Chapter 3 Sound Windows: Visibility, Views, Linkage, & Navigation

About this chapter

This chapter will explain how to work with and get around Raven in more detail. Before reading this chapter, you should have a solid understanding of the major components and basic layout that make up the Raven window. If you need to review this information, please see Chapter 1, "Getting Started" and Chapter 2, "The Raven Window". Topics discussed in this chapter are:

- using contextual menus
- learning the basic layout of a sound window
- understanding the five main view types
- linking and unlinking of views
- controlling how views are displayed
- changing the appearance of a Sound window
- changing the appearance of the Raven window

Using Contextual Menus

As you learn more about navigating around the Raven window, you might realize that it would be convenient to have a list of contextually-oriented commands readily available. Well, luckily for our users, there is such a list. A context menu is a menu of useful commands that apply to wherever your mouse pointer is positioned at that time. To activate a context menu, simply right-click using your mouse (or Control+click on a Mac) and the menu will appear.

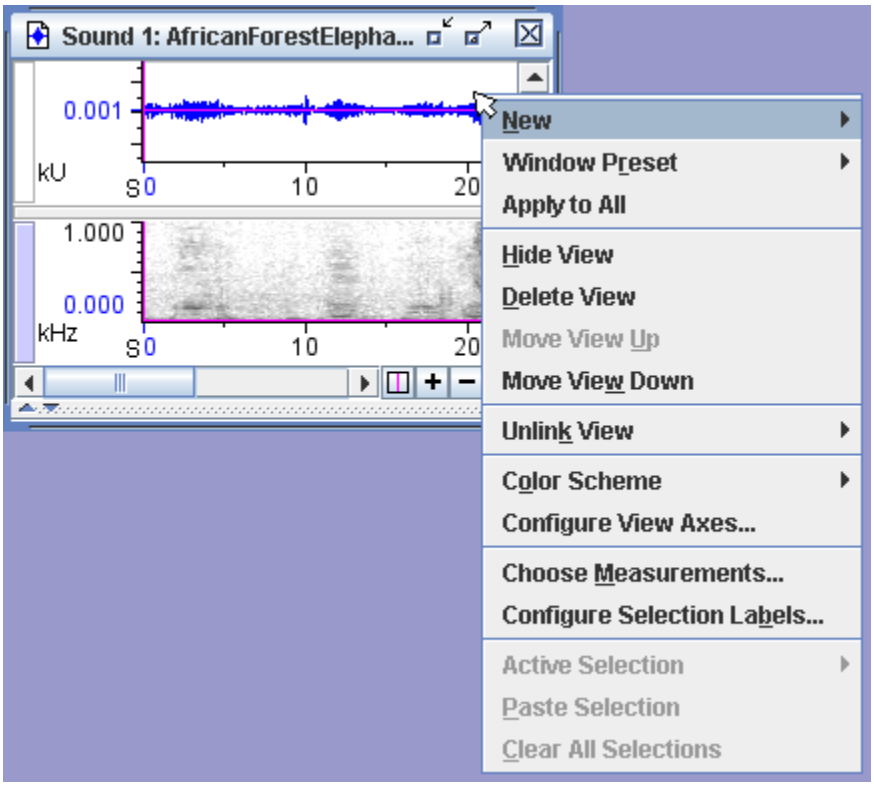

Figure 3.1. An example of a context menu when the mouse pointer is over a waveform view. The menu gives you many command options relevant to the mouse location and is accessible by a simple right-click of the mouse (or Control+click on a Mac).

Basic Layout of a Sound Window

This section contains information regarding the general makeup of sound windows. To review how to open a sound window, refer to "Opening a sound file" in Chapter 1 (page 2).

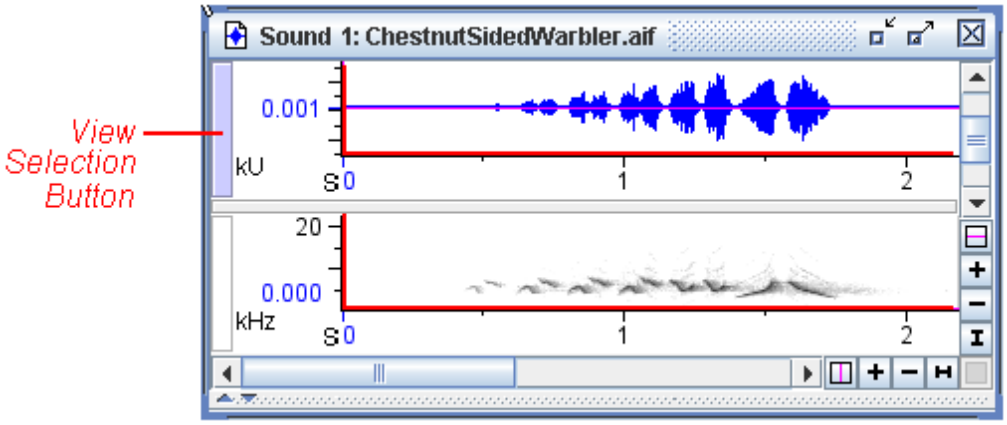

Figure 3.2. A basic sound window containing two views (a waveform view, top, and a spectrogram view, bottom) with the view axes (both vertical and horizontal) marked in red. Each axis is marked with a unit and number values.

The active view

Most commands, buttons and scroll bars that affect views apply only to the *active view*. Only one view in a sound window can be active at any given time. The active view is identified by a colored vertical *view selection button* at its left edge. The name of the active view is also highlighted on the side panel's Layout tab. In Figure 3.2, the waveform is the active view. To activate a view, click on its view selection button or in its axis areas. You can also activate a view by clicking on its name to select it in the side panel's Layout tab.

Although you can activate a view by clicking in the data region (i.e., above and to the right of the axes), doing so will create a selection. Basic information about selections can be found in "Making a selection" in Chapter 1 (page 9), while more advanced selection information is discussed in Chapter 6, "Selections: Measurements, Annotations, & Editing".

Moving, resizing, and closing a sound window

The sound window's title bar has controls for resizing and closing the window, and is the means by which you move a sound window. See Figure 3.3.

Figure 3.3. The title bar, with controls to resize and close a sound window. The title bar is also the anchor for moving the sound window.

To move the window around, simply click and drag on the title bar.

To minimize the window (to reduce the whole window to a short title bar at the bottom of the Raven window) click on the Minimize icon in the title bar. Clicking on a minimized window's title bar expands it again.

Clicking on the maximize icon makes the window fill the entire Raven desktop. When the window is maximized, you'll notice the Maximize button changes into a Restore button. Clicking this Restore icon restores the sound window to its previous size and position.

Clicking on the Close icon closes the window; if you close it, you'll have to reopen the sound file again by choosing File > Open Sound Files..., by typing <Ctrl-O> (Windows, Linux) or <Command-O> (Mac OS), or by using the Recent Files section of the File menu.

You can also resize the window by clicking and dragging on an edge or any corner of the window. On Mac OS, you must drag from the bottom right corner to resize the window.

Scrollbars

The horizontal and vertical scrollbars in a Raven 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's working memory.[1] The length of a scrollbar's scroll thumb (Figure 3.4) relative to the length of the entire scrollbar, indicates what proportion of the corresponding axis is visible in the view pane.

1. If you opened the entire sound at once (the default), the duration of the sound in memory is the duration of the entire sound file or file sequence. If you opened the sound in a paged window, the duration in memory is the length of one page. See "Configuring a new paged sound window" in Chapter 7 (page 188) for more on paged sound windows.

