmospheric pressure outside the vocal tract is our reference level.
ATMOSPHERIC PRESSURE
Here, the supraglottal pressure is the same as the atmospheric pressure.
ATMOSPHERIC PRESSURE
10
The subglottal pressure during speech is about 10 cm H2O above atmospheric pressure.
ATMOSPHERIC PRESSURE

Consonant Acoustics

Consonant Acoustics: Aerodynamic effects 4

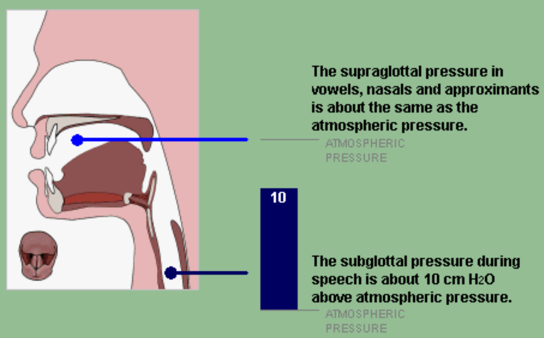
As the vocal folds vibrate, air flows through the glottis (the opening between the folds). As the glottis changes size, the air flow through it fluctuates, producing sound. The sound produced by vibrating vocal folds is phonation or voicing. This animation shows air molecules flowing from the subglottal region of higher pressure to the supraglottal region of lower pressure.



Consonant Acoustics

Consonant Acoustics: Aerodynamic effects 5

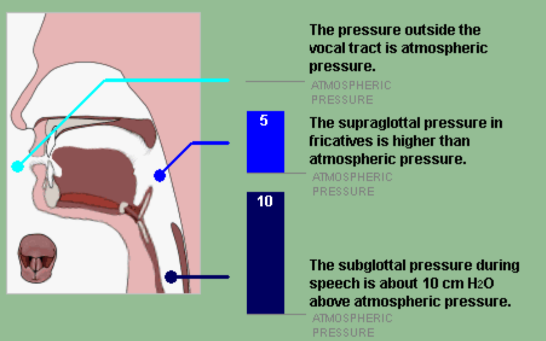
In a vowel, a nasal stop, or an approximant, the airflow out of the vocal tract is not blocked. Thus, air flows freely out of the vocal tract, and the supraglottal air pressure is about equal to the atmospheric pressure.



Consonant Acoustics

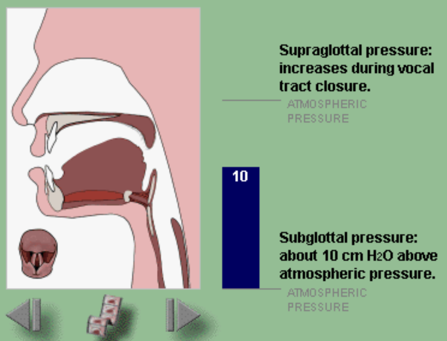
Consonant Acoustics: Aerodynamic effects 7

In a fricative, the constriction of the vocal tract produces a resistance to the airflow, just as pinching a garden hose creates a resistance to the flow of water. This decreases the total airflow in the vocal tract and creates an increase in the supraglottal pressure. The flow through the narrow constriction also becomes turbulent, producing fricative noise.



Consonant Acoustics: Aerodynamic effects 9

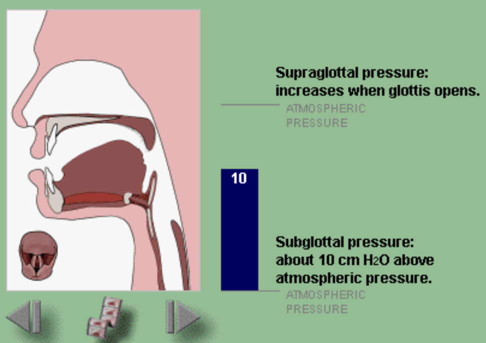
In a voiced oral stop, the articulation completely blocks the flow of air. This causes the air flowing through the glottis to collect in the oral and pharyngeal cavities, raising the supraglottal air pressure. This increase begins before articulatory closure - it begins when the articulators constrict the vocal tract enough to produce a resistance to the airflow.



Consonant Acoustics

Consonant Acoustics: Aerodynamic effects 11

In a voiceless stop, the vocal folds abduct immediately after the oral closure. This opens the glottis, allowing air to flow freely from the trachea into the pharynx. This causes the supraglottal pressure to rise immediately, bringing phonation to a halt.



Consonant Acoustics

Consonant Acoustics: Aerodynamic effects 12

Notes:

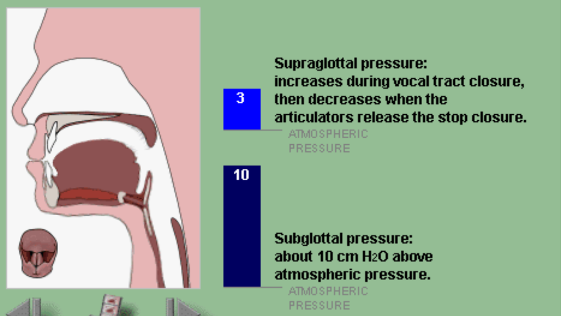
Constriction of the vocal tract affects airflow through the vocal tract and voicing:

- **Constricting the vocal tract reduces the amount of air that can flow through the vocal tract from the lungs. Constricting the vocal tract creates a supraglottal pressure build-up.**
- **Fricatives are produced when the airflow through the vocal tract is highly constricted.**
- **Constricting the vocal tract decreases the amplitude of vibration of the vocal folds by raising the supraglottal pressure.**

