Raven Lite 1.0 User's Guide

Revision 1

15 May 2006

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Credits

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Raven Lite was written by Scott Maher, Tim Krein, and Eric Spaulding, and is based on the earlier Raven project, which was written by Harold Mills, Tim Krein, Scott Maher, Christina Ahrens, Jason Rohrer, and Jason Adaska.

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When citing use of Raven Lite in scientific publications, please refer to this manual as follows:

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For more information about Raven Lite, visit the Raven Lite website: www.birds.cornell.edu/raven or www.RavenSoundSoftware.com

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About This User's Guide

This manual describes Raven Lite1.0, which runs on Windows and Mac OS X computers. Raven Lite's appearance on the two operating systems is slightly different. In most cases, the differences in appearance are cosmetic and simply reflect different styles used for rendering windows, dialog boxes, and other user interface items. In cases where the differences are merely cosmetic, illustrations in this manual show screen shots either from the Windows or the Mac OS version of Raven Lite. In the few cases where there are more significant differences in the content or layout of information in windows or dialog boxes, illustrations are shown from both platforms.

Typographical Conventions

Fonts

Throughout the manual, an alternate font is used to identify named items in the Raven Lite user interface, such as menus, menu commands, and items in dialog boxes. Example: "To delete a view, activate the view and choose Delete from its contextual menu or from the View menu.

Menu Commands

Menu commands are identified by the name of the menu, followed by >, followed by the name of the command. Example: **File > Save** "Sound 1".

Cross-reference Links

Cross-references within the PDF text are in blue, and are hyperlinks: clicking a cross-reference when viewing the text in Adobe (Acrobat) or Adobe (Acrobat) Reader will take you directly to the referenced place in the text. To return to the referencing point in the text, click the Back button in the Acrobat toolbar.

Boxed Notes

Boxes like this supplement the main text by providing helpful tips or calling your attention to specific points.

WINDOWS Boxes like this provide information that is specific to either the Windows or Mac OS version of Raven Lite.

Contextual Menus

This manual refers in many places to commands located on *contextual menus* (or *context menus*). A contextual menu is a menu that is relevant to the particular item being identified by the location of the mouse pointer. Under the Windows operating system, contextual menus are activated by right-clicking. Under Max OS X, contextual menus are activated by holding down the **Control** key while clicking.

MAC OS	Any computer running Mac OS X can be equipped with a third-party USB two-button mouse. A two-button mouse provides access to contextual menus by right-clicking (in addition to the use of the <**Control>** key while clicking

Keyboard shortcuts and menu mnemonics

There are two ways to use the keyboard (rather than the mouse) to activate menu commands. Some commands have single-keystroke equivalents or *shortcuts,* activated by pressing the **<Ctrl>** (Windows) or **<Command>** (Mac OS) key and a single other key simultaneously. Keyboard shortcuts are shown in menus to the right of the command name (Figure 1.) Any menu command can also be chosen by *mnemonics.* A menu mnemonic consists of a sequence of two or more keystrokes in which the first keystroke activates a particular menu; subsequent keystrokes choose particular items within the menu. To activate a particular menu, press the **<Alt>** (Windows) or **<Option>** (Mac OS) key and the first letter of the menu name simultaneously. To choose an item from the menu once it is activated, press the key corresponding to the underlined letter in the item name. For example to choose the **Open Sound Files…** command from the File menu (Figure 1), press **<Alt-F><O>** (Windows) or **<Option-F><O>** (Mac OS).

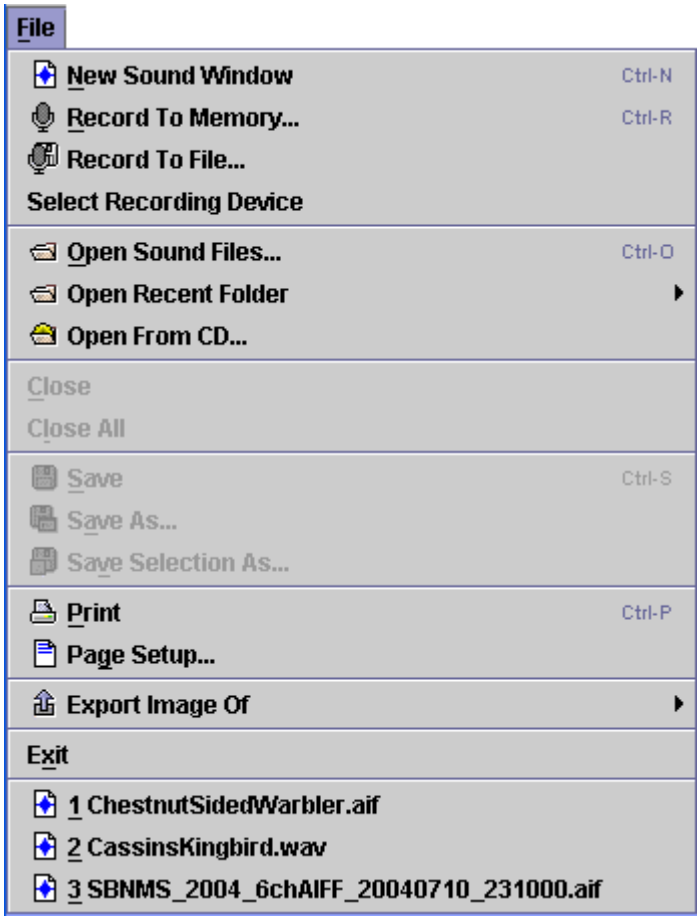


Figure 1. The File Menu, showing keyboard shortcuts and mnemonics.

Your Feedback and updates to this manual

If you find errors in this manual or have suggestions for future editions, please contact us at: http://help.RavenSoundSoftware.com/.

From time to time, we release revisions of the manual to correct errors and make other improvements. To find out whether you have the latest version of the manual, and to download any updates, use Raven Lite's **Check for Updates** feature, described in "Getting Help".

Using Raven Lite

The Raven Lite window

The Raven Lite window contains menus, toolbars, and the Raven Lite desktop, which may contain one or more sound windows.

Toolbars

By default Raven Lite displays six toolbars, called File, Edit, View, Spectrogram, Play and Selection/Zoom toolbars. You can toggle the display of each toolbar off or on by choosing the toolbar's name from the **View > Toolbars menu**.

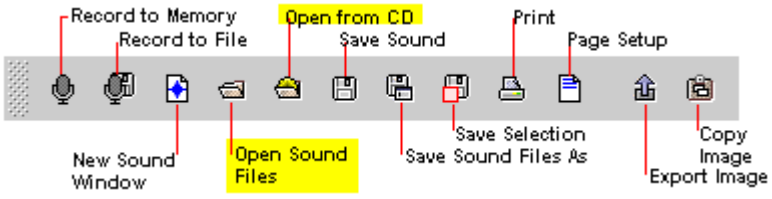
To find out what a button on a toolbar does, place the mouse pointer over the button and wait for a "tooltip" to appear that identifies the button's function.

Some toolbar buttons are not available until you open a sound window, as discussed below. You can drag toolbars by their left edge to any of the Raven Lite's four edges or even outside the Raven Lite window. To lock the toolbars along the edges (**Lock** will bring floating toolbars back to the top edge) in places that they cannot be moved again, select the "**Lock Toolbar**" item from the Toolbars menu in the View menu. To move them again, select the "Unlock Toolbars" item.

Opening a sound – File Toolbar

There are three ways to get a sound into Raven Lite. You can (1) open a sound file stored on your computer's hard disk or on a CD-ROM, (2) open a track from an audio CD, or (3) record a new sound. To learn about recording new sounds, see *Recording New Sounds*.

Buttons for these and some other File operations are shown in the Raven Lite File toolbar:



What's the difference between an "audio CD" and a "CD-ROM"?

There are two different ways that information can be stored on a compact disc (CD). An *audio CD* contains only sound tracks (such as music or bird sounds) that can be played on an audio CD player or on a computer's CD drive. A *CD-ROM* (ROM stands for Read-Only Memory) can contain computer files of any kind, such as text, pictures, or sound files. A CD-ROM can be opened only on a computer, and is not recognized by an audio CD player.

Opening a sound file

Raven Lite can open sound files saved in WAVE (.wav), AIFF (.aif), MP3, QuickTime movie .mov, or AIFC formats. To open a sound file, click on the Open Sound File button on the File toolbar, or choose **File > Open Sound File**.... Choose a file to open from the Open Sound File dialog box, and then click OK.

WINDOWS	To enable Raven Lite to open MP3, Quick Time movie .mov, or AIFC format files, you must first of all install QuickTime for Windows version 7.0 or higher or iTunes, version 6.0 or higher. Use the **Help > Download QuickTime Installer** menu item in Raven Lite to get this Software. On Mac OS X, QuickTime is already included in the operating system

Opening a track from audio CD

To open a track from an audio CD, choose **File > Open From CD**..., or click the Open CD Track icon. Raven Lite will display the Open CD Track dialog box. Choose the CD track you wish to open, and click OK. . Raven Lite will then open the track in a sound window.

If the checkbox labeled **Get CD information from The Internet** is checked in the Open CD Track dialog box, and your computer is connected to the Internet, Raven Lite will attempt to use an online database to display the names of the individual tracks on the selected CD. Otherwise, tracks are displayed by number.

Raven Lite will only allow you to open one channel from a stereo audio CD Track. You get to choose 1 (left) or 2 (right).

Paged vs. unpaged sound windows

If you open a sound file or a CD track that is too large to fit into the available memory, Raven Lite will display a message to inform you that the sound will be opened in a *paged* sound window. Raven Lite's available predetermined memory for each sound is one minute of 48 kHz audio or equivalent (6 minutes of 8 kHz audio). A paged sound window initially displays the portion of a sound that is presently in memory. An unpaged sound window initially displays the entire sound. In either kind of window, you can zoom in on a portion of the sound initially shown. To view or play other portions of

the sound, you must page forward or backward in the sound using the horizontal scrollbar. Zooming and scrolling are described in the section on "Changing the scale of the views and navigating through a sound".

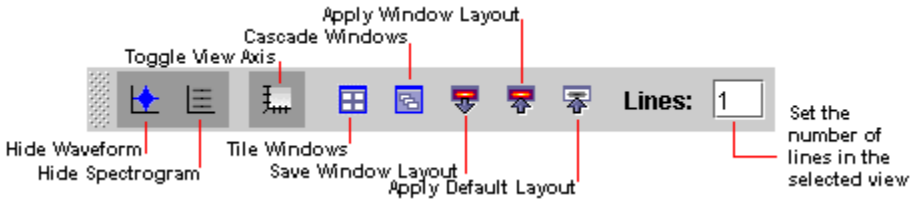
By default, when you first open a sound file or a CD track, Raven Lite shows you a sound window that contains two views of the sound. The *waveform* (upper) view displays an oscillogram, or graph of the sound showing amplitude versus time. The *spectrogram* (lower) view represents time on the horizontal axis, frequency on the vertical axis, and relative power at each time and frequency as a color (by default grayscale) value.

Recent files and folders

Raven Lite keeps track of the last 4 files that you have opened. To reopen one of these files, click on its item at the bottom of the File menu.