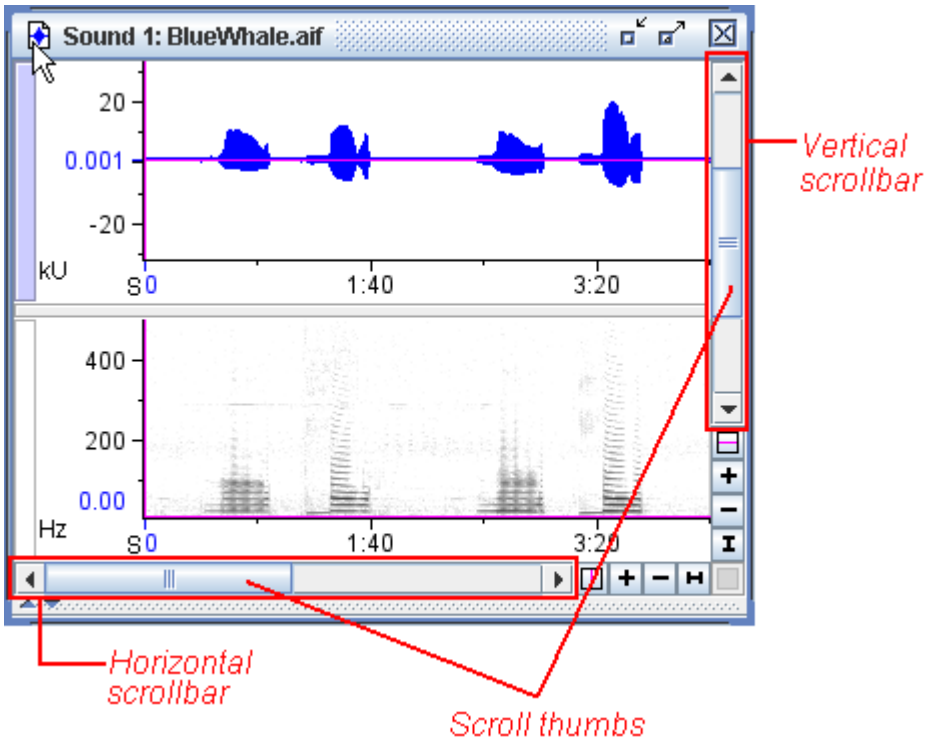

Figure 3.4. A sound window with its scrollbars and scroll thumbs labeled in red.

As touched on in "Filtered play" in Chapter 1 (page 9) the location of the scroll thumb within the scrollbar indicates the view's position relative to the data. When the horizontal scroll thumb of a waveform or spectrogram is at the left edge of the scrollbar, the start of the data is aligned with the position marker (Figure 3.4).

Raven displays a gray background for areas in each view pane that are beyond the limits of the data, for example before the beginning or after the end of a signal in the time dimension.

Axis units in views

The units used on the axes are indicated in the lower left corner of each view. In the waveform, the units are seconds (S) for the horizontal time axis, and kilounits (kU) for the vertical amplitude axis. In the spectrogram,

the units are seconds (S) for the horizontal time axis, and kilohertz (kHz) for the vertical frequency axis.

The "units" displayed on the vertical axis of a waveform view are the actual sample values in the signal, which are proportional to the sound pressure at the microphone when the sound was recorded.

Major and minor grid lines

You can choose to overlay a grid onto any of the views in Raven by checking the corresponding box in the layout tab of the side panel. The spacing of the major and minor grid lines is determined by the spacing of the major and minor tickmarks on an axis. You can configure which grids appear in which views by right-clicking on a sound (or Control+clicking on a Mac) and choosing Configure Grids... from the contextual menu, or using View> Configure Grids....

Position markers

Each view that Raven displays has a horizontal and a vertical *position* associated with it, shown by a magenta line, known as a *position marker*. You have already seen how the time position marker in a waveform view indicates the current time during scrolling play ("Filtered play" on page 9).

When we speak of the "horizontal position marker" we mean the line that marks the horizontal position, which is a vertical line.

Notice that when you move the time position of either the waveform or spectrogram, the time position marker in the other view moves with it. This is because views that share a dimension (e.g., the time dimension for waveform and spectrogram views) are by default *linked* by their position in that dimension. More detailed information regarding linkage of views is discussed in "Linking and unlinking views" on page 62.

Centering a position

You can move the horizontal or vertical position marker of a view relative to the window by grabbing it with the mouse and dragging it. To move a particular point in the data shown in a view to the horizontal or vertical center of the view pane, place the position marker on the point of interest, then click the corresponding Center Position button (Figure 3.5). The position marker and the underlying data will jump to the center of the

view pane. Blue labels along the axes show the exact numeric values of the current horizontal and vertical positions.

WINDOWS	On computers running the Windows operating system, you can make a view's horizontal position marker jump directly to a point by control-clicking at that point.

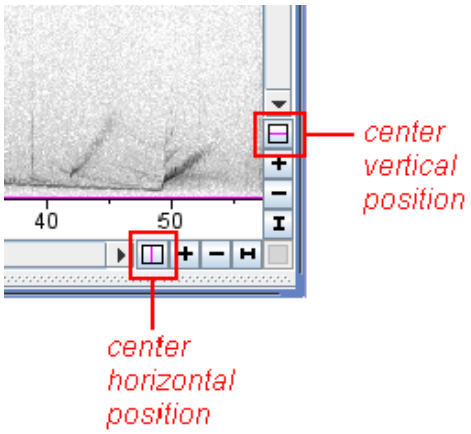

Figure 3.5. The horizontal and vertical Center Position buttons.

Positions control view appearance and behavior

The horizontal and vertical position of a view control aspects of a view's appearance and behavior in four ways:

1. First, a view's horizontal and vertical position, in combination with the view's horizontal and vertical scales, determine what portion of the view's data is visible in the window.
2. Second, a view's position is the point around which *zoom* operations are centered.
3. Third, the position of a view in a particular dimension (e.g., time or frequency) may be used to link that view to any other view that shares that dimension ("Linking and unlinking views" on page 62).
4. And fourth, during scrolling playback the time position moves through the data (though the *position location* stays fixed— see below) and can be used to control where playback starts (see "Filtered play" on page 9).

Position vs. position location

The position of a signal identifies a point *in the data* along a particular axis, such as time or frequency. In contrast, the *position location* is the point *in a particular view's panel* where the position marker is displayed, i.e., from left to right or top to bottom. For example, when you drag a time position marker, you change both the position location (relative to the window) and the position (relative to the data), since the data do not move with the marker.[2] When you click the Center Position button for an axis, the

position marker jumps to the corresponding (horizontal or vertical) center of the view panel, and the data move with it— i.e., the position location changes, but the position (relative to the data) does not.

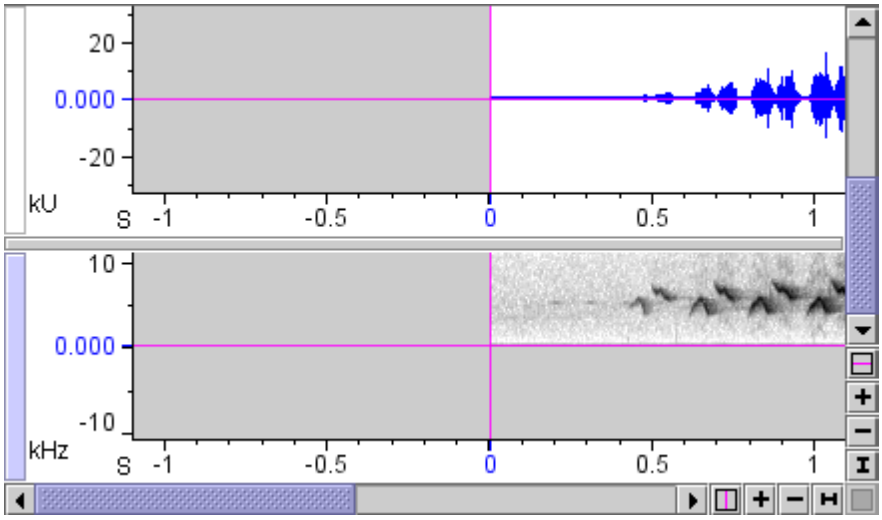

Figure 3.6. Waveform and spectrogram views with centered position markers, positioned at the start of the signal (left edge of horizontal scrollbar) and the lowest frequency (bottom end of vertical scrollbar) of the spectrogram. The vertical scrollbar refers to the spectrogram view, because the spectrogram is the active view.