Consonant Acoustics

Consonant Acoustics: Aerodynamic effects 13

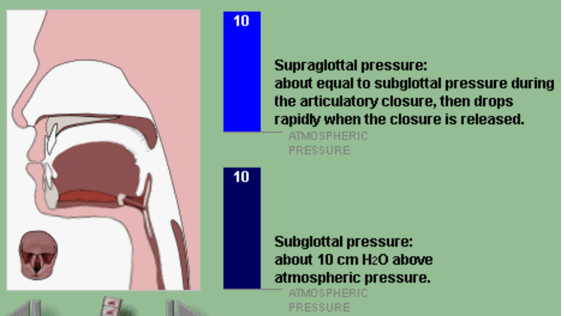
When the stop articulation in a voiced oral stop is released, the high-pressure air in the oral and pharyngeal cavities is released, producing a burst. As the high supraglottal pressure drops, voicing begins again since the vocal folds are in the adducted position.



Consonant Acoustics

Consonant Acoustics: Aerodynamic effects 14

In a voiceless stop, the glottis is generally fully open, since the vocal folds are abducted. Although the supraglottal pressure drops (producing a burst) as soon as the articulators release the closure, voicing does not resume until the vocal folds return to their adducted position.



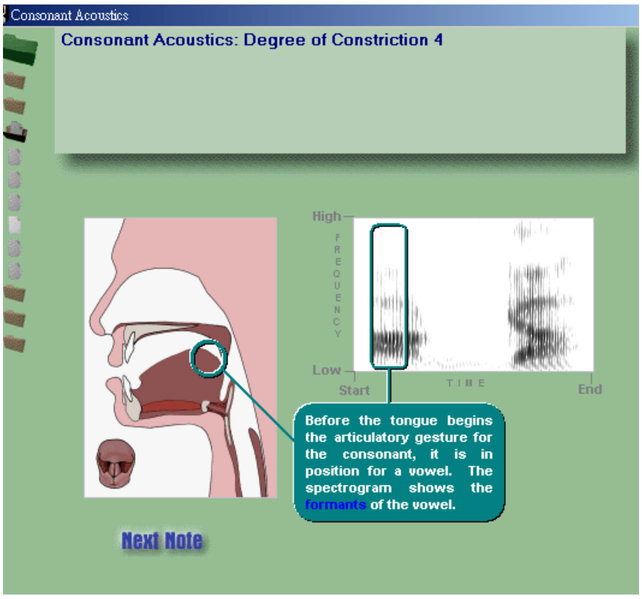
Consonant Acoustics

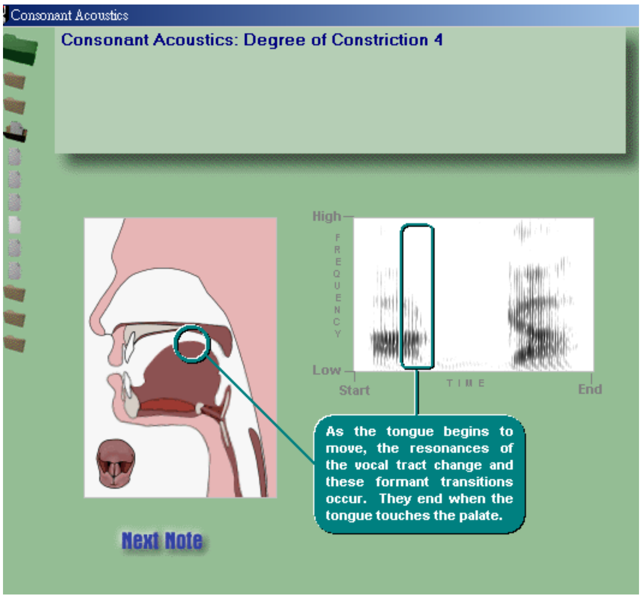
Consonant Acoustics: Aerodynamic effects 15

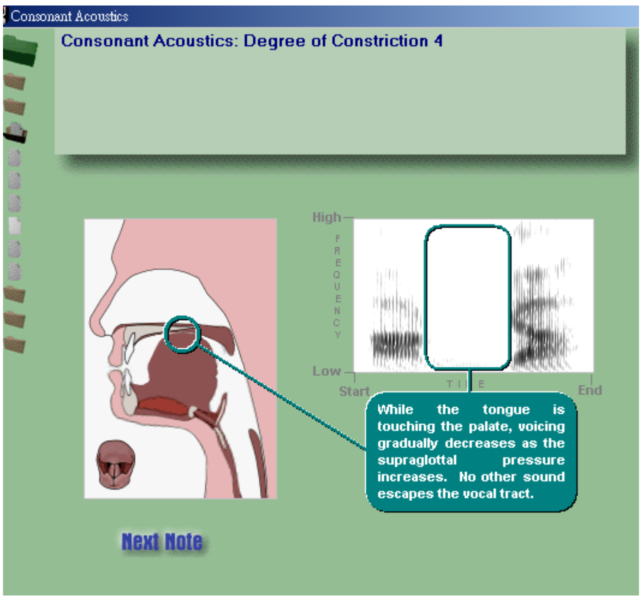
Notes:

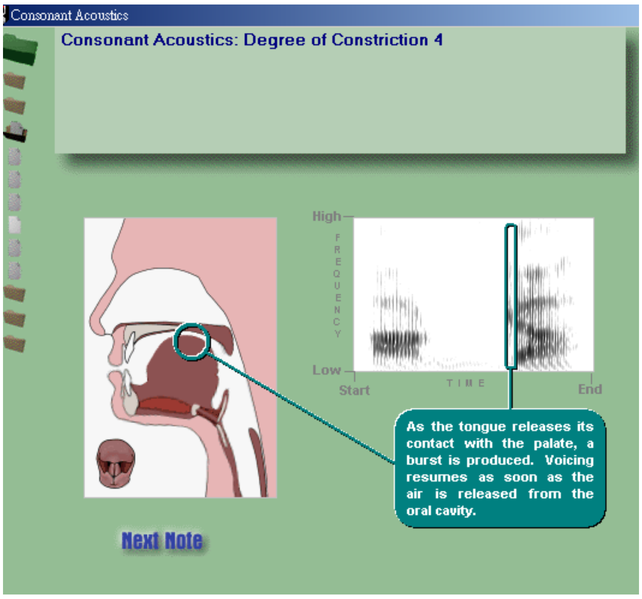
Airflow through the vocal tract resumes when a stop articulation is released:

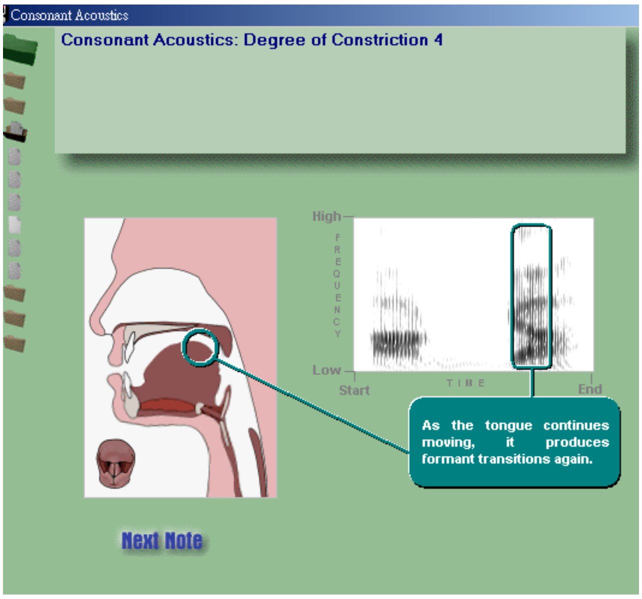
- **The supraglottal pressure build-up is released rapidly, creating a burst.**
- **If the vocal folds are already adducted, voicing resumes immediately.**
- **In a voiceless stop, the vocal folds are abducted. Voicing does not resume until the vocal folds are adducted again.**

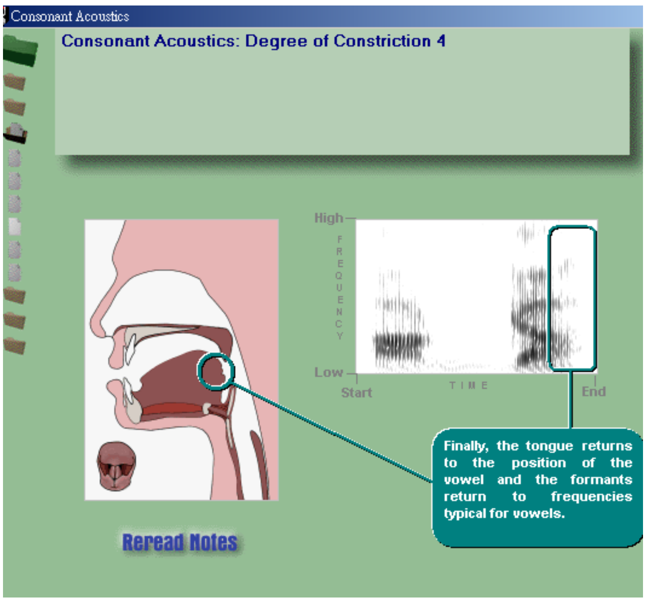

Consonant Acoustics
Consonant Acoustics: Degree of Constriction 4
High
FREQUENCY
Low
Start
TIME
End
Before the tongue begins the articulatory gesture for the consonant, it is in position for a vowel. The spectrogram shows the formants of the vowel.
Next Note


Consonant Acoustics
Consonant Acoustics: Degree of Constriction 4
High
FREQUENCY
Low
Start
TIME
End
As the tongue begins to move, the resonances of the vocal tract change and these formant transitions occur. They end when the tongue touches the palate.
Next Note


Consonant Acoustics
Consonant Acoustics: Degree of Constriction 4
High
FREQUENCY
Low
Start
TIME
End
While the tongue is touching the palate, voicing gradually decreases as the supraglottal pressure increases. No other sound escapes the vocal tract.
Next Note


Consonant Acoustics
Consonant Acoustics: Degree of Constriction 4
High
FREQUENCY
Low
Start
TIME
End
As the tongue releases its contact with the palate, a burst is produced. Voicing resumes as soon as the air is released from the oral cavity.
Next Note


Consonant Acoustics
Consonant Acoustics: Degree of Constriction 4
High
FREQUENCY
Low
Start
TIME
End
As the tongue continues moving, it produces formant transitions again.
Next Note


Consonant Acoustics
Consonant Acoustics: Degree of Constriction 4
High
FREQUENCY
Low
Start
TIME
End
Finally, the tongue returns to the position of the vowel and the formants return to frequencies typical for vowels.
Reread Notes

Consonant Acoustics

Consonant Acoustics: Degree of Constriction 5

Notes:

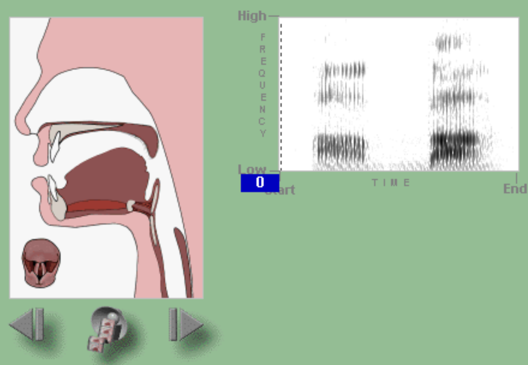
Consonant articulation produces acoustic results:

- **Changing the configuration of the articulators in the vocal tract results in formant transitions.**
- **Turbulent noise occurs when the vocal tract is highly constricted. It is an additional sound source in fricatives.**
- **Bursts occur when the articulators release a vocal tract closure. Bursts are an additional sound source in stops.**
- **While the articulators have closed the vocal tract, an interval of near-silence occurs. But the articulatory gesture begins before and lasts after the closure.**

Consonant Acoustics

Consonant Acoustics: Nasalization 1

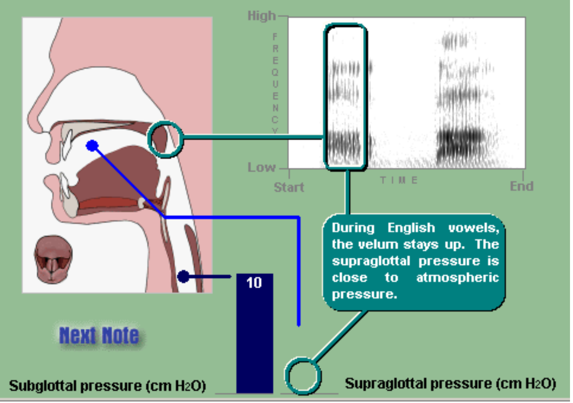
Here is an animation of the articulation of a voiced bilabial oral stop / **b** /. Notice that the velum stays raised during this stop. In fact, sometimes the increased oral cavity pressure during an oral stop consonant appears to push the soft palate and velum up.