Raven Lite keeps track of the last 5 folders from which you have opened files. To open a file from one of those folders, choose **File>Open Recent Folder**, and then click on the folder name from which you want to open a file. Raven Lite will show the "Open Sound Files" dialog with the contents of the chosen folder showing.

Sound windows – View Toolbar



Showing and hiding views

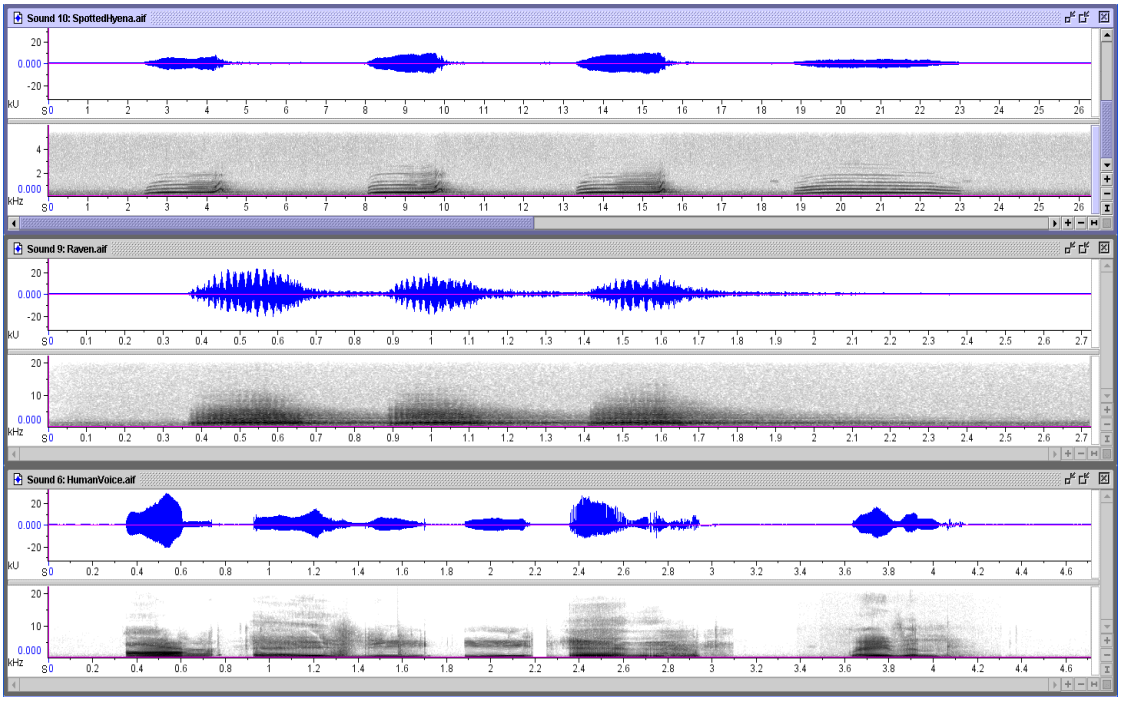
You can hide or show the waveform or spectrogram view by clicking on the waveform or spectrogram icon in the View toolbar.

Lines

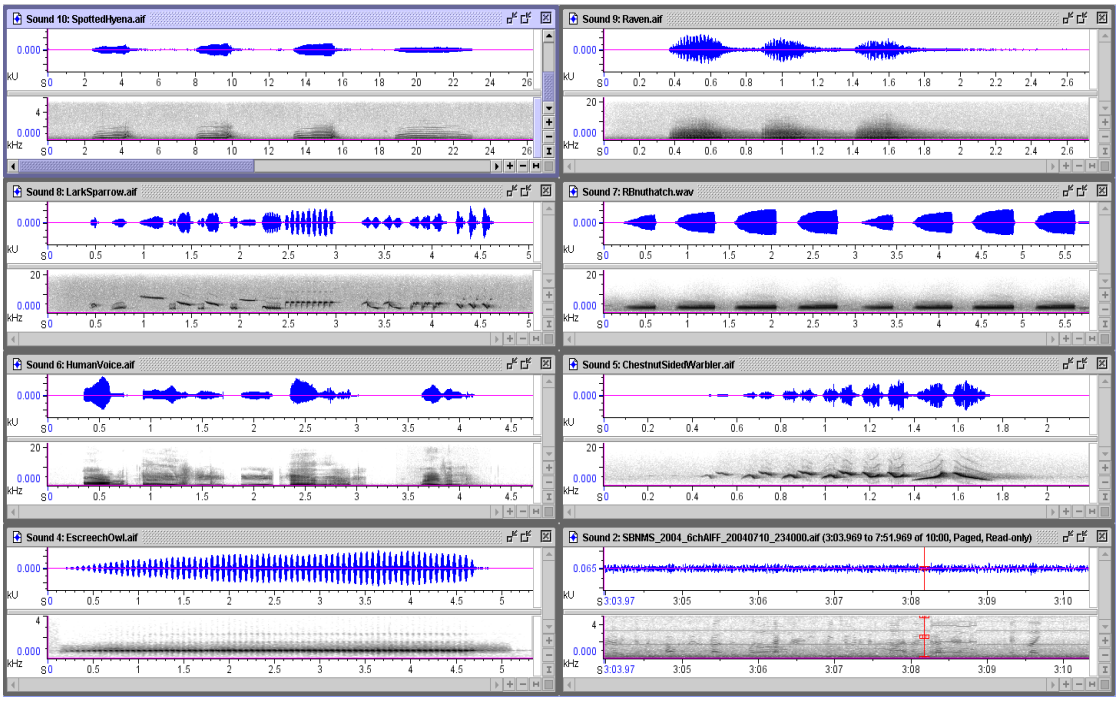
You can change the number of lines that you use to view the sound. Enter the number of lines required in the **Lines** field of the View toolbar. The number of lines will change for whatever sound window is in view. Hidden views are also updated by the Lines field. When the view is shown again, it will contain that number of lines. Whether displaying a single line or multiple lines, all the waveform lines will be above the spectrogram lines. The advantage of increasing the number of lines is that you can view more time for a given resolution, however as you increase the number of lines, you will also be compressing the frequency and/or amplitude axis.

Tiling and cascading windows

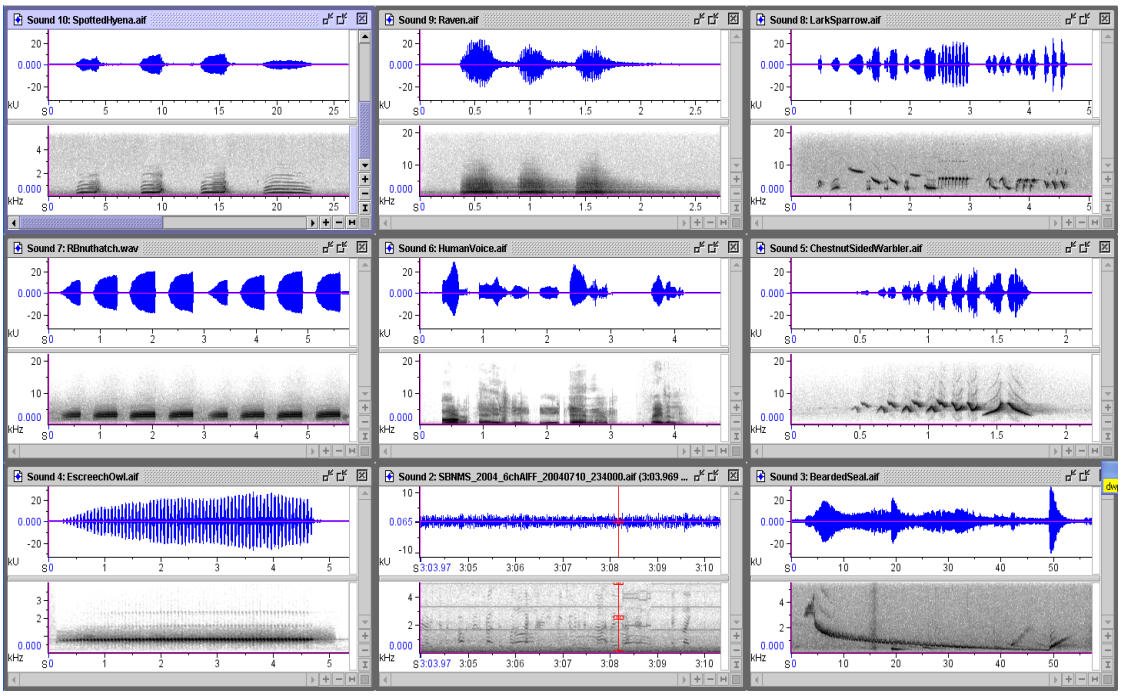
If you have multiple sound windows open, you can view all of them at once by clicking the tile icon in the View toolbar. Two or three sound windows will be tiled in one column.



Four to eight windows will be tiled in two columns.

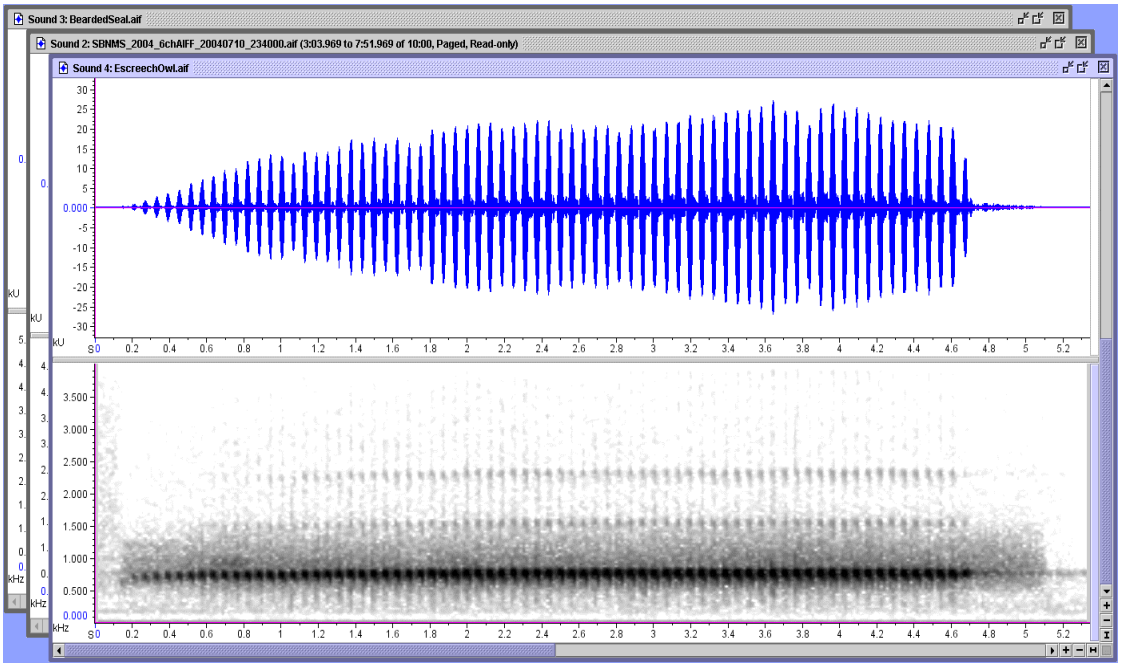


Nine to fifteen windows will be tiled in three columns.



