

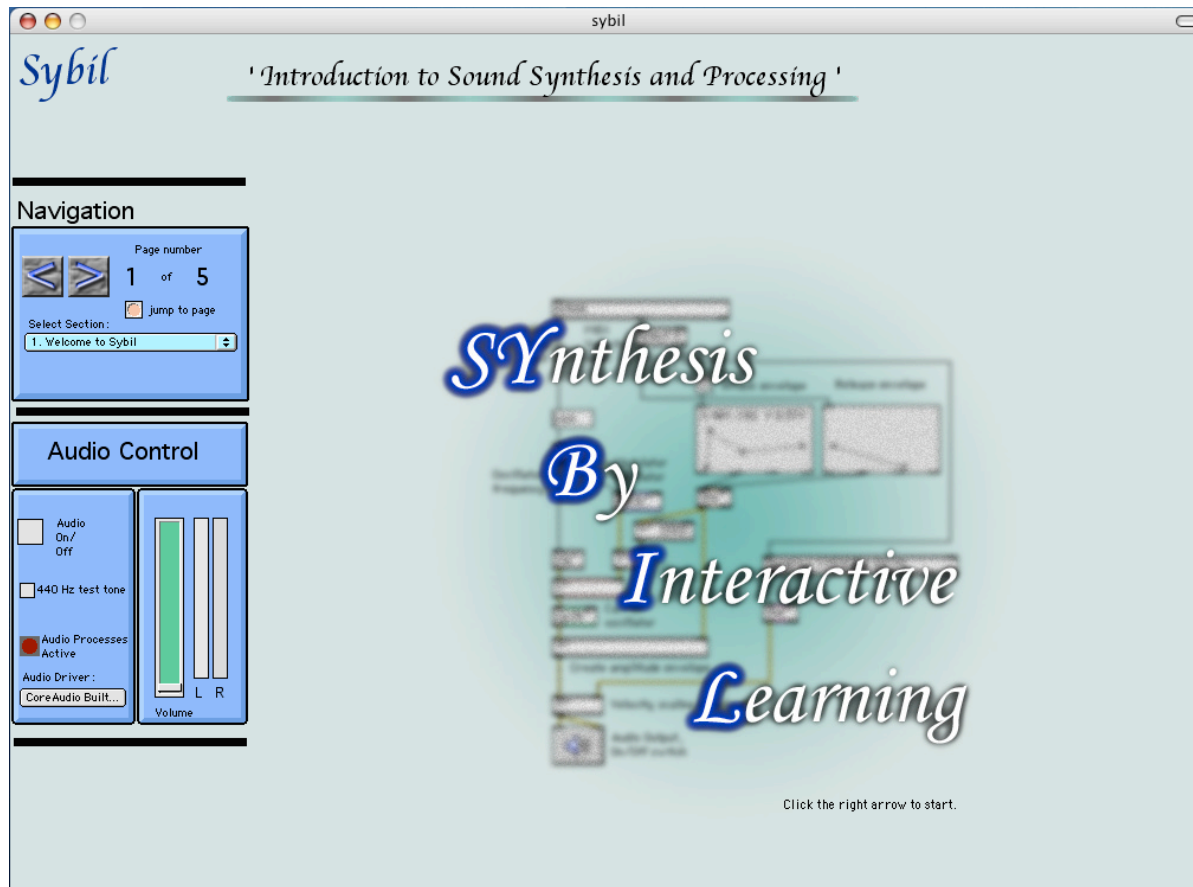
Sybil

A guided tour of some key features

***Sybil*: a guided tour of some key features**

This tour uses screenshots to illustrate some of the main features of *Sybil*. However, since the live sound and live graphics, with which the student can interact, are crucial to *Sybil*, a static presentation such as this is inevitably limited. The resolution of the screenshots is also restricted and can make reading some of the text difficult. Having followed this tour you might therefore find it helpful to look at the software itself, where the interactivity will become evident.

1. This screenshot is from the very beginning of the first module 'Introduction to Sound Synthesis and Processing'. It shows the navigation tools, permitting users to move between Sections and Pages easily, and the Audio Controls.



2. Here, the basics of waveforms and their spectral content are introduced. The student can select different waveforms and see both the waveform and the spectrum generated live, along with hearing the sound. Explanatory text is provided. More technical notes can be found, optionally, in a pop-up text box.