Scale of a view

Each view that Raven displays has a horizontal and vertical *scale* associated with it. The scale determines the relationship between the dimensional units shown along that axis (e.g., seconds or kilohertz) of the view and display units (e.g., pixels, centimeters, or inches) on your computer screen. The scale at which the entire extent of an axis just fits in the view pane is called the *default scale* for that axis. When you first open a sound file, the time scale of the waveform view is set to the default. When you first create a spectrogram (information on creating views will be discussed later in the chapter) the frequency scale is set by default so that the entire frequency range of the signal fits vertically in the spectrogram pane.

Setting the scale of view axes

The scale and position of the horizontal and vertical axes of any view can be changed using the zoom controls and scrollbars, as described in the next section. However, more precise control of scale and position is available in the Configure View Axes dialog box (Figure 3.7). To display the Configure View Axes dialog box, choose Configure View Axes... from the contextual menu for any view or from the View menu for the active

2. The one exception is when you try to drag the position marker beyond the limits of the signal. In that case, the end point of the signal will move with the marker, and you will be changing the position location but not the position (which is set to one of its limits already).

view. You can enter precise values for the position and scale of the view's horizontal and vertical axes. Scale is specified in units per line of the view (see "Multiple-line views within sound windows" on page 74).

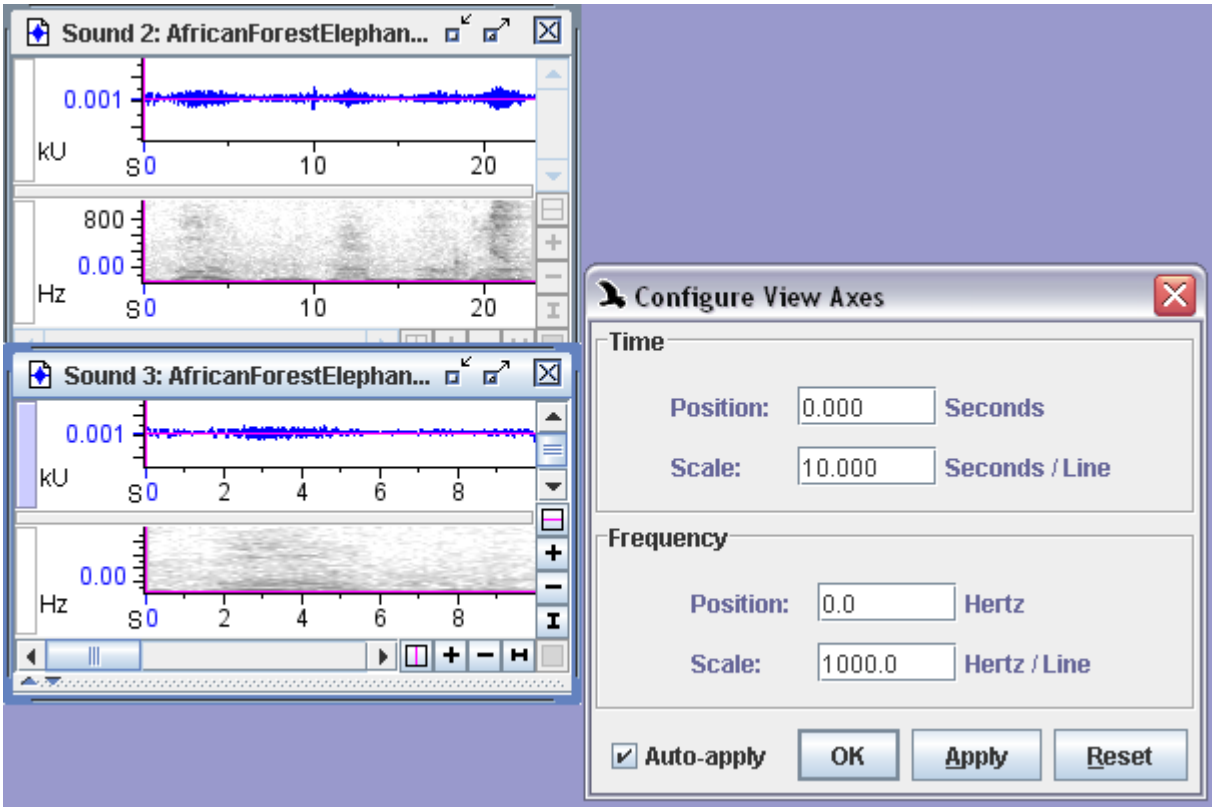

Figure 3.7. The original file (top left) is shown with the default time scale. Below that (bottom left) is the sound with its time scale changed to 10 Seconds/Line. The Configure View Axes box is shown (right) with the edited time scale displayed. You can see the original view shows more than 20 seconds of the signal, while the bottom view (with the altered time scale) shows only 10 seconds of the signal across the line.

Changing view scales by zooming

At the scale of magnification shown in Figure 3.6, you can't see individual cycles of oscillation of the waveform view (top); what you see is the envelope of the entire signal. In order to see more detail of a signal, you must adjust the *zoom* level of the view. In the lower right-hand corner of a Raven sound window are the zoom controls for the active view (Figure 3.8). Buttons marked with '+' and '-' at the right and bottom ends of the horizontal and vertical scrollbars respectively increase and decrease magnification (zoom in and out) around the current position along that axis.

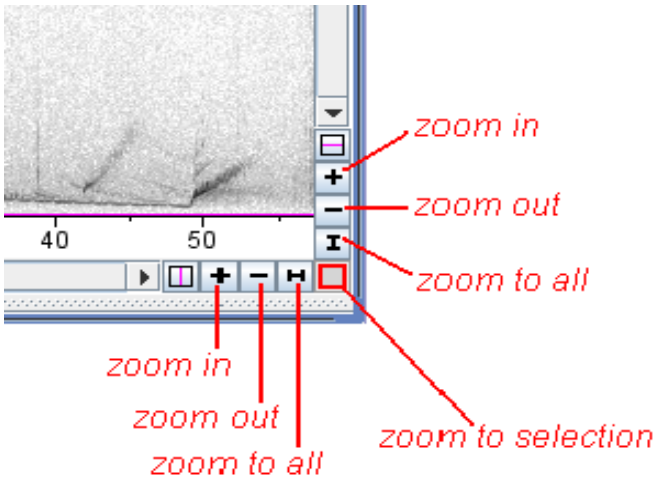

Figure 3.8. The zoom controls, which apply to the active view. The Zoom to Selection button is gray if no selection exists in the signal.

Zoom details

Each time you click a Zoom In or Zoom Out button, the corresponding axis of the active view is re-scaled by a factor of $\sqrt{2}$ (= 1.41). Thus, clicking the Zoom In or Zoom Out button twice in succession changes the scale by a factor of 2. To zoom in horizontally on a view, first make sure that view is active, then move the horizontal position marker to the point where you want to center the zoom. Click the '+' button at the end of the horizontal scrollbar, and observe how the display changes. Clicking the '-' button reverses the change.

Each time that you zoom in or out horizontally or vertically, the corresponding scroll thumb shortens or lengthens to indicate what proportion of the signal is visible. (Remember that the scroll thumb is half the length of the scrollbar when that axis's scale is set to its default value.)

Zooming in horizontally

If you click the horizontal '+' (zoom in) button repeatedly the scale will eventually be stretched to the point where Raven displays the individual samples in the waveform as dots (Figure 3.9).