In general the number of columns will be the floor of the square root of the number of windows. With tiling, all the sound windows are sized so that all of the area of each window is visible. The top left corner of each window is offset a few pixels vertically from the previous window.

You may also choose to use the cascade icon. Here all the sound windows are stacked on top of one another with all window title bars visible.



The sound window that was selected last will appear on bottom of the pile. Clicking the cascade icon again will bring it to the top of the pile.

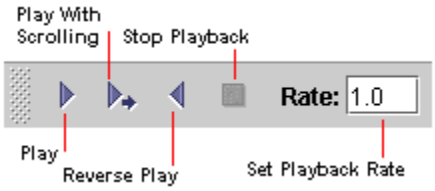
Save Window Layout, Apply Window Layout, and Apply Default Window Layout

If you have a preferred page layout that differs from the default window layout, you can save it by clicking the Save Window Layout icon in the View toolbar. This action will save the current color map, brightness, contrast, spectrogram sharpness, and window size. Once you have saved the window layout, you can apply your window layout to any windows by clicking the Apply Window Layout button. To return to the default window layout, click the Apply Default Window Layout button. New sound windows will be displayed using the saved windows layout. There are also items on the view menu for applying and saving windows layouts. To have all future windows opened using the default layout, save it using the Save Window Layout button.

Toggle view axis

If you do not want to view the sound window axes, you can turn them off by clicking on the toggle view axis button in the View toolbar. This has the advantage of giving you more space in which to view the spectrogram and/or waveform. To restore the axes, just click the button again. You can also use the "Hide View Axes" and "Show View Axes" items on the View menu to toggle the view axes visibility.

Playing sounds – Play Toolbar



Playing from the beginning of a sound

To play a sound, click the Play button on the Play toolbar, or press **<Ctrl-Shift-P>** (Windows) or **<Command-Shift-P>** (Mac OS). As the sound plays, a vertical green line, the *playback cursor*, moves across the waveform from left to right to show you what part of the sound you are hearing. To stop playing at any time, click the Stop button. When the sound finishes playing, or when you click Stop, the playback cursor disappears.

Pressing the spacebar causes the currently focused button or control to be activated. When a sound is opened, the play button gets focus, and so pressing the spacebar will cause the sound to play. Focus will shift to the stop button, then pressing the spacebar will stop the playing of the sound, at which point focus returns to the play button.

Playing a selected portion of a sound

You can select a portion of a sound to play: click and drag from one side to the other of the part of the sound you want to listen to, in either the waveform or spectrogram view. Raven Lite marks your selection with a red rectangle. Click the Play button to play it.

If you make a new selection, the previous selection rectangle disappears. To clear the selection so that you can play the entire sound again, click the Clear Selection button on the View toolbar, or choose **View > Clear Selection**.

Playing all of a sound from a selected point

To play from a particular point in a sound to the end of the viewable part of the sound, click once at the point in time where you want the playback to begin. A vertical red line (a *point selection*) will appear where you clicked in the waveform and red crosshairs will appear if you clicked the spectrogram view. When you click the Play button, playback will begin at the point in time where you clicked.

Playing a sound backwards

To play a sound in reverse, click the Reverse Play button on the Play toolbar.

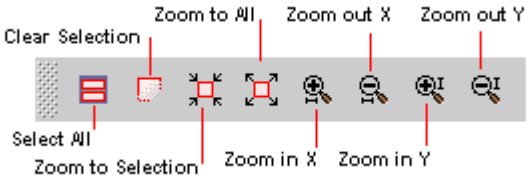
Changing the play speed (Rate)

You can speed up or slow down the playback rate of the sound by changing the value in the Rate field on the signal toolbar. By default, the playback rate is set at 1.0, or the same as the recording rate. Playback rates greater than 1 speed up the playback; decimal rates less than 1 slow down the playback. Slowing down the rate makes the sound lower in pitch; speeding it up makes it higher in pitch. For example, to set the playback speed to one-quarter normal speed, type 0.25 into the Rate field, and press **<Enter>**.

Scrolling Play

You can scroll the window display as you play the sound by pressing the Play With Scrolling button.

About selections – Selection/Zoom Toolbar



You can *select* part of a sound in Raven Lite by clicking and dragging the mouse across part of a view. The selection that you define this way is shown by a red rectangular border. The selection is displayed in both the waveform and spectrogram views. If you create the selection in the spectrogram, it is a rectangle with a start and end time and an upper and lower frequency. If you create the selection by clicking and dragging in the waveform, it encompasses the entire frequency range of the spectrogram. Raven Lite allows you to have only one selection at a time. When you click in a view to define a new selection, the previous selection disappears You can use selections to define the part of a signal that you want to play or enlarge or edit.

You can quickly select the entire sound by clicking the Select All button, or by selecting **Edit > Select All** in the Menu.

To clear a selection, click the Clear Selection button, or if you create a new selection, the previous selection will be cleared as you are only allowed one selection at a time. You can also clear a selection by using **View > Clear** Selection.

Changing the scale of the views (zooming)

When Raven Lite first opens a sound window, the time scale is set so that you can see the entire sound if it fits within available memory. If the sound does not fit, the sound window will be paged (see "paged vs. unpaged sound windows" above) and the time scale will be set to show all of the sound that is currently in memory.

The active view

If both views are displayed, one of them is considered the *active view* at any one time. The active view displays a pale blue *view selection button* along its right edge; the view selection button of the inactive view is gray. You can activate an inactive view by clicking on its view selection button or by clicking anywhere on that view. Raven Lite's zoom controls and scrollbars operate on the active view.

Zoom in and zoom out

You can zoom in (increase magnification) or zoom out (decrease magnification) in the horizontal or vertical dimension of a view by clicking the appropriate zoom button in the Selection/Zoom toolbar. The horizontal and vertical zoom buttons are indicated by a small horizontal or vertical bar next to the magnifying glass. To zoom in, click the horizontal or vertical button marked with a '+'; to zoom out, click the button marked with a '-'. Zoom buttons are also located in the lower right corner of each sound window, at the ends of the horizontal and vertical scrollbars, marked with '+' and '-'.

When you click a vertical zoom button, only the active view zooms. However, when you zoom in the horizontal (time) dimension, both the waveform and spectrogram views zoom, no matter which one is the active view. That's because the time scales of the views are *linked*: whatever changes you make to the time scale of one view are made to the time scale of the other view automatically. This ensures that the same part of the sound is always displayed in both views.

Zoom to selection

To zoom in on a particular part of a view so that selection fills the view pane, draw a selection with the mouse, then click the Zoom to Selection button on the signal toolbar. If there is no active selection, the Zoom to Selection button is not available. There is also a Zoom to Selection button (marked with a red square) in the lower right corner of each sound window

The **Zoom to Selection** button behaves slightly differently depending on which view is the active view. If the spectrogram view is active, the spectrogram's time and frequency axes both zoom to the selection borders. Since the time axis of the waveform is linked to that of the spectrogram, the waveform zooms as well. If the waveform is active when you click the Zoom to Selection button, the time axes of both views zoom, but the frequency axis of the spectrogram remains unchanged.

Zoom to all

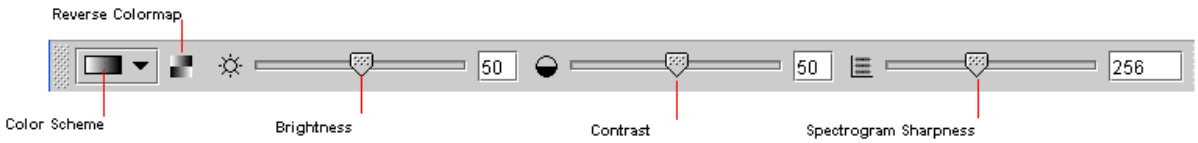
To restore the views so that the entire time and frequency extent of the sound in memory is shown, click the Zoom to All button on the View toolbar.

Scrollbars

The horizontal and vertical scrollbars in a Raven Lite sound window always refer to the active view. The length of the horizontal scrollbar in a waveform or spectrogram view corresponds to the total duration of the sound that is in Raven Lite's working memory. If the window is unpaged (see link to paged vs. unpaged), this is the entire length of the sound. The length of a scrollbar's scroll box, relative to the length of the entire scrollbar, indicates what proportion of the corresponding axis is visible in the view pane. When the entire axis is visible, the scroll box is half the length of the scrollbar.

The location of the scroll box within the scrollbar indicates the view's position relative to the portion of the sound that is in memory. When the horizontal scroll box of a waveform or spectrogram is at the left edge of the scrollbar, the start of the data is aligned with the position marker; when the box is all the way to the right, the end of the data is aligned with the position marker.

Working with spectrograms – Spectrogram Toolbar

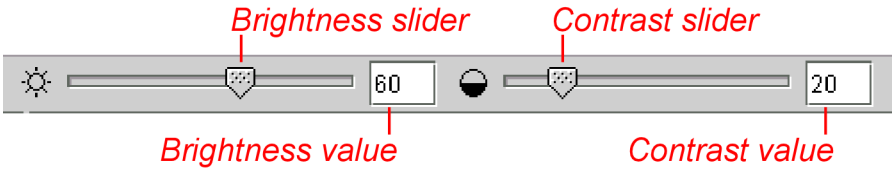


Choosing the color scheme

Raven Lite can display spectrograms using any of four color schemes. To use a different Color Scheme, choose its icon from the color schemes menu on the View Menu or from the color schemes dropdown combobox control in the Spectrogram toolbar.

Adjusting brightness and contrast

When a spectrogram view is active, the brightness and contrast controls on Raven Lite's Spectrogram toolbar become active.



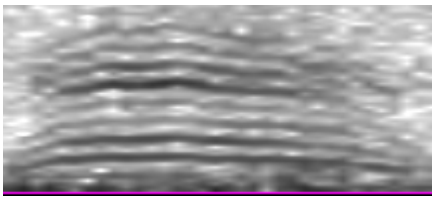
If your spectrogram looks too dark or light, or if it's hard to pick the sound out of the background, move the brightness and contrast sliders to achieve the desired appearance of the spectrogram. The brightness control adjusts the overall darkness of the spectrogram: for a grayscale spectrogram (the default), sliding the control to the right lightens the display.

The contrast control adjusts the number of different color (by default, grayscale) values that are shown in the spectrogram. In a grayscale spectrogram, moving the contrast slider all the way to the right makes the display black and white: all values below some threshold are assigned to white and the rest become black. In this case, the threshold between black and white is determined by the brightness control. With the contrast control all the way to the left, Raven Lite displays up to 200 shades of gray.

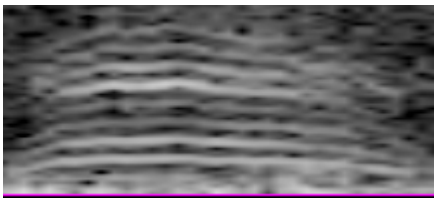
The box next to each control tells you what percent brightness or contrast you've set. If you prefer, you can type a percentage number into a box instead of moving the slider.