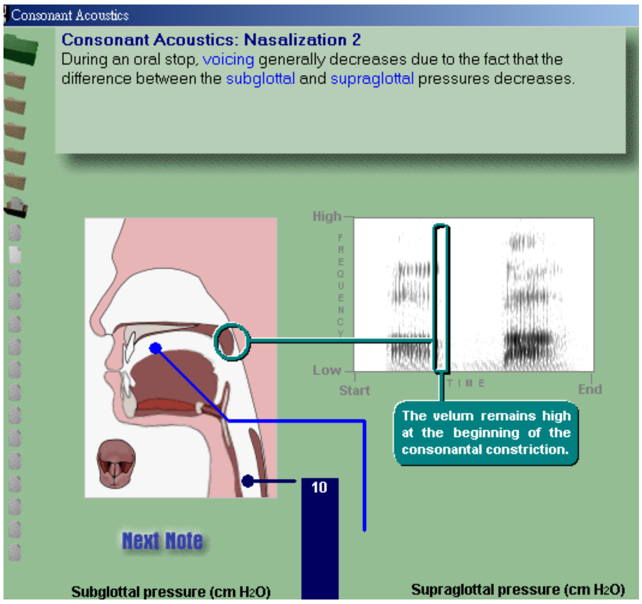


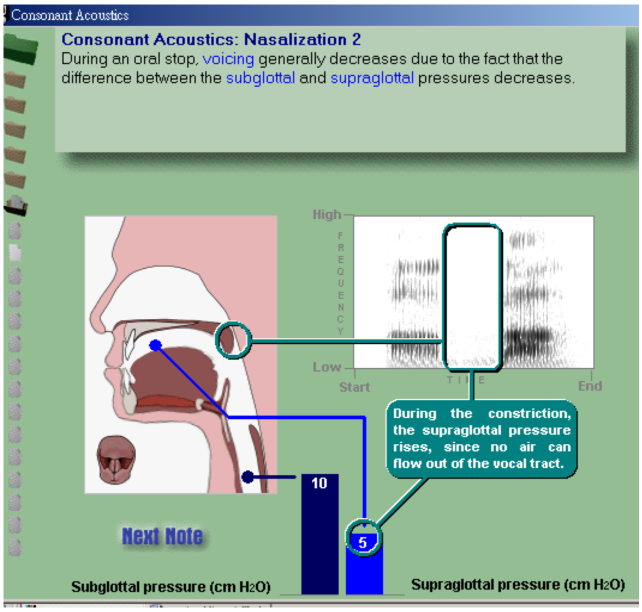
Consonant Acoustics

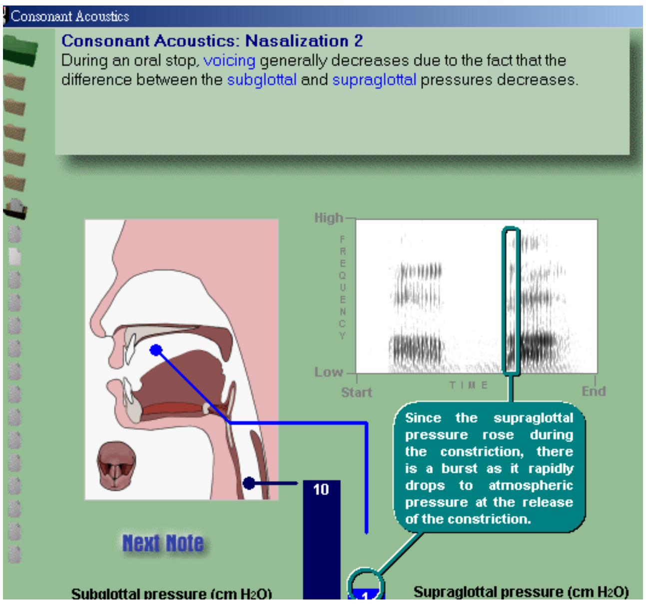
Consonant Acoustics: Nasalization 2

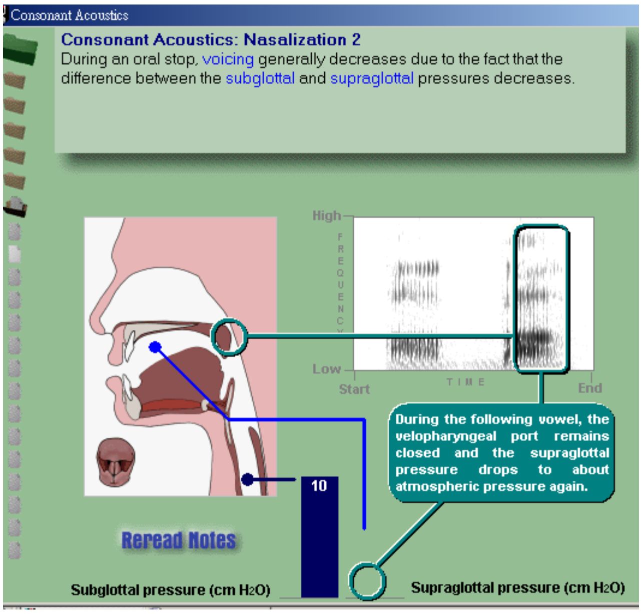
During an oral stop, voicing generally decreases due to the fact that the difference between the subglottal and supraglottal pressures decreases.

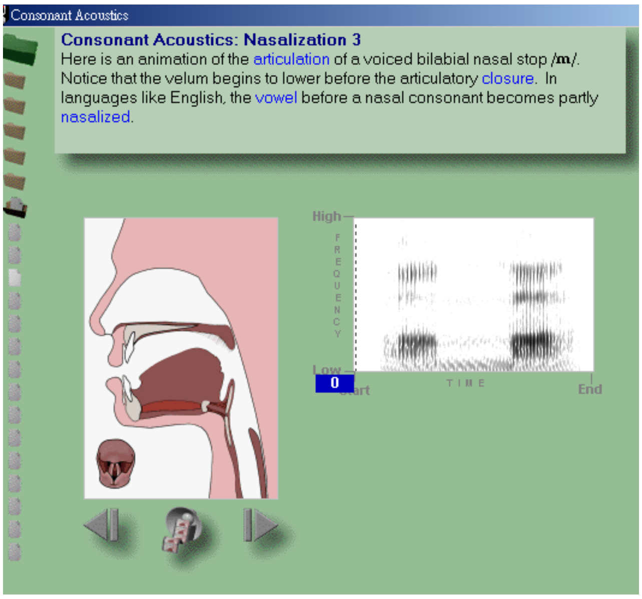


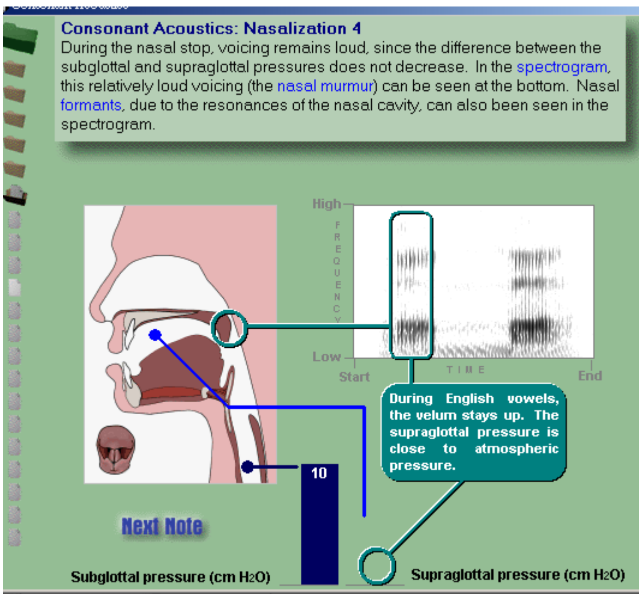

Consonant Acoustics
Consonant Acoustics: Nasalization 2
During an oral stop, voicing generally decreases due to the fact that the difference between the subglottal and supraglottal pressures decreases.
High
FREQUENCY
Low
Start
TIME
End
The velum remains high at the beginning of the consonantal constriction.
10
Next Note
Subglottal pressure (cm H2O)
Supraglottal pressure (cm H2O)

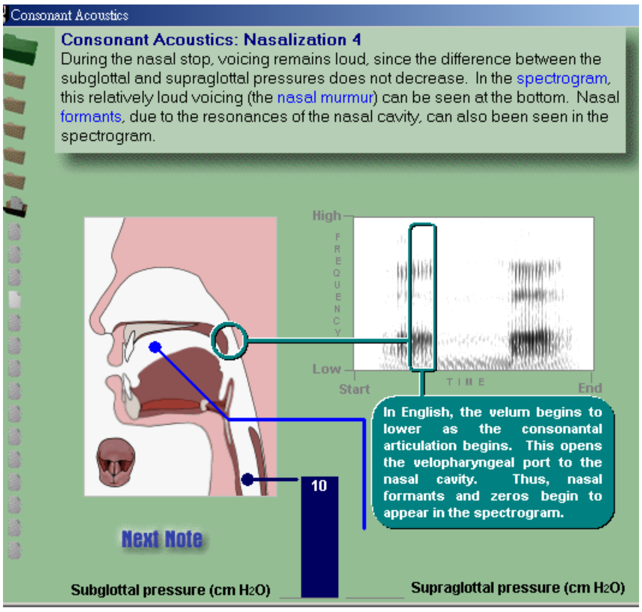

Consonant Acoustics
Consonant Acoustics: Nasalization 2
During an oral stop, voicing generally decreases due to the fact that the difference between the subglottal and supraglottal pressures decreases.
High
FREQUENCY
Low
Start
End
During the constriction, the supraglottal pressure rises, since no air can flow out of the vocal tract.
10
5
Next Note
Subglottal pressure (cm H2O)
Supraglottal pressure (cm H2O)