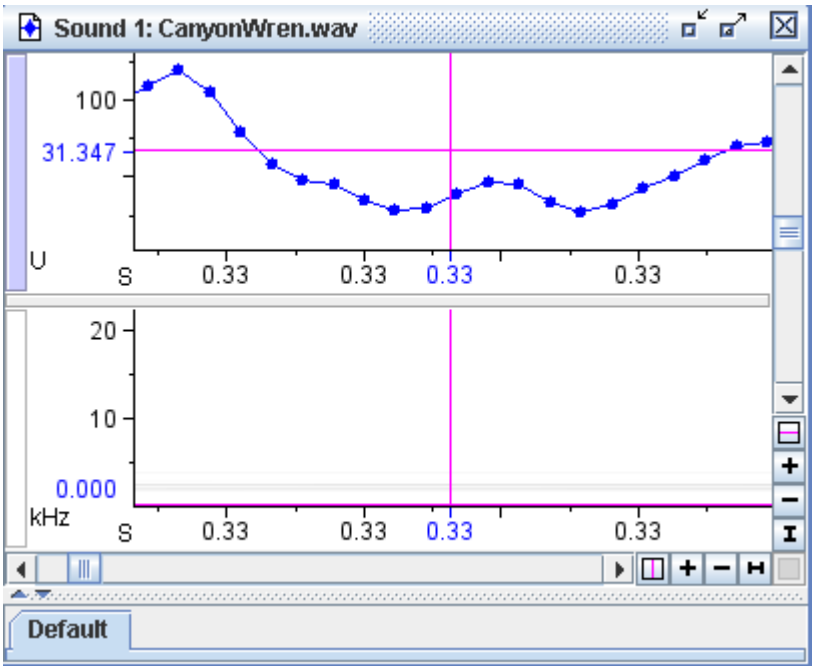

Figure 3.9. A sound window with its waveform view (top) horizontally zoomed in enough to display individual sample points.

As mentioned before, the spectrogram and waveform views are linked by their time scale (and time positions.) So, you'll notice that both the waveform and spectrogram views zoomed in, even though only one of them is the active view.

Zooming vertically

To zoom vertically in the spectrogram, activate that view, and drag the vertical position marker to the point where you want to center the zoom. Click the '+' or '-' button at the bottom of the vertical axis to increase or decrease magnification around the vertical position marker.

Notice that changing the vertical position or scale of the spectrogram has no effect on the waveform. The vertical dimensions of the views are different (amplitude in the waveform, frequency in the spectrogram), so the vertical scales of the views cannot be linked.

Zoom to all

To reset the horizontal or vertical scale of a view to display the entire axis, click on the corresponding Zoom To All button, marked with a horizontal or vertical I-beam icon (Figure 3.8, page 54).

Zoom to selection

The Zoom To Selection button rescales the active view so that the active selection fills the view frame. If there is no active selection, the Zoom To Selection button is not available. In the spectrogram view, select a rectangular area to enlarge by clicking and dragging the mouse pointer. Then click on the Zoom To Selection button in the lower right corner of the sound window (Figure 3.8, page 54).

View Types

The six main view types

Waveform view

When you open a sound in Raven, the top view in a sound window is a waveform view by default. This view displays an oscillogram which is a graph of the sound showing amplitude versus time.

Spectrogram view

The second view shown by default in a sound window, below the waveform view, is a spectrogram view. It shows time on the horizontal axis, frequency on the vertical axis, and relative power at each point as a color (grayscale by default.)

Spectrogram Slice view

A spectrogram slice view is a plot of relative intensity versus frequency at a particular point in time within a signal. A spectrogram slice represents a vertical cross section through a spectrogram at a single time, but is rotated 90° so that the frequency axis is horizontal. In fact, a spectrogram is built of a series of spectrogram slices stacked side by side (with their frequency axes running vertically).

Where a spectrogram view shows a series of slices at successive points in time, and represents power at each frequency by a color value, a spectrogram slice view shows only one slice and represents power at each frequency on a line graph. The relationship between spectrogram and spectrogram slice views is explained in more depth in Chapter 5, “Spectrographic Analysis”.

Selection Spectrum view

These show the average spectrum of a sound over the time interval defined by a user-made active selection. More information about selections and how they affect this view type can be found in “Selection spectrum views” in Chapter 5 (page 139).

Beamogram View

Beamforming provides a means for determining a sound source's likely bearing relative to a multi-channel array of sensors. The beamogram view creates a plot of potential bearing angles versus time. Areas of higher energy in the beamogram view correspond to greater likelihood that specific angles represent actual sound source bearings. More information about determining source directions using the beamogram view can be found in “Bearing analysis: Beamforming, Beamogram View, and Max Bearing Measurement” in Chapter 8 (page 213).

Beamogram Slice view

The beamogram slice view represents a vertical cross section of the beamogram view, showing the potential bearing angles at a specific point in time. Potential bearing angles are plotted on the horizontal axis, with vertical values corresponding to the likelihood that a sound is coming from the corresponding direction. More information regarding the beamogram slice view and its relation to the beamogram view can be found in "Bearing analysis: Beamforming, Beamogram View, and Max Bearing Measurement" in Chapter 8 (page 213).

Color Bar View

A color bar view serves as a key to the current spectrogram color scheme. It displays the spectrum of colors in the color scheme along with their associated intensity values. While this view contains no new information about the sound, it can be helpful for visually interpreting spectrograms.

Making a new view

New views are created by using the appropriate buttons located on the view toolbar (Figure 3.10).

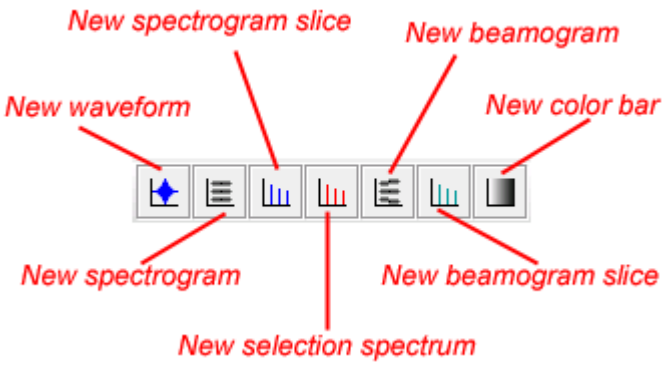

Figure 3.10. The new view buttons on the view toolbar.

Open a sound file like ChestnutSidedWarbler.aif. The sound window shows a spectrogram and waveform view by default. To create a new view, like a spectrogram slice view, simply click on the New Spectrogram Slice button in the view toolbar. Alternately, you can choose View > New > Spectrogram Slice View..., or type <Ctrl-L> (Windows, Linux) or <Command-L> (Mac OS). The Configure New Spectrogram Slice View dialog box should appear (Figure 3.11.).