Reversing the color map

You can reverse the spectrogram color map by clicking the Reverse Color Map button on the Spectrogram Toolbar or by choosing the Reverse Color Map item in the Color Scheme menu of the View menu.



grayscale colormap

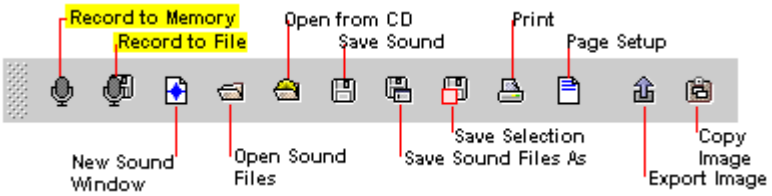


inverse grayscale colormap

Adjusting the spectrogram sharpness tradeoff

Making a spectrogram of a sound always involves a tradeoff between sharpness or resolution in the time (horizontal) dimension and in the frequency (vertical) dimension. A spectrogram that is very sharp in its time dimension will be fuzzy in its frequency dimension, and vice versa. You can adjust this tradeoff by moving the sharpness slider control on the Spectrogram Toolbar. Moving the slider to the right improves frequency sharpness at the expense of time sharpness; moving it to the left improves time sharpness at the expense of frequency sharpness.

Recording sounds – File Toolbar



Raven Lite can display scrolling waveform and spectrogram views of sound coming into your computer (either from a microphone or from an audio CD or other sound source) in a *recorder window*. To create a recorder window, click the Record to Memory button on the File toolbar, choose **File > Record to Memory**, or press **<Ctrl-R>** (Windows) or **<Command-R>** (Mac OS X). A recorder window looks and behaves like any other Raven Lite sound window except that it has additional controls displayed in the status bar at the bottom of the window.

Choosing and setting up a sound input device

In order to choose and configure the sound input device that Raven Lite will use, you use controls supplied by the operating system, which are different for Windows and Mac OS X. The Appendix, "Configuring Audio Input" discusses how to choose a particular audio input device on each operating system. **Before proceeding further, you should refer to Appendix C to ensure that your system is properly configured.**

Starting and stopping recording

Click the triangular green Record-to-Memory button to start real-time scrolling waveform and spectrogram displays in the recorder window. When you start providing an audio signal (by starting playback of a tape or CD, or by speaking into a microphone), you should see waveform and spectrogram views appear at the right edge of the window and scroll across to the left. The Record-to-Memory button is replaced by a square Stop Recording button, and the status field next to the button displays the message "Recording to memory". When the waveform reaches the left edge, the oldest data are discarded to make room for the newest data. (You can see this happening if you zoom out along the time axis. Raven Lite will display a gray background to the left of the oldest data in the view.) Clicking the Stop Recording button stops recording. If you click the button to start recording again, Raven Lite clears the recorder window before beginning to display the new signal.

Recording to a file

To create a recorder window that can record sound to a WAVE file, click on the Record To File button on the File toolbar, or choose **File > Record To File**. (These commands are not available if there is already a recorder window open.) Raven Lite will display a dialog box in which you can specify the name and location of the sound file to create,

for example voice.wav. After you complete this dialog and click OK, Raven Lite will display a recorder window containing an extra button for controlling file recording.

There are two buttons the bottom left of the recorder window. The green Record-to-Memory button will start recording to memory. Click the red Record-to-File button to start saving to file.

Raven Lite always records to memory when recording to a file, so that the recorder window can display real-time views during acquisition. To begin recording to a file, click the round red Record-to-File button. The Record-to-File button is then replaced by the square red Stop-Recording-to-File button. If the recorder is not already recording to memory, recording to memory and to a file begins immediately, and all views in the window begin displaying data. If the recorder is already recording to memory when you click the Record-to-File button, recording to memory continues, and recording to the specified file begins.

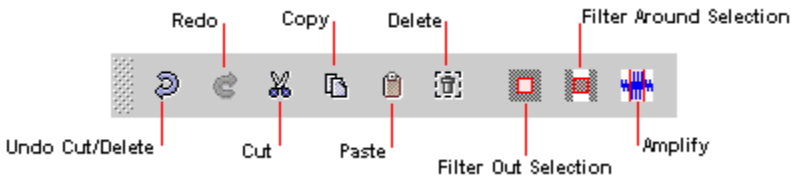
While recording to a file, Raven Lite displays the name of the file and a progress bar at the bottom of the recorder window to indicate how much of the file has been recorded. File recording stops when the file has reached a maximum length of one minute, or when you click the Stop-Recording-to-File button. If the recorder was recording to memory before file recording started, it continues recording to memory after file recording stops.

If you click the Record-to-File button again, Raven Lite will record to a new file with a 2 appended to the name e.g. voice2.wav, subsequent files will have incrementing numbers at the end of the sound file name.

Selecting a recording device

If your computer has more than one recording device in it, then Raven Lite allows you to select between them. One example of this would be if you install an additional sound card on a Windows PC, or if you use an iMic on a Macintosh computer. To select a recording device, choose **File>Select Recording Device**. On the Select Audio Input Device dialog, make a selection in the dropdown combo box, then press OK. You will need to close the current recorder window and open a new one for the change to take effect in the recorder window.

Editing sounds – Edit Toolbar



Cut, Copy, Paste, and Delete



Raven Lite lets you cut, copy, or delete data in a selection using buttons on the File toolbar, commands on the Edit menu, or standard keyboard equivalents. When you cut or copy a selection, a copy of the selected data is put in the clipboard; in a cut, the selected data are then deleted from the sound, and the window is redrawn to reflect the change. The Paste command inserts the contents of the clipboard at the time of the selection in the active sound window. If the selection is a range (rather than a point), the clipboard contents replace the data in the selection. If there is no selection, the Paste command is unavailable. Data on the clipboard can be pasted into the same sound window, or a different one.

You can create a new empty sound window for pasting data copied or cut from an existing sound window, by choosing **File > New Sound Window** or by typing **<Ctrl-N>** (Windows) or **<Command-N>** (Mac OS X), or by clicking the New Sound Widow button in the File Toolbar.

The clipboard can hold only one item at a time; whenever you Cut or Copy, the data that go into the clipboard replace what was there before. You can delete the data in the selection either by clicking the Delete button on the File toolbar, by choosing **Edit > Delete**, or by pressing **<Ctrl-backspace>** (Windows) or **<Command-backspace>** (Mac OS).

Cut Copy, Paste, and Delete operations apply only to the time dimension of a sound window. If you select a region for one of these operations in a spectrogram, the operation applies across all frequencies in the signal for the duration of the selection, irrespective of the frequency limits of the selection.

Amplifying a selection

To amplify all or part of a sound, click on the Amplify button on the Edit toolbar, or choose **Edit > Amplify**.... Raven Lite will display a dialog box in which you specify whether to amplify the entire sound or just the selected part, and how much to amplify the sound. Amplifying by factors greater than 1 makes the sound louder; amplifying by factors between 0 and 1 makes the sound softer. Amplifying by 0 silences the sound.

Filtering out or around a selection


Raven Lite allows you to *filter out* or *filter around* a selected frequency band in a sound. When you filter out a frequency band, frequency components in that band are removed from the signal. When you filter around a frequency band, frequency components outside of that band are removed, leaving only the frequencies in the selected band.

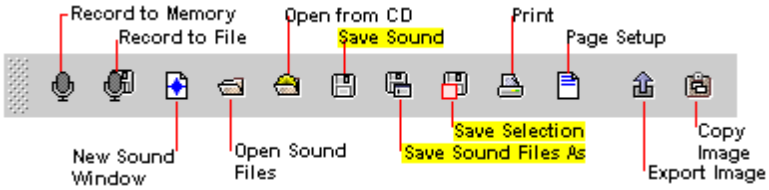
To filter out or around a particular frequency band, display the spectrogram, then use the mouse to select the time interval and frequency band to be filtered, then click the Filter Out Selection or Filter Around Selection button on the Edit toolbar, or choose **Edit > Filter > Filter Out Selection** or **Edit > Filter > Filter Around Selection**.

Undoing and redoing an edit

If you wish to undo an edit that you have just made, you can do this by clicking the undo button in the Edit toolbar or by choosing **Edit>Undo**. Undo works on a single edit at a time. If you want to redo the last edit that was undone, click the redo button in the Edit toolbar or chose **Edit > Redo**.

The Raven Lite clipboard will keep track of the last ten edits. Each of the edits can be undone and redone only in the context of the original operation. E.g. if you amplify and then cut, you need to undo the cut before you can undo the amplify.

Saving sounds – File Toolbar



Saving a Sound File

If you have recorded or modified a sound file that you have loaded into Raven Lite, you can save the sound file by either clicking the Save Button on the File Toolbar or by selecting **File > Save** or by hitting the Ctrl+S keys. The file will be automatically saved using the current file name. The file will be saved using the current sound file formats. If the file doesn't have a name, Raven Lite will prompt you for a name using the Save Sound As dialog.

After a sound has been recorded or edited, the resultant sound file can be saved by clicking the 'Save As' icon in the file toolbar or selecting **File > Save As**… in the dropdown menu. Doing so will open the Save As dialog. To save this file with a new name, you just type the new name in the File Name text box. To alter the format, select the required format from the Sound File Format dropdown menu. The Format options available are: 8-bit AIFF, 16-bit AIFF, 24-bit AIFF, 8-bit WAVE, 16-bit WAVE, 24-bit WAVE.

To save a selection, click 'Save Selection As' icon in the File toolbar or select **File > Save Selection As** in the menu. The same options are available as in the Save As command, but only the time period over which the selection occurred will be saved. You can save a selection in a similar way as you can save a File. When saving a selection to a file, the operation applies across all frequencies in the signal for the duration of the selection, irrespective of the frequency limits of the selection.

Copying and Exporting Images – View and File Toolbars

Raven Lite allows you to export the Raven Lite images to a file or to a clipboard. When you click the Copy Image button in the Edit Toolbar or select **Edit >Copy Image Of**, a dropdown menu will give you the choice of either copying the Raven Lite Application Window, copying the visible views associated with the current sound window, all views associated with the current sound file, the Waveform of the current selection, or the Spectrogram of the current selection. You can save the image to a file by clicking the Export Image button or selecting **File > Export Image of** , you are then given the same options as copy as to what part of the Raven Lite application you wish to save. You will then be asked for the filename of the image that you want to save, and which format you wish to save the image file as. The options are: Windows Bitmap Graphic Files (*.bmp), Encapsulated Postscript Files (*.eps), JPEG files (*.jpg, *.jpeg), Portable Network Graphics Files (*.png) or a TIFF file (*.tif, *.tiff). EPS files can only be saved for individual views.

Printing Sound Windows – File Toolbar

You can print the Sound Windows by clicking the Print button in the File Toolbar or by selecting **File > Print** in the dropdown menu or by selecting Ctrl-P from the keyboard in Windows or Command-P in Mac OS X. You can however only print the current window.

Clicking the Page Setup button or selecting **File > Page Setup** in the dropdown menu allows you to define how you want the page printed. You can choose to print the page in either 'Portrait' or 'Landscape' format. In addition you can also select the paper source and size, and you can define the size of the margins.

Getting Help

To read more about the software, choose **Help > Quick Start Guide** for a quick lesson on how to get started with Raven Lite.

Choose **Help > User's Guide** for a more in-depth description of the features of this product

Choose **Help > Technical Support** to be taken to a web forum FAQ site where you can ask questions and read questions from other users.

Choose **Help > Web Site** to visit the Raven Lite web site.

Choose **Help > License Agreement**… to read through the license agreement that you agreed to when you first started the software.