The screenshot shows a software window titled 'sybil' with the following components:

- Header:** 'Sybil' logo and the title '*Introduction to Sound Synthesis and Processing*'.
- Section Header:** 'Section 2: Oscillators' and '2. Waveforms'.
- Navigation Panel (Left):** Includes 'Page number 2 of 5', 'jump to page' button, and a dropdown menu for 'Select Section:' currently showing '2. Oscillators and Displays'.
- Audio Control Panel (Left):** Features an 'Audio On/Off' checkbox, a '440 Hz test tone' checkbox, 'Audio Processes Active' indicator, and 'Audio Driver: Core Audio Built...'.
- Main Content Area (Yellow):**
 - Text:** 'An oscillator produces sound by repeating a pattern over and over again. The shape of this pattern is what determines the timbre of the sound produced. This pattern is called a waveform and different waveforms produce specific spectra.'
 - Text:** 'Try selecting the sine wave again from the menu below. A sine wave is perfectly smooth (look at the left window) and produces only one frequency (as you will be able to see in the right window). In reality 'pure' sounds such as this are rarely produced (however good your loudspeakers are they will distort the sound a little, so even now you aren't hearing a completely pure sine wave). A flute is the nearest orchestral instrument to a sine wave.'
 - Link:** 'Click here for more on digital oscillators: [open](#)'
- Visualizations (Bottom):**
 - Oscilloscope:** Titled 'oscilloscope', it shows a green sine wave on a grid. The y-axis is labeled 'amplitude' and the x-axis is 'time (t) ->'. Above the plot, it says 'SELECT A SOUND: triangle' and '440. Hz'. A note below reads: 'The frequency here is fixed, in later examples you will be able to change it.'
 - Spectrum:** Titled 'spectrum', it shows a single sharp peak on a grid. The y-axis is 'amplitude' and the x-axis is 'frequency (f) ->'.

3. On this page the spectral implications of Amplitude Modulation (AM) can be seen, and experimented with live. Changing either the 'carrier' or 'modulation' frequencies has a different effect, which is both audible and visible in the display of the spectrum. Seeing and hearing the results makes the learning experience much more immediate, especially to less-technically oriented students.

sybil
' Introduction to Sound Synthesis and Processing '

Navigation

Page number
1 of 6

Select Section:
4. Amplitude and Ring Modulation

Section 4: Amplitude and Ring Modulation

1. Amplitude Modulation (AM)

The first type of modulation we will consider is amplitude modulation. In this, one signal, known as the 'carrier', is modulated by another signal, known as the 'modulator'. The two signals are simply multiplied together. The carrier is an ordinary waveform - we will use a sine wave to start with. Its values vary from positive to negative (it is 'bi-polar').

The modulator, however, is uni-polar, it has only positive values. Again we will use only the sine wave initially.

Click here for more on 'unipolar': [open](#)

Use the controls below to vary the pitch and amplitude of the two oscillators. Listen to the results (certain setting may result in no sound - for example, if the carrier oscillator has a zero amplitude or frequency) and look at the graphic displays.

Try to get some idea for yourself of what is going on - what changes to different controls do to the sounds. On the next page you will be given answers to some of these questions, but see if you can work it out for yourself first!

The display of the spectrum of low frequencies is not as accurate, so you might find it helpful to choose frequency ranges that place the displays in the middle, e.g. carrier freq = 900, modulator = 300. Sine waves will produce the 'cleanest' sound and the easiest to see what is happening.

Audio Control

Audio On/Off

440 Hz test tone

Audio Processes Active

Audio Driver: CoreAudio Built...

Volume

L R

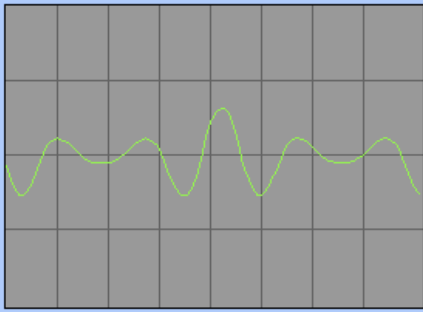
Signal 1: Carrier
sine
Basic settings:

900. Hz
1. amplitude

Signal 2: Modulator
sine

300. Hz
0.5 amplitude

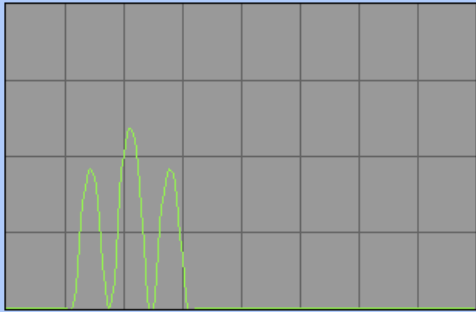
oscilloscope



amplitude

time (t) ->

spectrum



amplitude

frequency (f) ->

5. This screenshot is taken from late in the module 'Introduction to Sound Synthesis and Processing'. It is not as technical as some of the earlier sections but aims to stimulate students' interest in going further in their exploration of the creative potential of digital sound. Here two sounds (pre-recorded sound files) are selected from menus and the sounds are convolved before being filtered. The original, convolved and filtered signals are all displayed, as is the filter shape.

The screenshot shows the Sybil software interface with the following components:

- Navigation Panel:** Shows page number 5 of 6, with navigation arrows and a 'Select Section' dropdown menu set to '6. Introducing Filters and Convolution'.
- Audio Control Panel:** Includes checkboxes for 'Audio On/Off', '440 Hz test tone', and 'Audio Processes Active'. It also features volume sliders for 'L' and 'R' channels and an 'Audio Driver' dropdown set to 'Core Audio Built...'.
- Section 6: Introducing Filters and Convolution**
 - 5. Filtering one sound by another (2)**

In this example we create more interesting sounds by convolving two complex audio signals together. The type of convolution is the same as on the last page, and the principles are the same.

However, instead of using noise as one signal, this time both signals can be selected from a choice of soundfiles. The first sound is 'filtered' by the second, its amplitude being convolved with that of the second.

What you have seen here is only one aspect of convolution, that which relates most closely to filtering. For example, convolution can also be applied to the phase components of sounds or, using impulse responses, to impose the acoustic of a location on to a 'dry' recording.
- Waveform Displays:** Three stacked waveforms showing:
 - original soundfile
 - convolved soundfile
 - convolved and filtered soundfile
- Control Panel:**
 - Buttons for selecting 'drum' (sound to be filtered) and 'cello' (filtering sound).
 - Volume controllers for 'original processed sound' and 'sound'.
 - A 'filter on' dropdown menu.
 - Filter settings: 'bandpass' type, 'Cutoff/Centre Frequency' (830), 'Q (resonance)' (0.6), and 'Gain (some filters)' (0).
- Filter Shape Graph:** A graph showing a bell-shaped curve representing the filter's frequency response.

6. This screenshot from early in the more advanced module on 'FOF synthesis: an Introduction' shows the spectrum of the formant region generated by the FOF algorithm. On this page particular page the student is encouraged to experiment with changing the setting of the 'tex' parameter, to see and hear the resulting changes to the spectrum. This is a particularly complex algorithm with many parameters and *Sybil* provides a much more intuitive and creative approach to learning about it.

The screenshot shows the Sybil software interface. At the top, the window title is 'sybil'. The main header reads 'FOF Synthesis: an Introduction'. Below this, a blue box contains 'Section 2: FOF Parameters' and '6. Tex - skirtwidth'. The main content area is yellow and contains text explaining the 'tex' parameter and its effect on the spectrum. Below the text are two plots: an oscilloscope showing amplitude over time and a spectrum showing amplitude over frequency. The 'Tex' parameter is set to 0.18. On the left side, there is a navigation panel with page number 6 of 8, a section selector set to '2. FOF Parameters', and an audio control panel with volume sliders for L and R channels.

Section 2: FOF Parameters
6. Tex - skirtwidth

There is a second parameter that effects the breadth of the spectrum. This controls the 'skirtwidth', how broad the spectrum is at -60dB below the main frequency.

This is not controlled directly but via a parameter know as 'tex'. (This is an abbreviation for the French 'temps d'excitation' - attack time). The mechanics of this need not concern us for now (in a later section it may become more apparent) all you need to know is that as tex increases the spectrum becomes narrower, focusing more exclusively on the area around the formant frequency.

You will need to change the value of tex in small fractional amounts, so click to the right of the decimal point and drag up or down to make small changes. Notice once more how the sound and the spectrum changes.