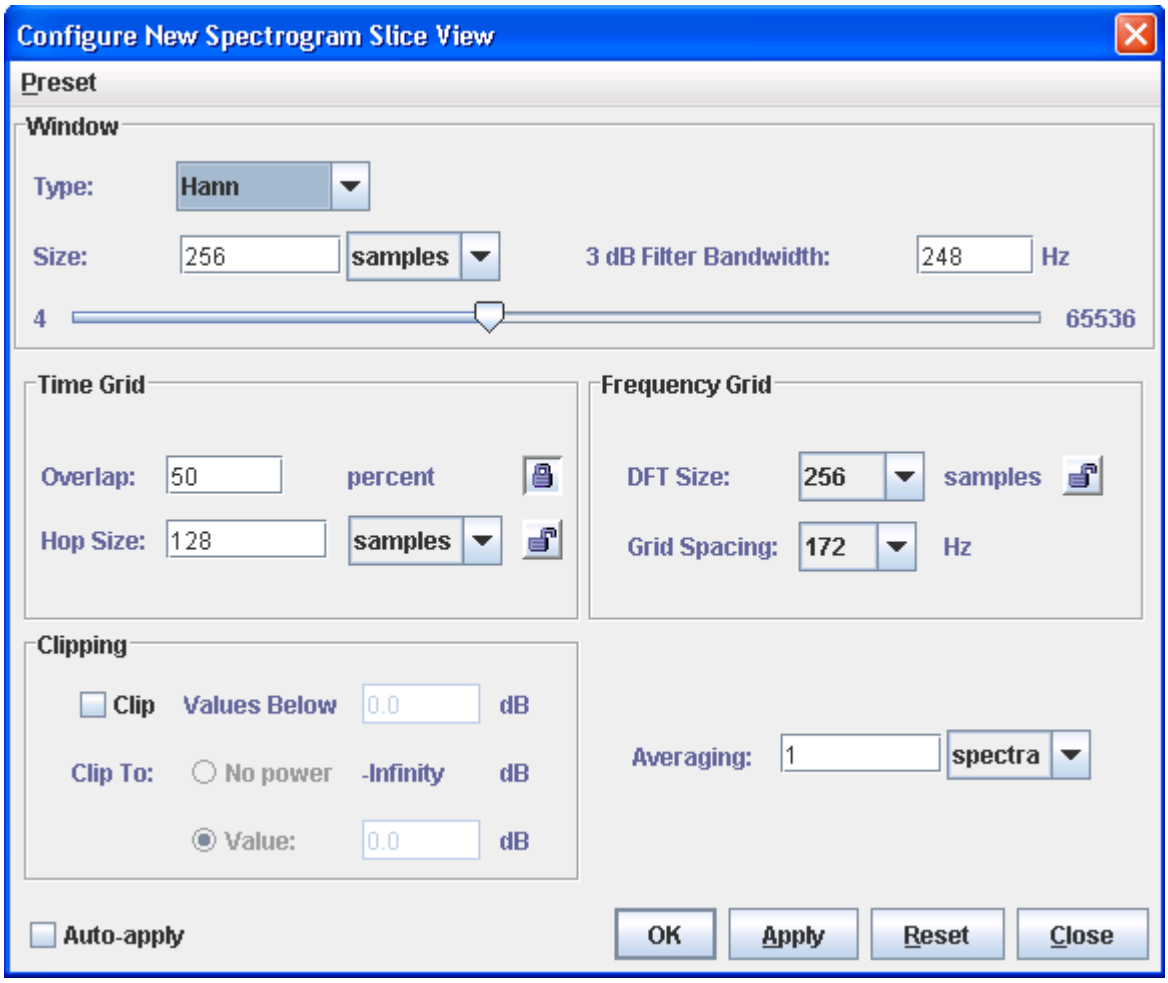

Figure 3.11. The Configure New Spectrogram Slice View dialog box.

This dialog box lets you specify various parameters that affect the appearance of the spectrogram. For now, don't worry about what these parameters mean; they are explained in detail in "Configuring spectrographic views" in Chapter 5 (page 112). Click OK to accept the default settings and compute the spectrogram slice view.

The sound window is re-drawn with an additional view pane, containing the new spectrogram slice view. If the time position marker of the waveform or spectrogram view is at the very beginning of the data (where Raven puts it by default when opening a new signal) the spectrogram slice view does not display any data (Figure 3.12).

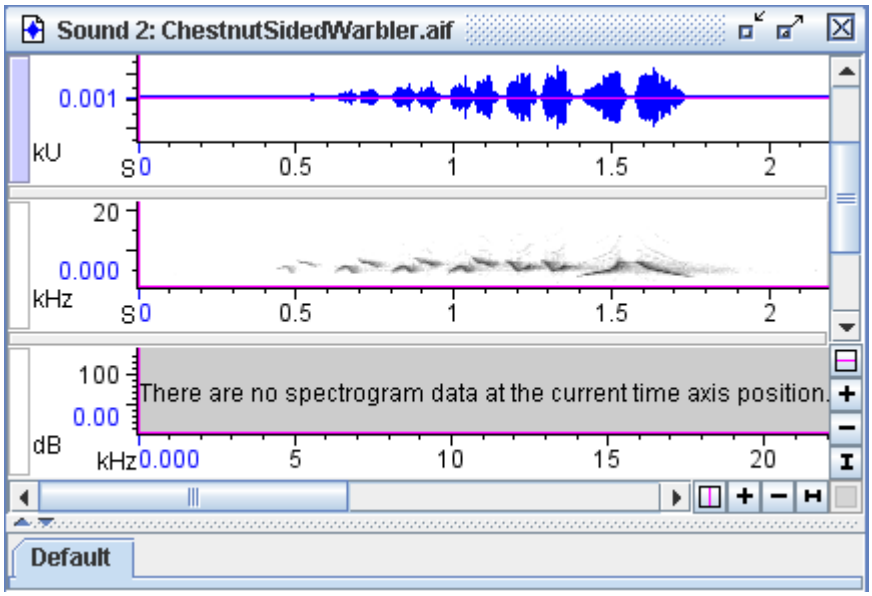

Figure 3.12. This sound window contains the usual waveform and spectrogram views, but it also contains a blank spectrogram slice view as well. The spectrogram slice view displays no data when the time position marker of the spectrogram and waveform view is located at the start of the data (all the way to the left).

Showing data in a new view

To see valid data, drag the time position marker to the right in either the waveform or spectrogram view (Figure 3.13). (For a complete explanation of why no data are visible in the spectrogram slice view when the position marker is at the start of the signal, see Chapter 5, "Spectrographic Analysis".)

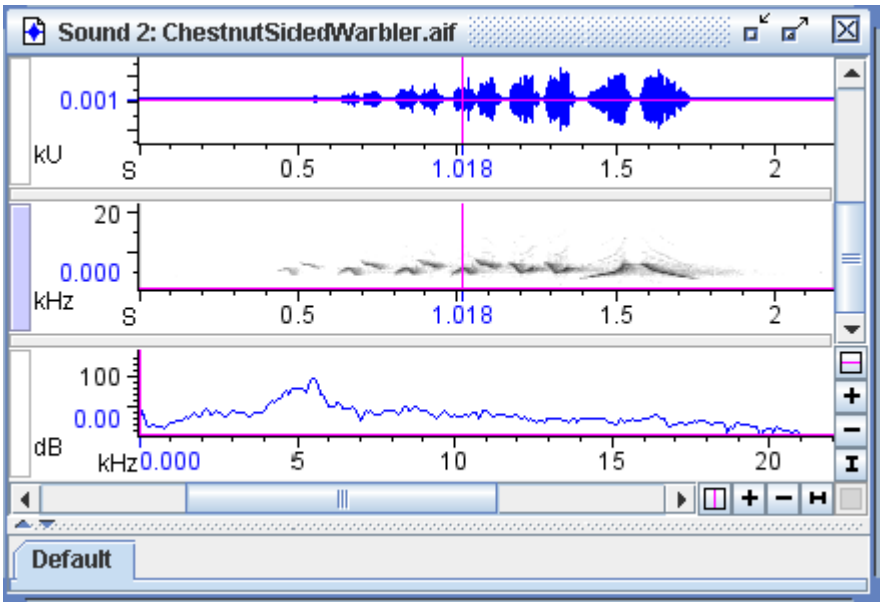

Figure 3.13. The same sound window as shown in Figure 3.12 but with the time position marker (the vertical magenta line) moved to a position in the waveform and spectrogram data. The spectrogram slice view now displays the data from the time designated by the time position marker.

Selected view dictates toolbar content

Remember that the active view in a sound window is marked by the highlighted view selection button to the left of the view (for example, the spectrogram view is active in Figure 3.13). The activated contents of the toolbars are dictated by which view is active in the current sound window. For example, if a spectrogram view is active, the brightness and contrast sliders in the spectrogram toolbar become active (Figure 2.12 on page 37). If any of the other views are active, the brightness and contrast sliders are grayed out because they have no relevance in those cases.

The zoom window

The zoom window is a separate window on the Raven desktop that can be used to view selections from any open sound. Once a zoom window is opened, it displays a magnified view of the active selection of the active sound. If the zoom window is the active window, it will display the active selection from the previously active sound. The zoom window automatically updates as you move through selections in a sound, making it particularly useful for browsing details of selections without having to manually zoom in on each one before advancing.

To open a zoom window, choose Zoom Window from the Window menu. You can configure the views or change display settings in the zoom window through the context menu or side panel in the same way as other sound windows. These settings are applied specifically to the zoom window, and override the display settings of the original sound when displaying selections. For multi-channel files the zoom window only

displays the channels containing the active selection; however, you can choose to add other channels from the side panel. Figure 3.14 shows the default zoom window with the parent sound window for a selection.