Choose **Help > About Raven Lite** to see copyright information as well as the names of the people who created this product.

Updating your software

Choose **Help > Check for Updates** to see if there are updates to the software that were made available after you installed it.

Choose **Help > Read About Updates** to see a list of updates that have been made available since the software was first released.

Choose **Help > Proxy Configuration** to set your proxy settings if you are connecting to the Internet through a proxy server.

Downloading Sounds and Extras

Choose **Help > Example Sounds** to be taken to a website describing the example sounds that are available with Raven Lite. The site also points to the download site for these sounds.

Choose **Help > Download QuickTime Installer** to be given directions for downloading QuickTime from Apple Computer, Inc. Raven Lite uses QuickTime for access to MP3, Quick Time movie .mov, and AIFC files.

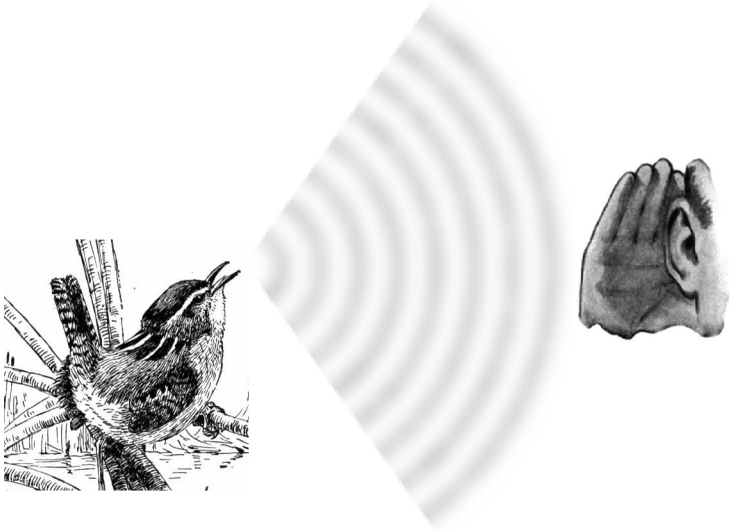
Appendix A

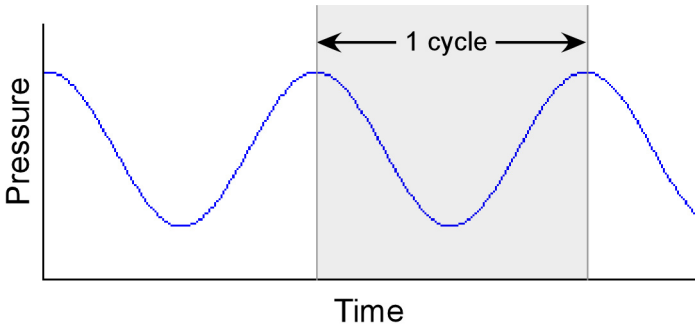
What is Sound?

About this appendix

This appendix provides a brief explanation of the basic physical properties of sound and how they are represented in Raven Lite.

When an object vibrates, it creates alternating regions of higher and lower pressure in the surrounding air or water. These pressure variations are called *sound waves*, and travel through air or water the way ripples do when a stone drops into a pond. The speed of sound can vary through different media in different conditions. We hear a sound when our ears respond to sound waves by generating electrical signals that travel through nerves to the brain.





The simplest sound is a pure tone or whistle. If we measure the changes in air pressure when a pure tone is present, and make a graph of how the pressure changes over time, we see a smoothly changing repeated curve called a *sine wave*.

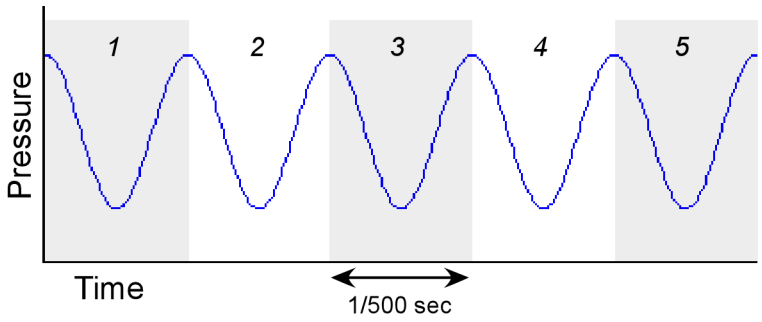
The time between one peak in pressure

and the next peak is called one *cycle*.

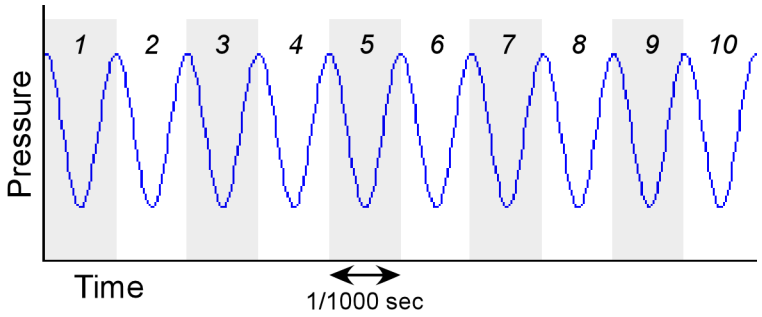
This type of graph, showing sound pressure changes over time, is called a *waveform*. More complex sounds have more complex waveforms.

Frequency

The number of cycles per second in a pure tone is called the *frequency* of the tone. The higher the frequency of the tone, the higher the pitch that we hear. Frequency is measured in units of Hertz (abbreviation: Hz); one Hertz = one cycle per second.

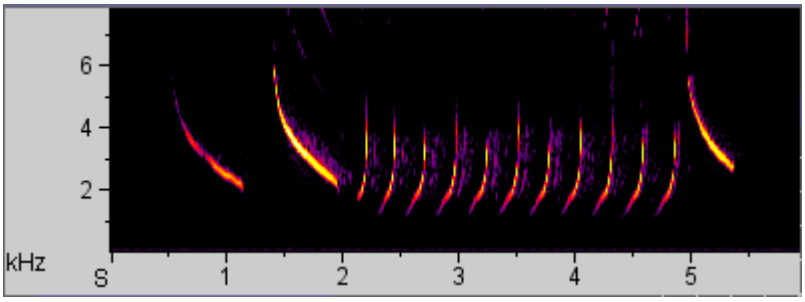


These waveforms show two tones with different frequencies. For each tone, a time interval of 1/100 of a second is shown. The gray and white bands show individual cycles in each waveform. The first tone has a frequency of 500Hz, and the second has a frequency of 1000Hz.

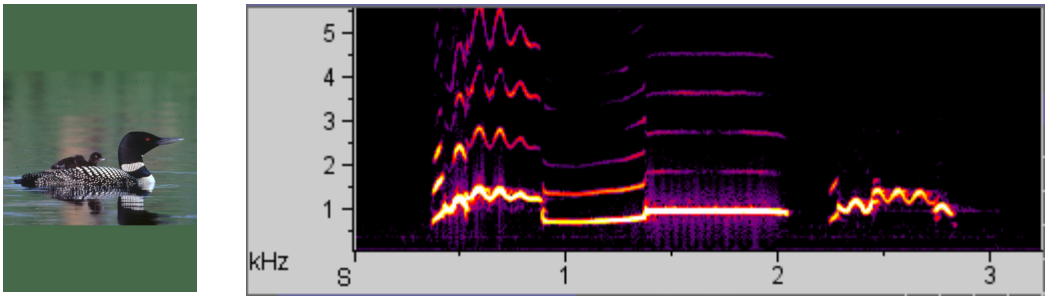


Seeing Sound

Scientists use computer-generated images called *spectrograms* to visualize the sounds of animals. Like a musical staff, a spectrogram reads from left to right. Higher-pitched sounds appear higher on the spectrogram.



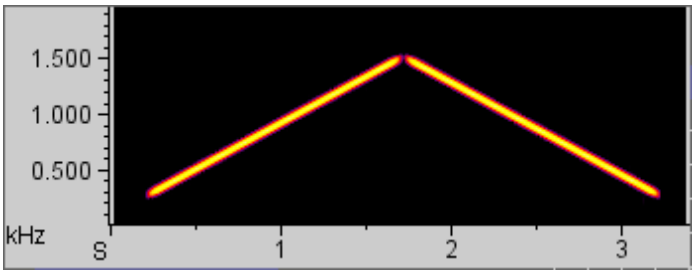
Northern cardinal – Photograph © Gary W. Carter



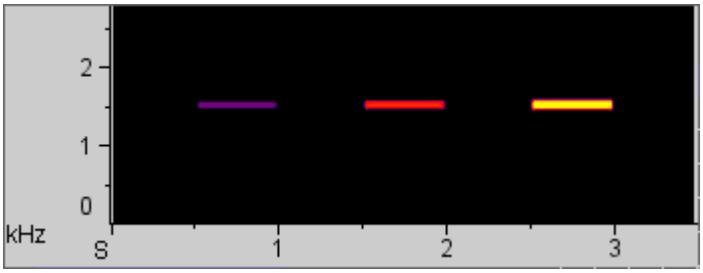
Common loon – Photograph © Robert E. Peltz

These images show how sounds of different pitch, duration, and loudness appear in spectrograms. These sounds were produced by a computer.

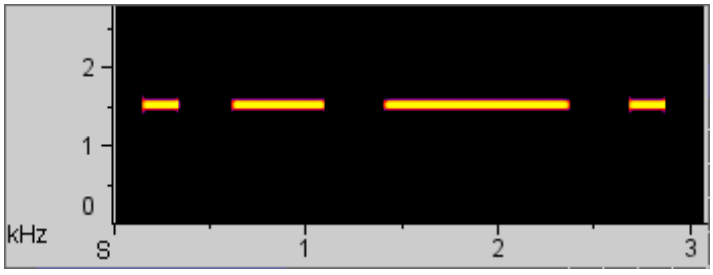
Higher sounds appear higher on the spectrogram:



Louder tones are shown in a brighter color on the spectrogram:

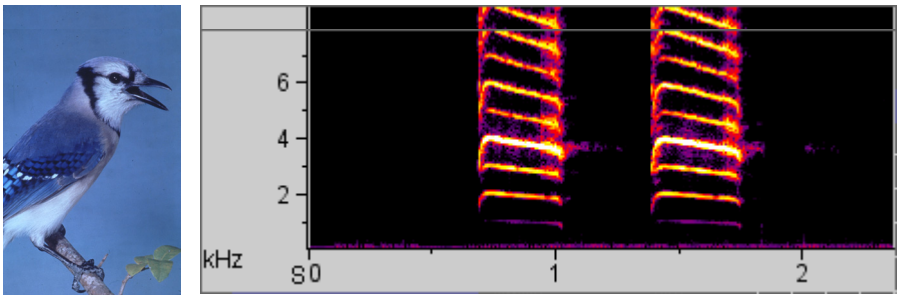


Longer tones appear as longer marks on the spectrogram:



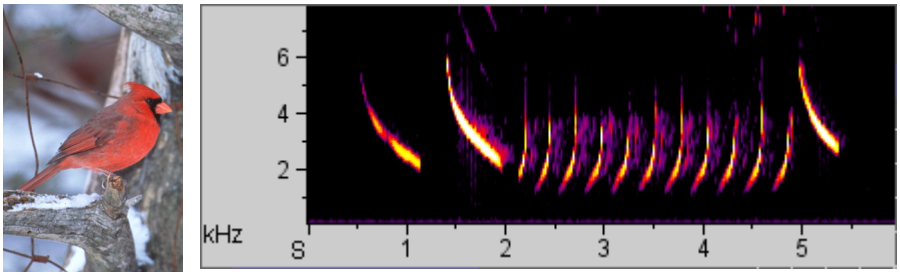
Buzzy and whistled sounds appear differently on spectrograms:

Buzzy sounds appear as sets of evenly spaced parallel lines at different frequencies. The lines are called *harmonics*.