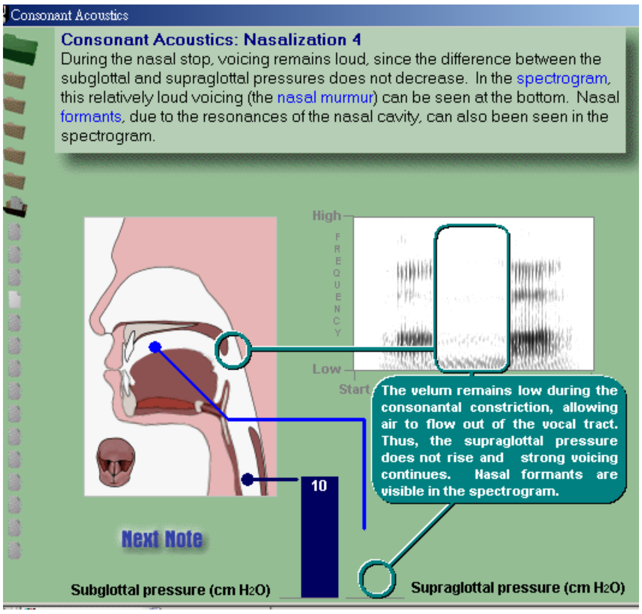

Consonant Acoustics
Consonant Acoustics: Nasalization 2
During an oral stop, voicing generally decreases due to the fact that the difference between the subglottal and supraglottal pressures decreases.
High
FREQUENCY
Low
Start
TIME
End
Since the supraglottal pressure rose during the constriction, there is a burst as it rapidly drops to atmospheric pressure at the release of the constriction.
10
Next Note
Subglottal pressure (cm H2O)
Supraglottal pressure (cm H2O)

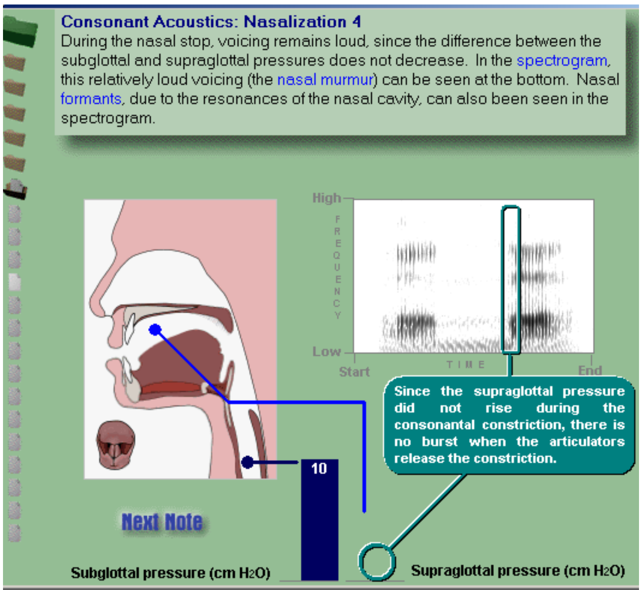

Consonant Acoustics
Consonant Acoustics: Nasalization 2
During an oral stop, voicing generally decreases due to the fact that the difference between the subglottal and supraglottal pressures decreases.
High
FREQUENCY
Low
Start
TIME
End
During the following vowel, the velopharyngeal port remains closed and the supraglottal pressure drops to about atmospheric pressure again.
10
Reread Notes
Subglottal pressure (cm H2O)
Supraglottal pressure (cm H2O)

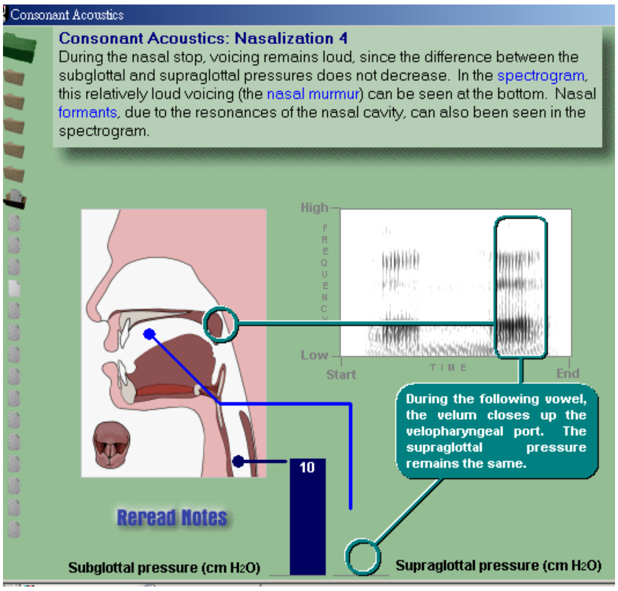

Consonant Acoustics
Consonant Acoustics: Nasalization 3
Here is an animation of the articulation of a voiced bilabial nasal stop /m/. Notice that the velum begins to lower before the articulatory closure. In languages like English, the vowel before a nasal consonant becomes partly nasalized.
High
FREQUENCY
0
TIME
End