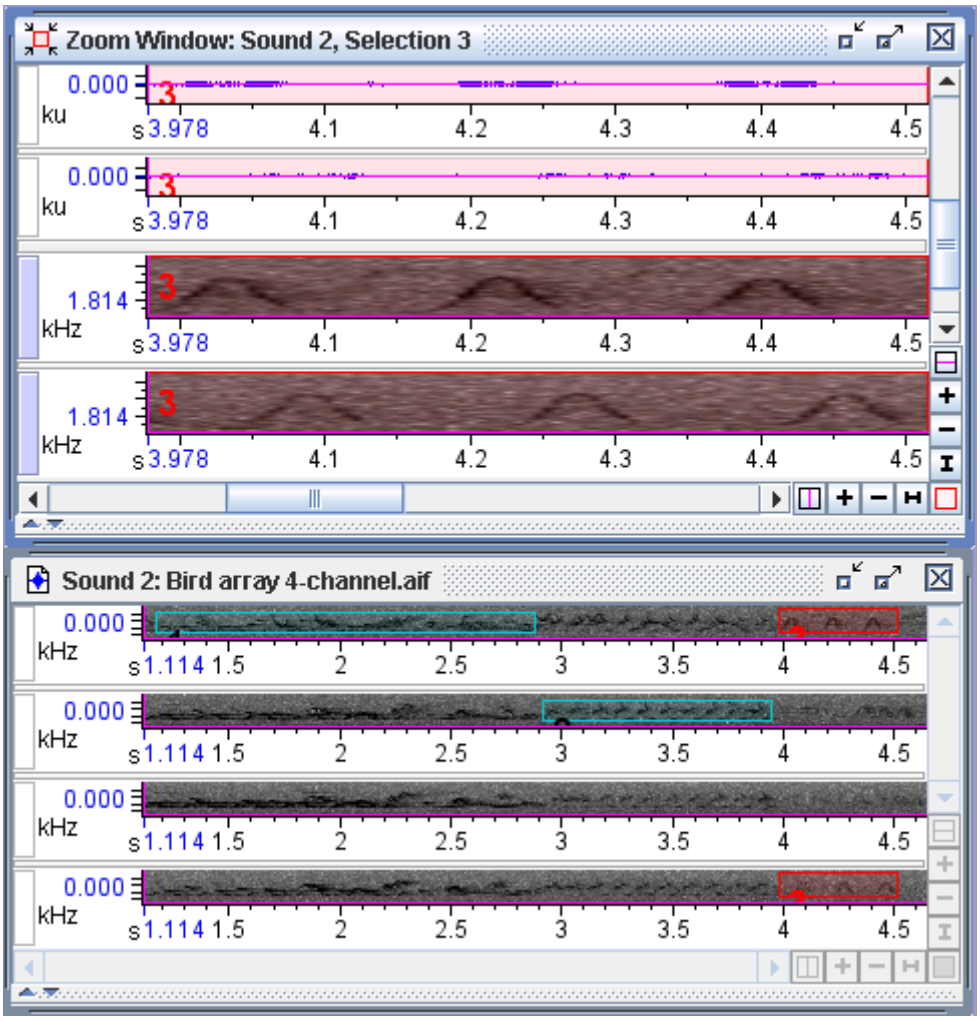

Figure 3.14. The zoom window displays a magnified view of the active selection, showing only those channels that contain the selection.

When the zoom window is active the cursor will change from its current setting to a play cursor, allowing you to play the selection simply by clicking in the zoom window. This is the case for both the create selection and activate selection modes. However, the Grab and Scroll mode retains its normal function in the zoom window.

When a workspace is saved, the zoom window's visibility and settings will be saved as well. However, if the zoom window is active when the workspace is saved, its contents may not be fully restored. If another sound window is active, however, the zoom window will restore accordingly.

Linking and unlinking views

Two views that share a dimension— such as time or frequency— can have their positions and scales either *linked* or *unlinked* by that dimension. When the positions of two views are linked, moving the position of either one (by moving the corresponding scroll thumb, or by moving the position marker within the window) causes the positions of both views to move together. When the scales of two views are linked, changing the scale of either one (using the zoom buttons) causes both views to be re-scaled. In the examples you've seen so far, waveform and spectrogram views have been linked by time position and in time scale.

When you open or record a signal and create multiple views, each view is initially linked in position and scale to every other view that shares its dimensions. For example, waveforms and spectrograms are initially all linked to each other in time position and time scale, and spectrogram and spectrogram slice views are linked in frequency position and frequency scale. Spectrograms and waveforms cannot be linked in frequency because waveforms have no frequency dimension.

Unlinked views

In some situations, it can be useful to work with views that are unlinked from each other in particular ways. For example, Figure 3.15 shows two spectrogram views of a signal that is 53 seconds long. The views are linked in time position but unlinked in time scale. Unlinking the time scales makes it possible to view simultaneously an eight-second portion segment of the signal (upper view), and a close-up of a two-second segment contained within it (lower view). Since the two views remain linked in time position, the position markers provide a reference point to show where the close-up view is located within the entire signal. As either view is scrolled horizontally through the signal, the linked position markers identify the same point in time in both views.

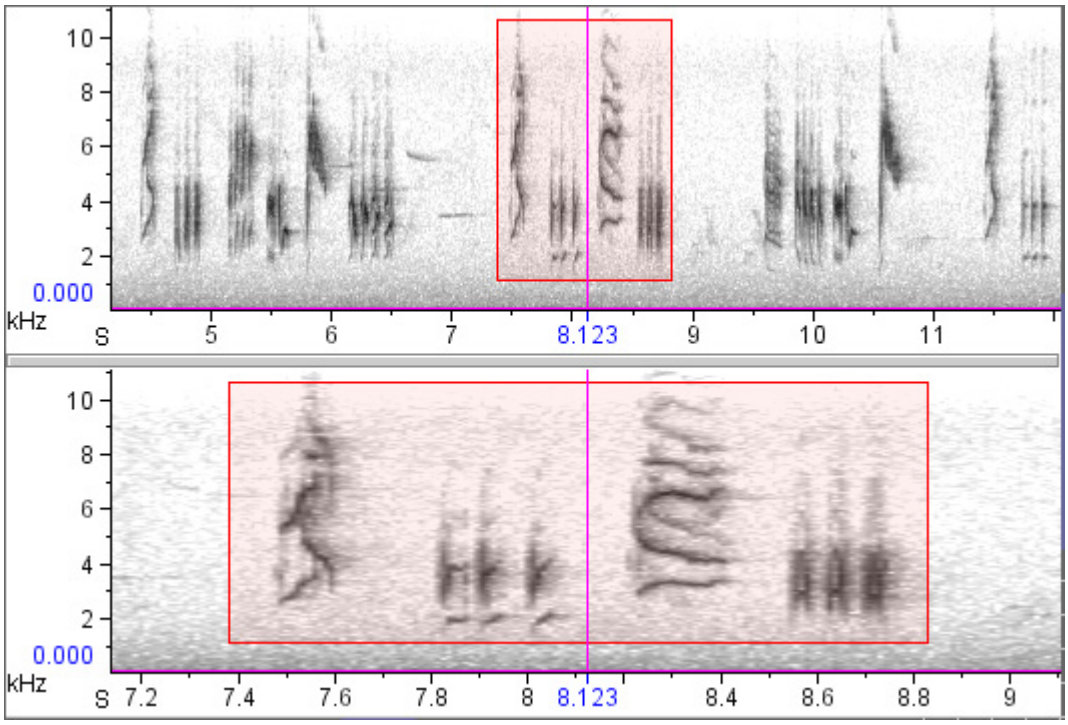

Figure 3.15. Two spectrogram views of the file "BlackCappedVireo.aif" that are linked in time position, but unlinked in time scale. The upper spectrogram shows 7.8 seconds of the signal; the lower spectrogram is a close-up of 2.0 seconds. The highlighted rectangle identifies the same selection in both views. The time position markers in both spectrograms identify the same time, because the time positions are linked.

Unlinking views through the contextual menu

To create two spectrograms that are unlinked in time scale as discussed in the above example (Figure 3.15):

1. Open a signal.
2. Make a second spectrogram by clicking the New Spectrogram button (Figure 3.10, page 57), or typing <Ctrl-G> (Windows, Linux) or <Command-G> (Mac OS).