Blue jay – Photograph © John Dunning

Whistles appear as single lines that go up and down with pitch.



Northern cardinal – Photograph © Gary W. Carter

Appendix B

Digital Representation of Sound

About this appendix

This appendix provides a brief explanation of how sound is represented digitally. An understanding of the basic principles introduced here will be helpful in using Raven Lite.

Digital sampling

Before a continuous, time-varying signal such as sound can be manipulated or analyzed with a digital computer, the signal must be *acquired* or *digitized* by a hardware device called an analog-to-digital (A/D) converter, or *digitizer*. The digitizer repeatedly measures or *samples* the instantaneous voltage amplitude of a continuously varying (analog) input signal at a particular sampling rate, typically thousands or tens of thousands of times per second (Figure B.1). In the case of an audio signal, this time-varying voltage is proportional to the sound pressure at a device such as a microphone. The digital representation of a signal created by the digitizer thus consists of a sequence of numeric values representing the amplitude of the original waveform at discrete, evenly spaced points in time.

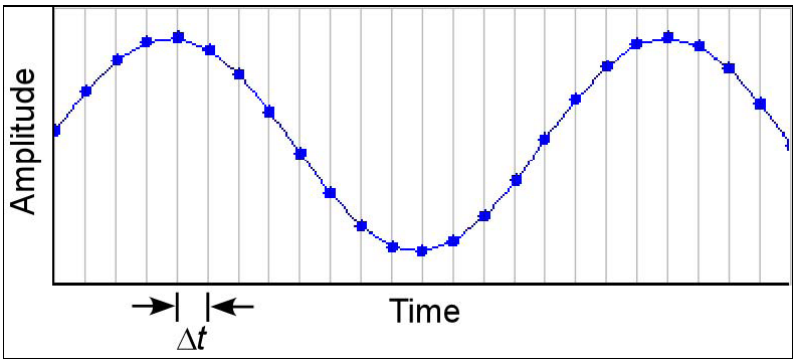


Figure B.1. Sampling to create digital representation of a pure tone signal. The blue sinusoidal curve represents the continuous analog waveform being sampled. Measurements of the instantaneous amplitude of the signal are taken at a sampling rate of 1/Δt. The resulting sequence of amplitude values is the digitized signal. The precision with which the digitized signal represents the continuous signal depends on two parameters of the digitizing process: the rate at which amplitude measurements are made (the *sampling rate* or *sampling frequency*), and the number of bits used to represent each amplitude measurement (the *sample size* or *bit depth*).

Sampling rate

Most digitizers have two or more sampling rates available. Commercial digital audio applications use sampling rates of 44.1 kHz (for audio compact discs) or 48 kHz (for digital audio tape). Once a signal is digitized, its sampling rate is fixed. In order to interpret a sequence of numbers as representing a time-varying signal, one needs to know the sampling rate. Thus, when a digitized signal is saved in a file format that is designed for saving sound information (such as AIFF or WAVE), information about the sampling rate is saved along with the actual data points comprising the signal. Raven Lite always records with a sampling rate of 44.1 kHz.

Aliasing and the Nyquist frequency

The more frequently a signal is sampled, the more precisely the digitized signal represents temporal changes in the amplitude of the original signal. The sampling rate that is required to make an acceptable representation of a waveform depends on the signal's frequency. More specifically, the sampling rate must be more than twice as high as the highest frequency contained in the signal. Otherwise, the digitized signal will have frequencies represented in it that were not actually present in the original at all. This appearance of phantom frequencies as an artifact of inadequate sampling rate is called *aliasing* (Figure B.2). Since Raven Lite records with a sampling rate of 44.1 kHz, it will record sounds up to 22.05kHz without aliasing. Since the limit of human hearing is about 20 kHz, Raven Lite should be able to record any sound that you can hear with your ears.

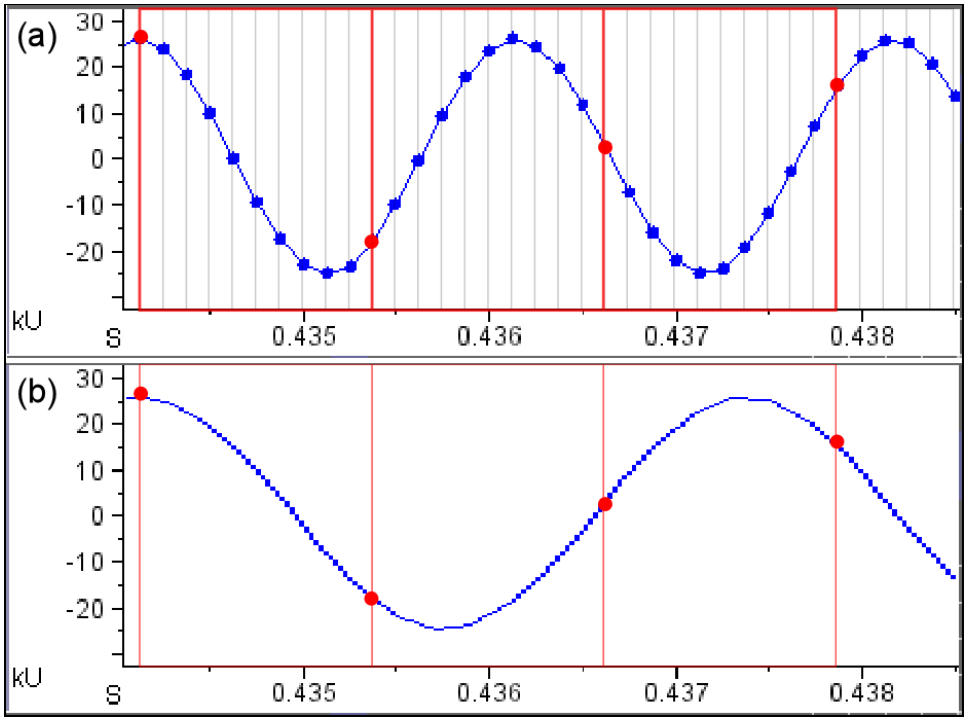


Figure B.2. Aliasing as a result of inadequate sampling rate. Vertical lines indicate times at which samples are taken. **(a)** A 500 Hz pure tone sampled at 8000 Hz. The blue sinusoidal curve represents the continuous analog waveform being sampled. There are 16 sample points (= 8000/500) in each cycle of the waveform. If the same analog signal were sampled at 800 Hz (red sample points), there would be fewer than two points per cycle, and aliasing would result. **(b)** The aliased waveform that would be represented by sampling the 500 Hz signal at a sampling rate of 800 Hz (Nyquist frequency = 400 Hz). Since the original waveform was 100 Hz higher than the Nyquist frequency, the aliased signal is 100 Hz below the Nyquist frequency, or 300 Hz.

The highest frequency that can be represented in a digitized signal without aliasing is called the *Nyquist frequency*, and is equal to half the frequency at which the signal was digitized. The highest frequency shown in a spectrogram or spectrum calculated by Raven Lite is always the Nyquist frequency of the digitized signal. If the only energy above the Nyquist frequency in the analog signal is in the form of low-level, broadband noise, the effect of aliasing is to increase the noise in the digitized signal. However, if the spectrum of the analog signal contains any peaks above the Nyquist frequency, the spectrum of the digitized signal will contain spurious peaks below the Nyquist frequency as a result of aliasing. In spectrograms, aliasing is recognizable by the appearance of one or more inverted replicates of the real signal, offset in frequency from the original (Figure B.3).

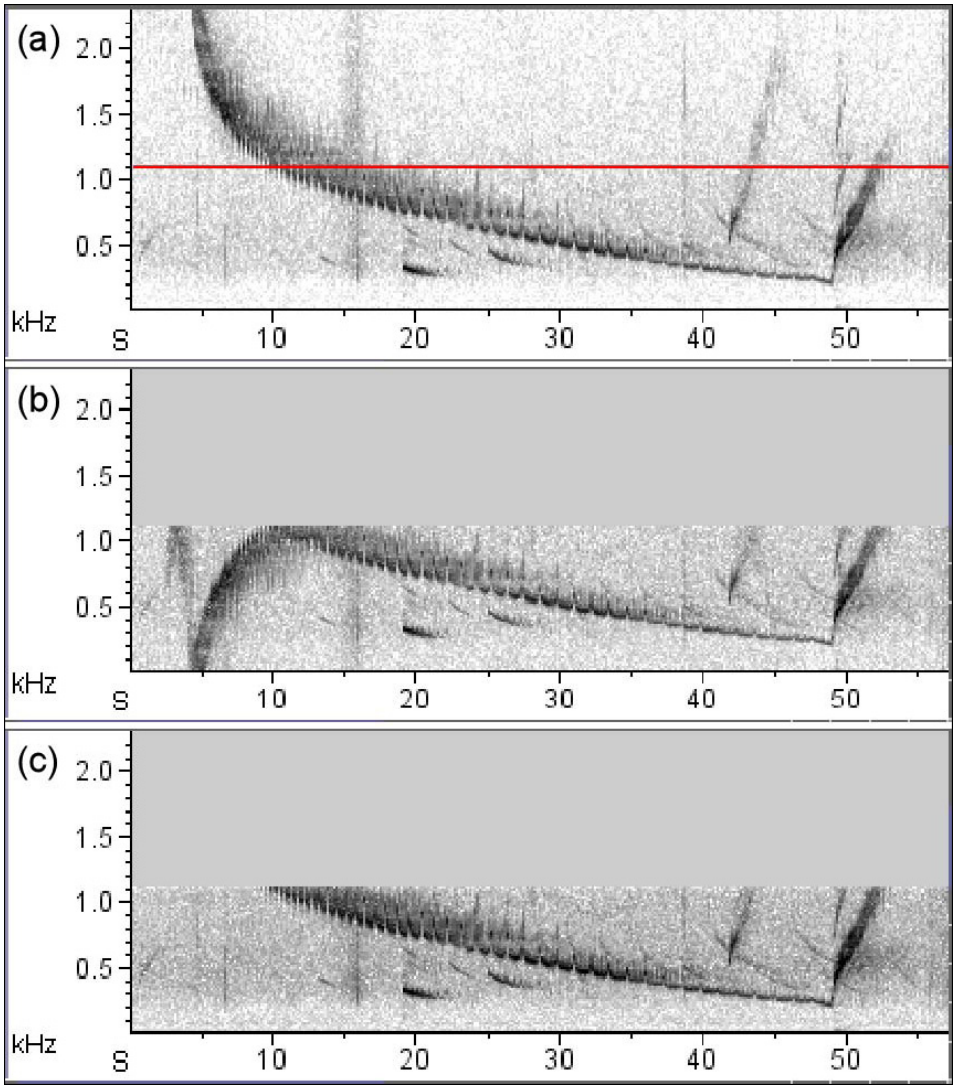


Figure B.3. Appearance of aliasing in spectrogram views. **(a)** Spectrogram of a bearded seal song signal digitized at 11025 Hz. All of the energy in the signal is below the Nyquist frequency (5512.5 Hz); only the lowest 2300 Hz is shown. The red line is at 1103 Hz, one-fifth of the Nyquist frequency. **(b)** The same signal sampled at 2205 Hz (one-fifth of the original rate; Nyquist frequency, 1102.5 Hz) without an anti-aliasing filter. The frequency downsweep in the first ten seconds of the original signal appears in inverted form in this undersampled signal, due to aliasing. **(c)** The same signal as in (b), but this time passed through a low-pass (anti-aliasing) filter with a cutoff of 1100 Hz before being digitized. The downsweep in the first ten seconds of the original signal, which exceeds the Nyquist frequency, does not appear because it was blocked by the filter.