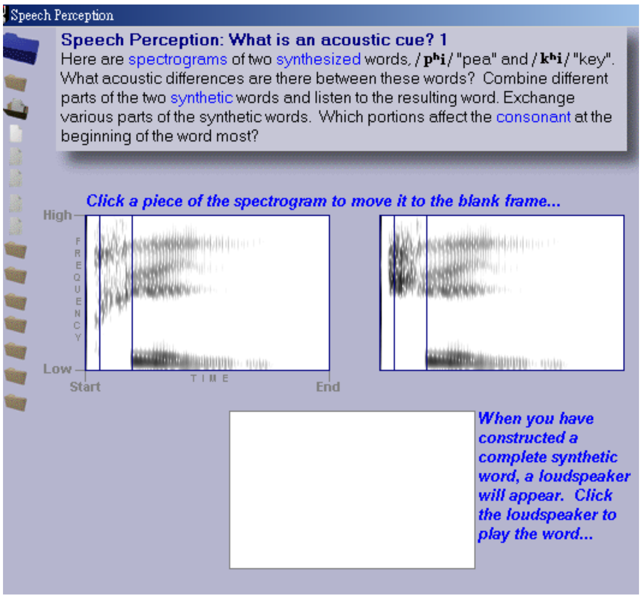

Consonant Acoustics: Nasalization 4
During the nasal stop, voicing remains loud, since the difference between the subglottal and supraglottal pressures does not decrease. In the spectrogram, this relatively loud voicing (the nasal murmur) can be seen at the bottom. Nasal formants, due to the resonances of the nasal cavity, can also been seen in the spectrogram.
High
FREQUENCY
Low
Start
TIME
End
During English vowels, the velum stays up. The supraglottal pressure is close to atmospheric pressure.
10
Next Note
Subglottal pressure (cm H2O)
Supraglottal pressure (cm H2O)

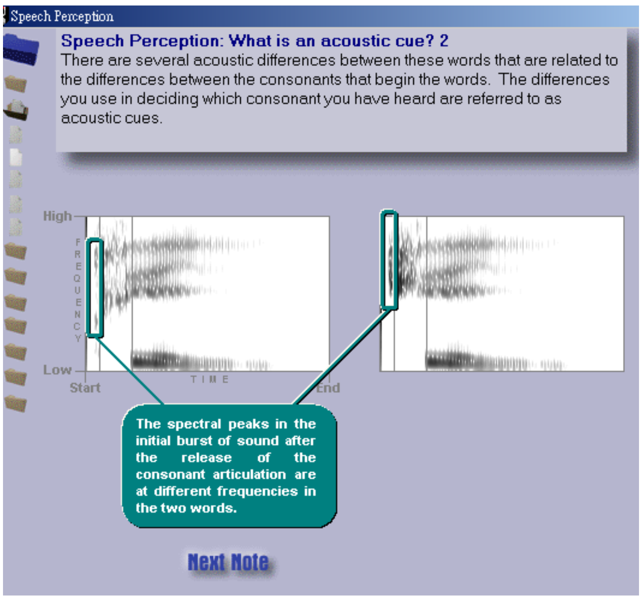

Consonant Acoustics
Consonant Acoustics: Nasalization 4
During the nasal stop, voicing remains loud, since the difference between the subglottal and supraglottal pressures does not decrease. In the spectrogram, this relatively loud voicing (the nasal murmur) can be seen at the bottom. Nasal formants, due to the resonances of the nasal cavity, can also been seen in the spectrogram.
High
FREQUENCY
Low
Start
TIME
End
In English, the velum begins to lower as the consonantal articulation begins. This opens the velopharyngeal port to the nasal cavity. Thus, nasal formants and zeros begin to appear in the spectrogram.
10
Next Note
Subglottal pressure (cm H2O)
Supraglottal pressure (cm H2O)

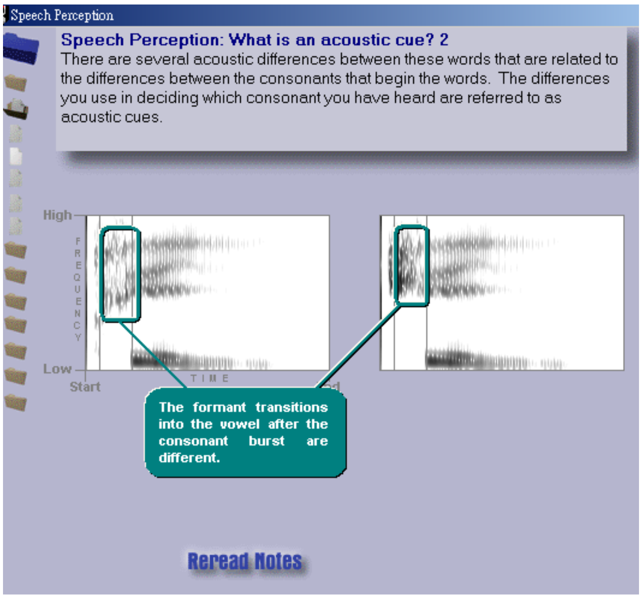

Consonant Acoustics
Consonant Acoustics: Nasalization 4
During the nasal stop, voicing remains loud, since the difference between the subglottal and supraglottal pressures does not decrease. In the spectrogram, this relatively loud voicing (the nasal murmur) can be seen at the bottom. Nasal formants, due to the resonances of the nasal cavity, can also been seen in the spectrogram.
High
FREQUENCY
Low
Start
The velum remains low during the consonantal constriction, allowing air to flow out of the vocal tract. Thus, the supraglottal pressure does not rise and strong voicing continues. Nasal formants are visible in the spectrogram.
10
Next Note
Subglottal pressure (cm H2O)
Supraglottal pressure (cm H2O)