Place the mouse pointer on the second spectrogram, activate the contextual menu, and choose Unlink View > Time Scale.

Now try using the zoom buttons to change the time scale of the first spectrogram. Notice that the time scales of the waveform and the first spectrogram change together, but the time scale of the second spectrogram does not change. If you activate the second spectrogram, and zoom in time, its time scale changes, while the time scales of the waveform and the first spectrogram remain unchanged. If you scroll any of the three views, their position markers will move in synchrony, because all three are still linked by time position.

Restoring or creating new linkages through the linkage tab

To restore linkages between views that have been unlinked, or to create linkages between views that have never been linked, activate the Linkage tab in the Raven side panel. (If the side panel is not visible, click on the right-pointing triangle at the top (Windows, Linux) or bottom (Mac OS) of the separator bar at the left edge of the Raven window.)

At the top of the Linkage tab, there is a drop-down menu showing all of the linkable properties of the current views. Click on this menu, and choose Time Scale. If you created two spectrograms and unlinked them as described above, the tab will display three folder icons representing *linkage groups*, with names like "Group 1", "Signal 1 Default", and "New" (Figure 3.16). (The second group may be called "Signal 2 default", "Signal 3 default", *etc.*, depending on how many signals you've opened in the current Raven session. If more than one signal is open, you will see a default linkage group for each signal.)

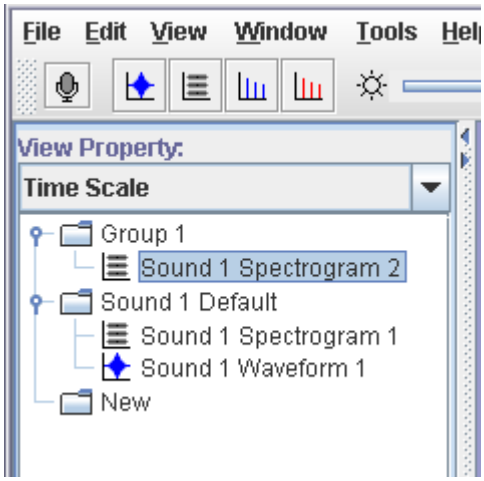

Figure 3.16. The Linkage tab, showing the linkage groups for the Time Scale property corresponding to Figure 3.15

A linkage group is a set of views that are linked to each other by a particular property (in this case, Time Scale). Views that are in different linkage groups are unlinked from each other in that property.

Open the first two folders by double-clicking on them (or single-clicking the icon to the left of each folder icon). In the present case, the linkage group called "Sound 1 Default" contains the views called "Sound 1 Waveform 1" and "Sound 1 Spectrogram 1"; Group 1 contains "Sound 1 Spectrogram 2". The active view is highlighted, and you can activate a different view by clicking on its name.

To link two views that are presently unlinked, drag the icon for one of the views to the linkage group that contains the other. In the case shown in Figure 3.16, you can unlink the waveform from Spectrogram 1 and link it

to Spectrogram 2 by dragging its icon from the Default folder to the Group 1 folder.

When you move a view from one linkage group to another, the view is immediately redrawn if necessary so that its image has the correct scale, position, or other linkable property. If a linkage group contains only a single view, and you drag that view to a different linkage group, the original (now empty) group disappears.

Creating a new linkage group

To create a new linkage group select one of the views listed by clicking on it, and drag it onto the folder labeled "New". A new linkage group will appear in the list, containing the view that you moved.

Creating new linked views

To create a new spectrogram, spectrogram slice, or selection spectrum view that is linked by spectrogram parameters to an existing spectrographic view, choose New > Similar Spectrogram View, New > Similar Spectrogram Slice View, or New > Similar Selection Spectrum View from the contextual menu for any spectrographic view, or from the View menu for the active spectrographic view.

Other linkable properties

In addition to its position and scale for each of its dimensions, every view has four other properties by which it can be linked to other views:

- **Position Location:** Moving the location of the time or frequency position bar in a view will also move the corresponding position bar in other views that are linked by Position Location.
- **Color Scheme:** Color schemes include color specifications for most of the graphical elements shown in a view (e.g., axes, backgrounds, selection boundaries), as discussed later in this chapter. Adjusting brightness and contrast settings for a spectrogram adjusts the settings for all spectrograms linked to it by Color Scheme. By default all views of a signal are linked to each other by Color Scheme.
- **Channel Visibilities:** In multi-channel signals (see Chapter 8, "Multi-channel Sounds"), hiding or showing particular channels of a view will also hide or show those channels in other views that are linked by Channel Visibility.
- **Number of Lines:** Changing the number of lines displayed for a view (see "Multiple-line views within sound windows" on page 74) automatically changes the number of lines displayed for any other views that are linked by Number of Lines. By default, all views in a signal that display a time axis are linked to each other by Number of Lines.

Additionally, spectrogram, spectrogram slice, and selection spectrum views can be linked by spectrogram parameters. If two views are linked

by spectrogram parameters, then changing the parameters for either view automatically changes both views.

Views that share a linkable property can be linked even if they are in different signal widows. This can be useful for example in setting views of different signals to the same scale.

Linkage between spectrogram and spectrogram slice views

When you request a spectrogram slice view, Raven actually calculates an entire spectrogram of the signal, but only displays one slice at a time. A spectrogram slice view thus has a "hidden" time axis. Which slice of the underlying spectrogram is displayed is determined by the view's time position. By default, the time position of a spectrogram slice view is linked to the time positions of waveform and spectrogram views. As you move the time position marker of a spectrogram view, any spectrogram slice view that is linked to it is continually updated to show the cross-section of the spectrogram at the time position marker.

Even though a spectrogram slice view has a time *position*, it does not have a time *scale*, since the time axis of the underlying spectrogram is not displayed.

By default, new spectrogram and spectrogram slice views are also linked to each other by frequency position and frequency scale. When you move the frequency position of a spectrogram, the frequency position of any linked spectrogram slice views move as well, and vice versa. Similarly, when you zoom the frequency scale of any spectrogram slice view, the frequency scale of any linked spectrogram zooms as well. It is important to remember that the frequency scales of spectrogram and spectrogram slice views are rotated 90° from each other.

Controlling how views are displayed

Using tools and commands in the side panel's Layout tab and in the View menu, you can rearrange the order of views and hide or show the non-data components of views such as the axes and position markers.

Another way to hide a view is to activate that view and choose Hide View from the View menu, or from that view's contextual menu.

Deleting a view

To delete a view, activate the view and choose Delete View from its contextual menu or from the View menu. When you delete a view (as opposed to hiding it), the memory occupied by that view is released for reuse. Re-displaying a hidden view occurs instantly, whereas re-

displaying a view that was deleted requires that it be recalculated, which may take a significant amount of time.

When you activate a contextual menu in a view pane, view-specific commands in the menu apply to whichever view the mouse pointer is on when the menu is activated, irrespective of whether or not that view is active.

Changing the order in which views are displayed

To rearrange the order in which views are displayed in the sound window, you can drag and drop view names in the Layout tab.

You can also move a view up or down within the sound window by choosing Move View Up or Move View Down from the View menu or the view's contextual menu.

Hiding and showing window components

The bottom pane of the side panel's Layout tab contains a list of *window components* that can either be displayed or hidden. You can display or hide each component of the active window by checking or unchecking its checkbox. Figure 3.17. shows a sound window containing two views, with all components hidden.