The usual way to prevent aliasing is to pass the analog signal through a low-pass filter (called an *anti-aliasing filter*) before digitizing it, to remove any energy at frequencies greater than the Nyquist frequency. (If the original signal contains no energy at

frequencies above the Nyquist frequency or if it contains only low-level broadband noise, this step is unnecessary.)

Sample size (amplitude resolution)

The precision with which a sample represents the actual amplitude of the waveform at the instant the sample is taken depends on the sample size or number of bits (also called *bit depth) used* in the binary representation of the amplitude value. Some digitizers can take samples of one size only; others allow you to choose (usually through software) between two or more sample sizes. An 8-bit sample can resolve 256 ($=2^8$) different amplitude values; a 16-bit converter can resolve 65,536 ($=2^{16}$) values. Sound recorded on audio CDs is stored as 16-bit samples. Raven Lite's recorder stores 16-bit samples. When a sample is taken, the actual value is rounded to the nearest value that can be represented by the number of bits in a sample. Since the actual analog value of signal amplitude at the time of a sample is usually not precisely equal to one of the discrete values that can be represented exactly by a sample, there is some *digitizing error* inherent in the acquisition process (Figure B.4), which results in *quantization noise* in the digitized signal. The more bits used for each sample, the less quantization noise is contained in the digitized signal. If you listen to a signal digitized with 8-bit samples using high-quality headphones, you can hear the quantization noise as a low-amplitude broadband hiss throughout the recording. Signals digitized with 16-bit samples typically have no detectable hiss. The ratio between the value of the highest amplitude sample that can be represented with a given sample size and the lowest non-zero amplitude is called the *dynamic range* of the signal, and is usually expressed in decibels (dB). The dynamic range corresponds to the ratio in amplitude between the loudest sound that can be recorded and the quantization noise. The dynamic range of a digitized sound is 6 dB/bit; therefore the dynamic range of recordings produced by Raven Lite is 96 dB.

1. The dynamic range of a signal in decibels is equal to $20 \log_{10}(A_{max}/A_{min})$, where A_{max} and A_{min} are the maximum and minimum amplitude values in the signal. For a digitized signal, $A_{max}/A_{min} = 2_n$, where n is the number of bits per sample. Since $\log_{10}(2_n) = 0.3n$, the dynamic range of a signal is 6 dB/bit.

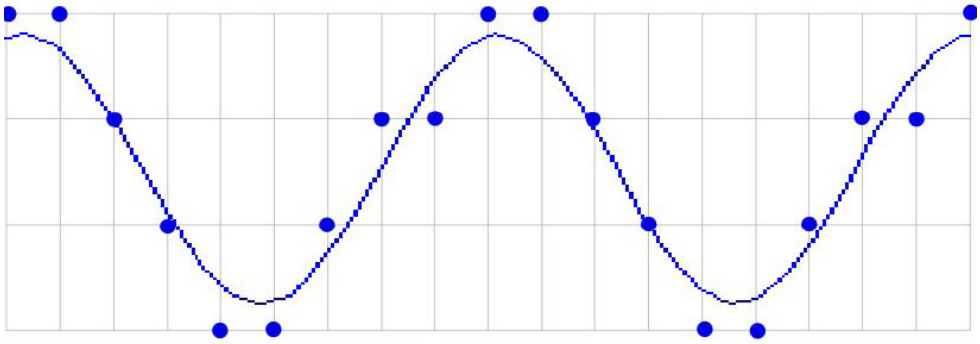


Figure B.4. Digitizing error with a hypothetical 2-bit sample size. 2-bit samples can represent only four different amplitude levels. The blue sinusoidal curve represents the continuous analog waveform being sampled. At each sample time (vertical lines), the actual amplitude levels are rounded to the nearest value that can be represented by a 2-bit sample (horizontal lines). The amplitude values stored for most samples (dots) are slightly different from the true amplitude level of the signal at the time the sample was taken.

Specifying sample sizes when acquiring and saving signals

Raven Lite sets the sample size for a signal when you first acquire it, and lets you specify it when you save the signal to a file. While Raven Lite is actually working with a signal, samples are always represented by 32-bit floating-point values. When you save a signal with a sample size other than the sample size that the signal had when it was acquired or opened, Raven Lite scales the values to the sample size that you select when you specify the format of the file (For example, if you open a file containing 8-bit samples, and then save the signal with 16-bit samples, each sample value will be multiplied by 2^8. This scaling ensures that a full-scale value in the original signal is still a full-scale value in the saved signal, even if the sample size differs.

Although you can open a sound with 8 bits and then save it with a larger sample size, the saved sound will retain the smaller dynamic range (and audible quantization hiss) of the 8-bit sound. This is because the quantization noise is scaled along with the desired sound when 8-bit sounds are scaled to the larger sample size.

Storage requirements

The increased frequency bandwidth obtainable with higher sampling rates and the increased dynamic range obtainable with larger samples both come at the expense of the amount of memory required to store a digitized signal. The minimum amount of storage (in bytes) required for a digitized signal is the product of the sample rate (in samples/sec), the sample size (in bytes; one byte equals 8 bits), and the signal duration (seconds). Thus, a 10-second signal sampled at 44.1 kHz with 16-bit (2-byte) precision requires 882,000 bytes (= 10 sec x 44,100 samples/sec x 2 bytes/ sample), or about 861 Kbytes of storage (1 Kbyte = 1024 bytes). The actual amount of storage required for a signal may exceed this minimum, depending on the format in which the samples are stored.

The amount of time that it takes Raven Lite to calculate a spectrogram of a sound depends directly on the number of samples in that signal. Thus, spectrograms take longer to calculate for signals digitized at higher rates. However, the sample size at which a signal is acquired or saved does affect the speed of spectrogram calculation, because Raven Lite always converts signals to a 32-bit floating-point representation for internal operations, even if sound was initially acquired or saved with a different sample size.

Appendix C

Configuring Audio Input

About this appendix

This appendix explains how to use controls provided by your operating system to select and adjust the audio device from which Raven Lite gets input when acquiring new signals.

Windows 98, 2000 and XP

Depending on which version of the Windows operating system you're using, the icons and windows you see may appear slightly different from those shown here. However, the audio input controls function the same way in all versions of Windows. To access the Windows audio input and output controls, double-click on the speaker icon that is displayed in the icon tray in the Windows task bar (Figure C.1).

Figure C.1. The Windows icon tray. Double-click on the speaker icon to display the Windows audio input and output controls. (You may see different icons in the tray, depending on how your system is configured.)

The Volume Control dialog appears (Figure C.2), showing the volume and balance settings for various audio output devices. To display the controls for audio input (recording) devices, choose **Options > Properties**. In the Properties dialog that appears (Figure C.3), the Mixer device drop-down menu lists all of the sound cards installed in your computer, and lets you choose which one to use for audio input. On many computers, only a single sound card is installed; its name may differ from that shown in Figure C.3. Click on Recording, check the boxes next to all of the sound input devices that you may want to use on the list of volume controls at the bottom of the dialog box, then click OK.

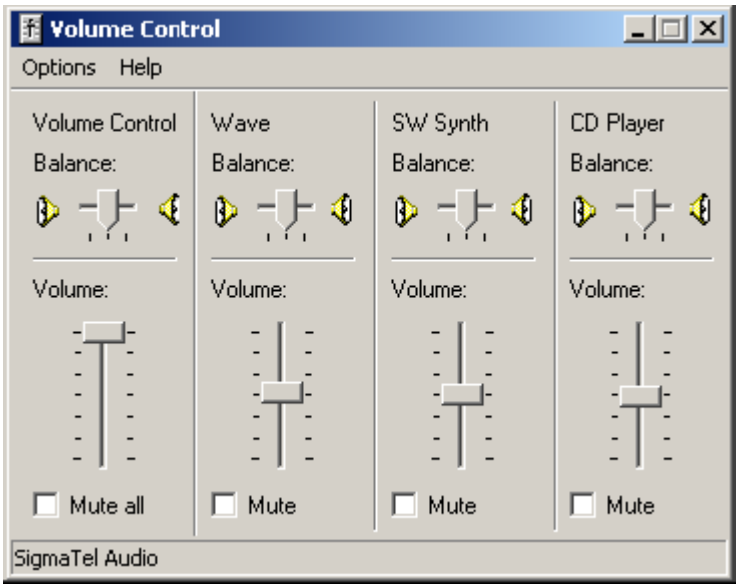


Figure C.2. The Windows Volume Control dialog as it's initially displayed, showing Playback controls. Controls for different devices may be displayed, depending on system configuration.

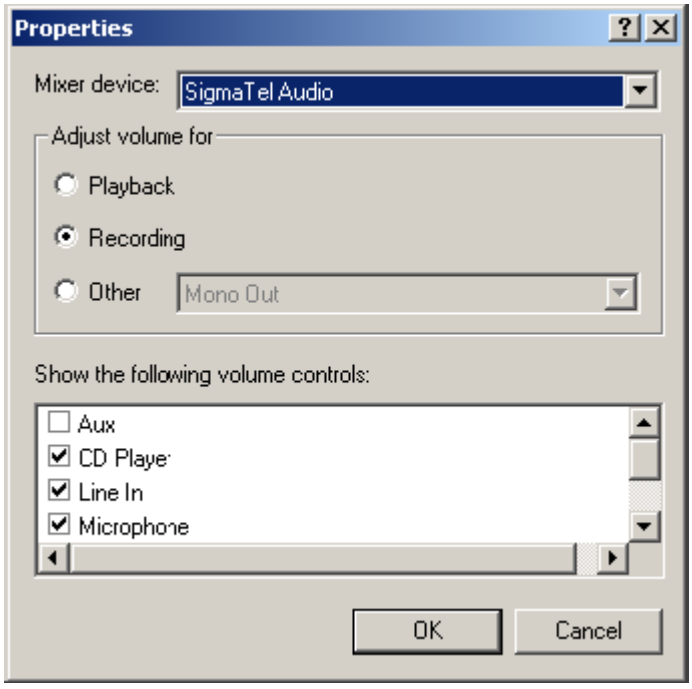


Figure C.3. The Properties dialog for the Windows audio playback and recording devices. The Mixer device name on your computer may differ from what's shown here.