Navigation
Page number: 6 of 8
Select Section: 2. FOF Parameters

Audio Control
Audio On/Off
440 Hz test tone
Audio Processes Active
Audio Driver: CoreAudio Built...
Volume: L R

oscilloscope
Tex: 0.18
amplitude vs time (t) ->

spectrum
amplitude vs frequency (f) ->

7. This is a screenshot from later in the FOF module. Here a vocal sound has been constructed from five formant regions. Students can experiment to find appropriate settings for vibrato speed and amplitude using on-screen faders, as well as adjusting random elements that add realism. Using their ears as they play with the sound they can learn about what makes for a 'realistic' and satisfying imitation. An on-screen music keyboard can be used to play pitches. The vowel sound can also be changed using a two-dimensional slider. As usual, the signal and spectrum are displayed to give live visual feedback in addition to the sound.

The screenshot shows the Sybil software interface. At the top, the title bar reads 'sybil' and the window title is 'FOF Synthesis: an Introduction'. The main content area is titled 'Section 3: Building a voice' and '9. Time to sing!'. It contains instructional text, a keyboard icon, and four vertical faders labeled 'jitter', 'vibrato freq', 'amp', and 'random'. A text box explains that the pitch range is limited to the lower range for timbral data and that high pitches require more CPU power. Below the faders is a two-dimensional slider for vowel selection with labels for 'a', 'e', 'o', and 'i'. The bottom section features an 'oscilloscope' showing amplitude over time and a 'spectrum' showing amplitude over frequency. The fundamental frequency is displayed as 116.5409 Hz. On the left, there are navigation and audio control panels.

Navigation

Page number: 9 of 9

Select Section: 3. Building Spectra

Audio Control

Audio On/Off

440 Hz test tone

Audio Processes Active

Audio Driver: CoreAudio Built...

Volume: L R

Section 3: Building a voice

9. Time to sing!

This is the end of this section on building a voice.

Try playing with all the controls. A keyboard has been added to the controls available to you so you can change the fundamental pitch more easily.

Although we have considered many aspects of simulating the vowels of the human singing voice there are still more features to the way the timbre varies, for example, at different pitches and at different levels of exertion.

Some of these factors were built in to the original CHANT program and are also included in the CHANT objects for Max/MSP from IRCAM in Paris.

The pitch range has been limited to the lower range as this is how the timbral data has been set up here. High pitches also require more CPU power and may cause problems on low-powered machines.

Vowel selection: "a", "e", "o", "i"

Controls: jitter, vibrato freq, amp, random

Fundamental: 116.5409

oscilloscope: amplitude vs time (t)

spectrum: amplitude vs frequency (f)

8. Finally, an example from one of the latest developments in *Sybil*. Here *Sybil* has been used to create an Interactive Aural Analysis of a piece of electroacoustic music (Jonathan Harvey's *Mortuos Plango, Vivos Voco*).

In addition to written text, the reader can explore the composition aurally. An additional set of CD controls has been added (bottom left corner), and the user can play back precise sound examples from the work. Live synthesis and processing is also used to re-create some of the techniques used in the composition and so give the reader a greater understanding of the processes used and the compositional choices facing the composer.

The screenshot shows the Sybil software interface for 'Mortuos Plango: An Interactive Aural Analysis'. The window title is 'sybilCD3'. The main title is 'Mortuos Plango: An Interactive Aural Analysis'. The current exercise is 'Interactive Exercise 1: Exploring the Winchester bell timbre', with the sub-section '2. More on Bell partials'.

Navigation: Page number 2 of 3. Jump to page. Select Section: Interactive Exercise 1.

Audio Control: Audio On/Off, 440 Hz test tone, Audio Processes Active, Audio Driver: Core Audio Built..., Volume control (L R).

CD Control: CD track Play/Stop, Select track, Load Cue Data, Time: 0.0, Sound Location: 0.0, Offset Cue: 0.0.

Interactive Exercise 1: Exploring the Winchester bell timbre

2. More on Bell partials

This page provides an alternative method of exploring the bell's timbre.

The window below represents a Graphic EQ which can be used to filter the sound of the bell. First start the bell playing and switch on the EQ. To change the settings of the Graphic EQ click in the window and drag across it to draw a spectral envelope.

This window displays the bell spectrum (filtered or unfiltered):

spectrum

amplitude

frequency (f) ->

Bell EQ on/off
PLAY: ON:
STOP: OFF:

128-band Graphic EQ. Draw in this window:
Restore original settings:
Set all bands to 0:

Freq (Hz.) 253 440 880 1760 2735
1012