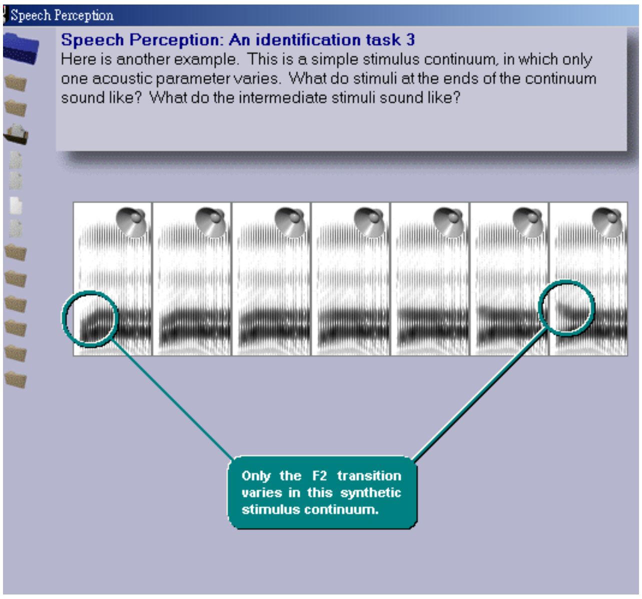

Consonant Acoustics: Nasalization 4
During the nasal stop, voicing remains loud, since the difference between the subglottal and supraglottal pressures does not decrease. In the spectrogram, this relatively loud voicing (the nasal murmur) can be seen at the bottom. Nasal formants, due to the resonances of the nasal cavity, can also been seen in the spectrogram.
High
FREQUENCY
Low
Start
TIME
End
Since the supraglottal pressure did not rise during the consonantal constriction, there is no burst when the articulators release the constriction.
10
Next Note
Subglottal pressure (cm H2O)
Supraglottal pressure (cm H2O)

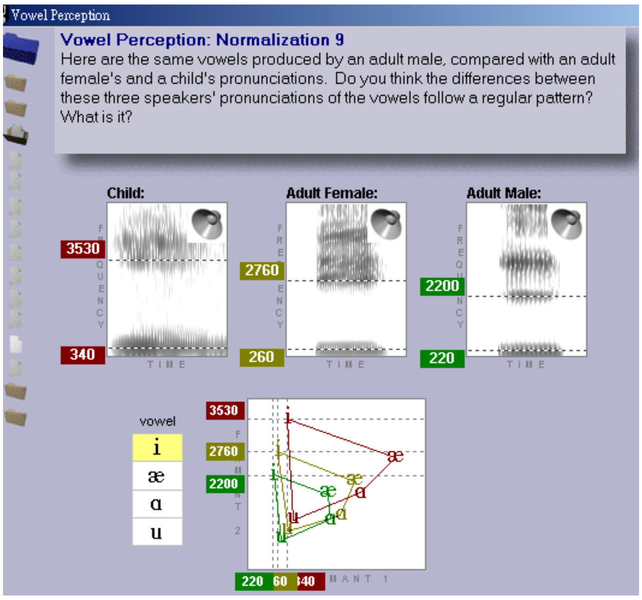

Consonant Acoustics
Consonant Acoustics: Nasalization 4
During the nasal stop, voicing remains loud, since the difference between the subglottal and supraglottal pressures does not decrease. In the spectrogram, this relatively loud voicing (the nasal murmur) can be seen at the bottom. Nasal formants, due to the resonances of the nasal cavity, can also been seen in the spectrogram.
High
FREQUENCY
Low
Start
TIME
End
During the following vowel, the velum closes up the velopharyngeal port. The supraglottal pressure remains the same.
10
Reread Notes
Subglottal pressure (cm H_2O)
Supraglottal pressure (cm H_2O)


Speech Perception
Speech Perception: What is an acoustic cue? 1
Here are spectrograms of two synthesized words, /pʰi/ "pea" and /kʰi/ "key". What acoustic differences are there between these words? Combine different parts of the two synthetic words and listen to the resulting word. Exchange various parts of the synthetic words. Which portions affect the consonant at the beginning of the word most?
Click a piece of the spectrogram to move it to the blank frame...
High
FREQUENCY
Low
Start
TIME
End
When you have constructed a complete synthetic word, a loudspeaker will appear. Click the loudspeaker to play the word...


Speech Perception
Speech Perception: What is an acoustic cue? 2
There are several acoustic differences between these words that are related to the differences between the consonants that begin the words. The differences you use in deciding which consonant you have heard are referred to as acoustic cues.
High
FREQUENCY
Low
Start
TIME
End
The spectral peaks in the initial burst of sound after the release of the consonant articulation are at different frequencies in the two words.
Next Note


Speech Perception
Speech Perception: What is an acoustic cue? 2
There are several acoustic differences between these words that are related to the differences between the consonants that begin the words. The differences you use in deciding which consonant you have heard are referred to as acoustic cues.
High
FREQUENCY
Low
Start
TIME
The formant transitions into the vowel after the consonant burst are different.
Reread Notes


Speech Perception
Speech Perception: An identification task 3
Here is another example. This is a simple stimulus continuum, in which only one acoustic parameter varies. What do stimuli at the ends of the continuum sound like? What do the intermediate stimuli sound like?
Only the F2 transition varies in this synthetic stimulus continuum.


Vowel Perception
Vowel Perception: Normalization 9
Here are the same vowels produced by an adult male, compared with an adult female's and a child's pronunciations. Do you think the differences between these three speakers' pronunciations of the vowels follow a regular pattern? What is it?
Child:
Adult Female:
Adult Male:
3530
340
2760
260
2200
220
TIME
vowel
i
æ
ɑ
u
3530
2760
2200
220
60