The Volume Control dialog will be replaced by the Recording Source dialog (Figure C.4). To choose which recording source will be used, check the Select box for that device. To adjust the recording level, move the Volume slider control. Changes that you make in this dialog box are reflected immediately in the signal reaching Raven Lite. You can thus start a recorder running in Raven Lite and then use the Windows audio controls to adjust the recording level.

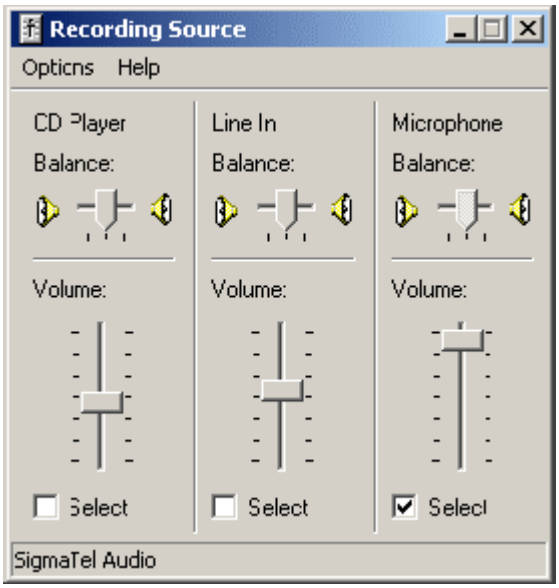


Figure C.4. The Recording Source controls. Controls for different devices may be displayed, depending on system configuration.

Mac OS X

Launch the utility program called Audio MIDI Setup, located in /Applications/ Utilities. Audio MIDI Setup is supplied with Mac OS X. Click on the Audio Devices tab to display controls for choosing a sound input device and setting the input (recording) level (Figure C.5). For Default Input, choose the sound input device that you plan to use with Raven Lite. In most cases, this will be Built-in Audio. Under Audio Input (left side of window), choose the Source to use for input to the audio device. In most cases, this will be Line In. The choices listed for Source correspond to physical input jacks or ports on the computer or external audio device. To adjust the recording level, move the Volume slider control. Changes that you make to the recording level in Audio MIDI Setup are reflected immediately in the signal reaching Raven Lite. You can thus start a recorder running in Raven Lite and then use the Audio MIDI Setup controls to adjust the recording level..

Do not make changes to the audio input format (sample rate, number of channels, and sample size) in Audio MIDI Setup while Ravel Lite is running. Doing so may result in corrupted recordings in Raven Lite.

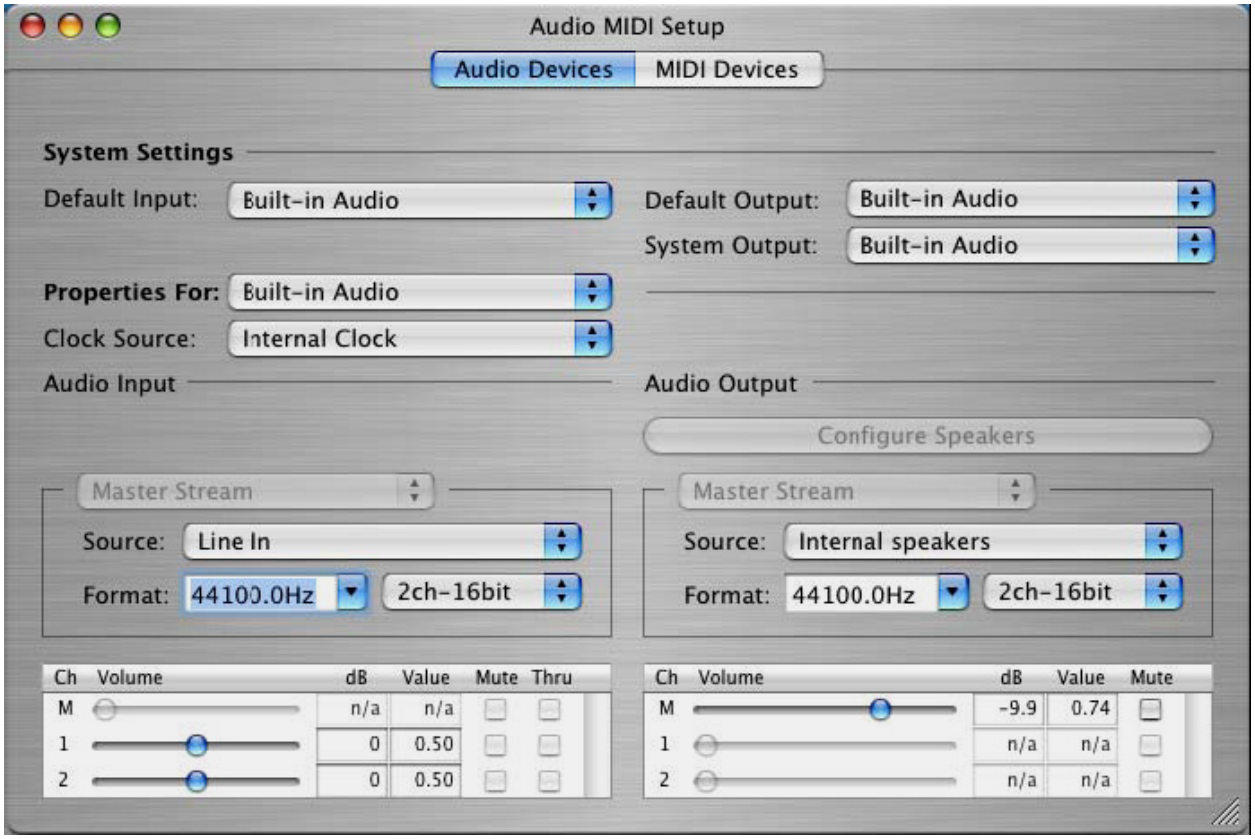


Figure C.5. The Audio Devices screen in the Audio MIDI Setup program.

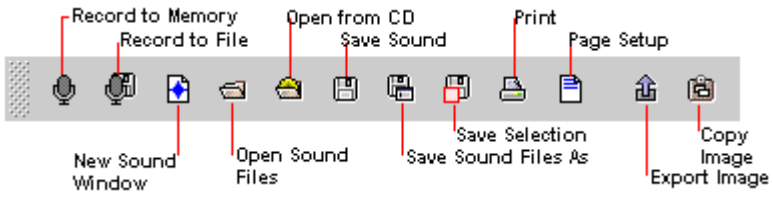
Appendix D

Glossary

About this appendix

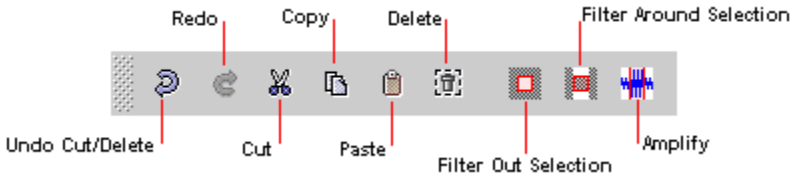
This Appendix gives a brief overview of the commands used in this manual, with hypertext links to the relevant sections

File Toolbar



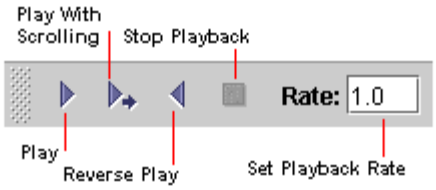
Record to Memory	Record sound to memory
Record to File	Record sound to a file
New Sound Window	Open a new Sound Window in the main Raven Lite Window
Open Sound Files	Select the sound files you wish to open
Open from CD	Open a track from an audio CD
Save Sound	Save the active sound
Save Sound File As	Save the active sound to file with a new name and/or file format
Save Selection	Save selection to file
Print	Print the active sound windows
Page Setup	Select page orientation and margins
Export Image	Save image of selected windows to file
Copy Image	Copy image of selected windows to clipboard

Edit Toolbar



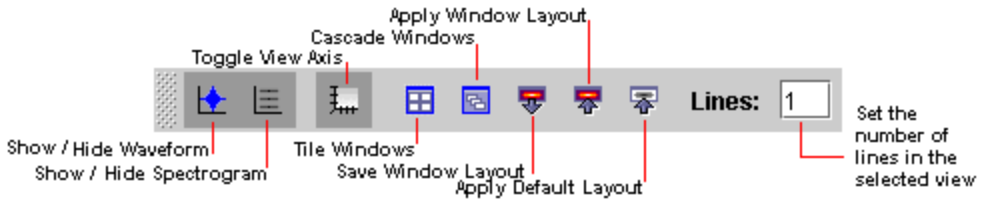
Undo	Undo an edit operation (cut, delete, amplify, filter)
Redo	Redo an edit operation (cut, delete, amplify, filter)
Cut	Cut the selected time slice
Copy	Copy the selected time slice
Paste	Paste the selected time slice
Delete	Delete the selected time slice
Filter Out Selection	Filter out the selected frequencies within selected time slice
Filter Around Selection	Filter around selected frequencies within selected time slice
Amplify	Amplify selected area or entire sound

Play Toolbar



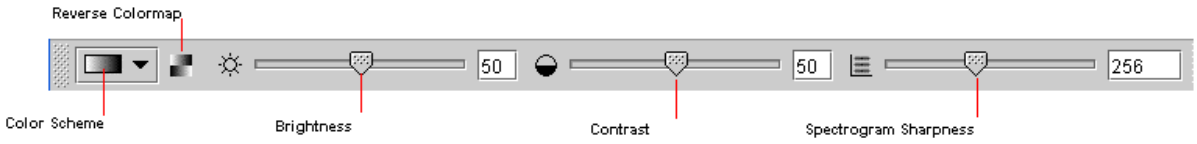
Play	Play active sound
Play With Scrolling	Scrolls Window as sound plays
Reverse Play	Play active sound backwards
Stop Playback	Stop playback
Set Playback Rate	Speed up or slow down playback

View Toolbar



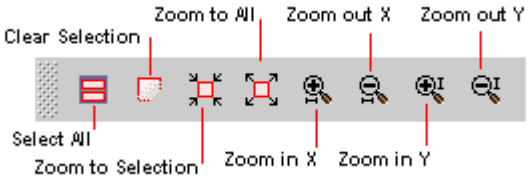
Show / Hide Waveform	Show or hide waveform view of active sound
Show / Hide Spectrogram	Show or hide spectrogram view of active sound
Toggle View Axis	Turn view axis on or off
Tile Windows	Tile all of the sound windows
Cascade Windows	Cascade all of the sound windows
Save Window Layout	Save the current sound window layout
Apply Window Layout	Apply the saved sound window layout
Apply Default Layout	Apply the default sound window layout
Set Lines	Set the number of lines to view

Spectrogram Toolbar



Color Scheme	Set the color scheme for the spectrogram
Reverse Color Map	Invert the spectrogram color map
Brightness	Increase / decrease spectrogram brightness
Contrast	Increase / decrease spectrogram contrast
Spectrogram Sharpness	Increase / decrease spectrogram sharpness

Selection/Zoom Toolbar



Select All	Select the entire sound
Clear Selection	Clear the current selection
Zoom To Selection	Zoom to current selection
Zoom to All	Zoom out to sound extents
Zoom In X	Zoom in time axis
Zoom Out X	Zoom out time axis
Zoom In Y	Zoom in frequency or amplitude axis
Zoom Out Y	Zoom out frequency amplitude axis