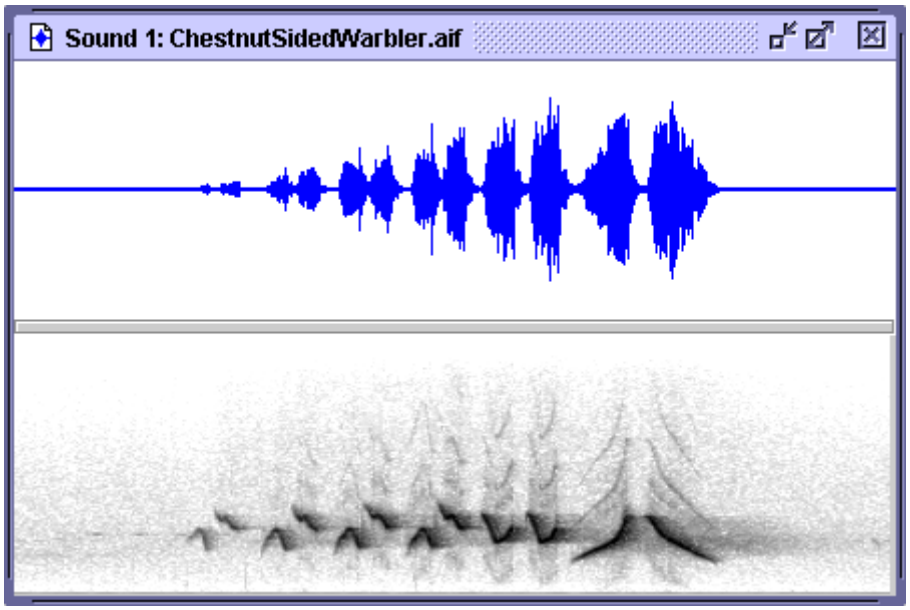

Figure 3.17. A sound window with all components hidden.

By default, all window components are displayed except for *line titles*, which identify the view type and number of each view (Figure 3.18.). If the sound has multiple channels (see Chapter 8, "Multi-channel Sounds") or a view has multiple lines, channel and line numbers are displayed in line titles as well.

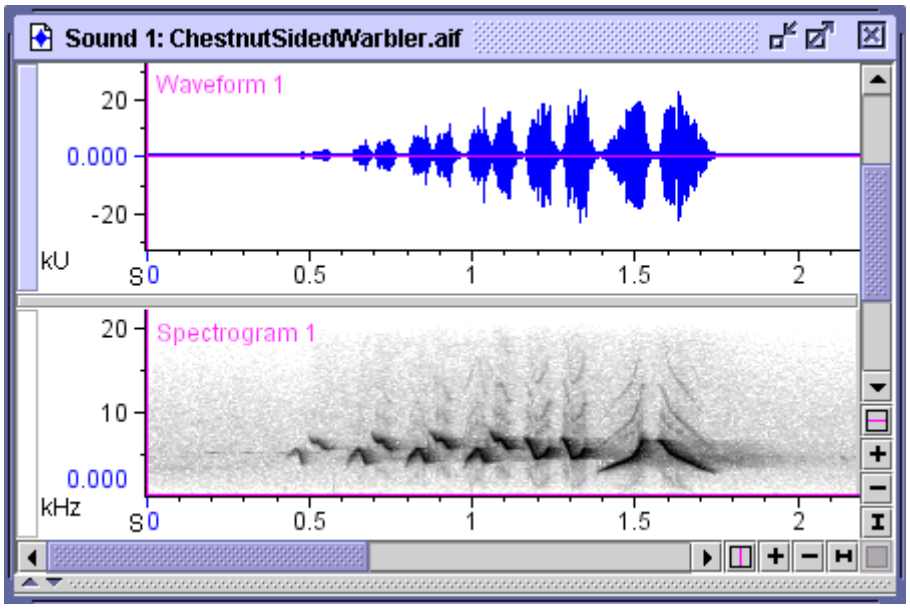

Figure 3.18. A sound window showing a waveform and a spectrogram view, with line titles displayed.

Changing the Appearance of a Sound Window

Spectrogram brightness and contrast

When a spectrogram view is active, the brightness and contrast controls on Raven's spectrogram toolbar become active too (Figure 2.12 on page 37).

If your spectrogram looks too dark or light, or if it's hard to pick the signal 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 displays up to 200 shades of gray.

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

In addition to the toolbar controls, you can also configure spectrogram brightness and contrast by choosing Configure Brightness and Contrast... from a view's contextual menu. In addition to a set of brightness and

contrast sliders, the resulting dialog allows you to alter these parameters by specifying floor and ceiling values for the spectrogram and displays a plot illustrating how colors are assigned to each value in a spectrogram. The floor and ceiling threshold parameters determine the power levels beyond which all values are assigned the same color. In the case of a grayscale spectrogram, values below the floor threshold are all displayed as white, and values above the ceiling threshold are all displayed as black. For more information on the relationship between these threshold parameters and corresponding brightness and contrast values, see "Brightness and contrast" in Chapter 5 (page 130).

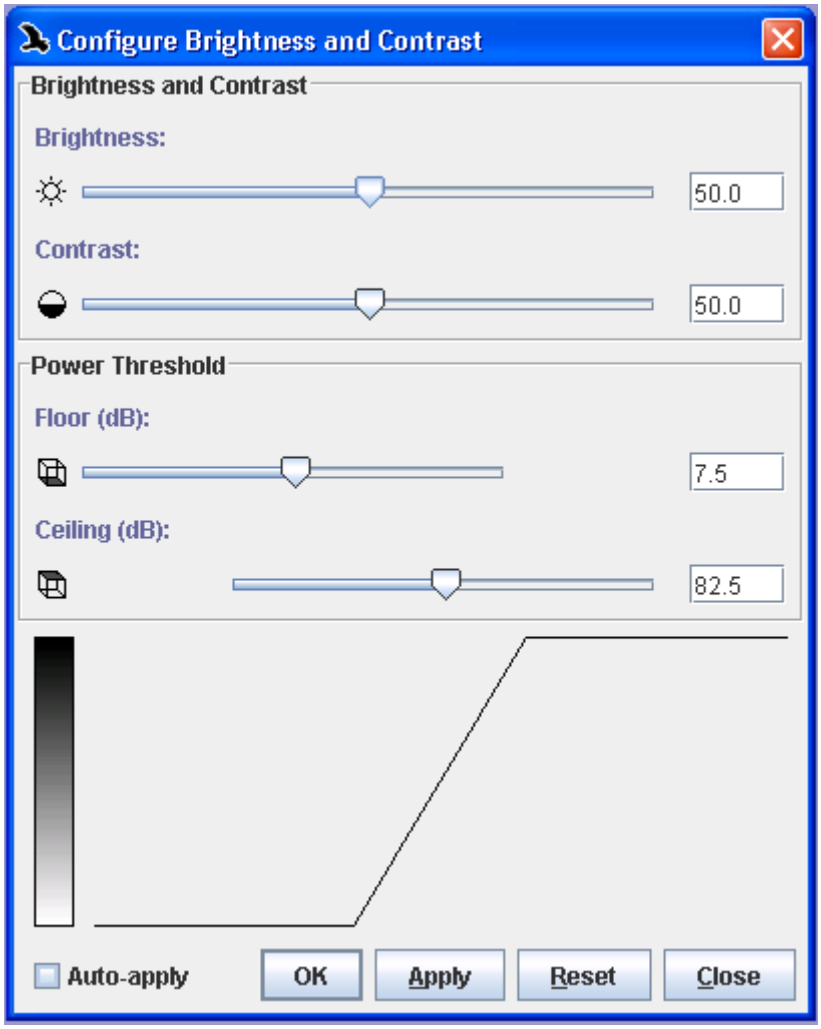

Figure 3.19. The configure Brightness and Contrast dialog

Color schemes of sound windows

Each view in a sound window has a particular *color scheme*. A color scheme consists of a spectrogram colormap and particular colors for items such as plottable measurements, active and inactive selection borders and fills, and the waveform line.

A *spectrogram colormap* defines the relationship between power values in the spectrogram and colors used to display them. Raven provides six predefined colormaps: Grayscale, Hot, Cool, Standard Gamma II[3], Bone, and Copper (Figure 3.20.). You can also create customized colormaps as text files as described in "Creating customized colormaps" in Chapter 11 (page 296). To change the colormap of a spectrogram, choose Color Scheme > *Colormap-name* from the spectrogram's context menu, or from the View menu when the spectrogram is active. You can reverse the spectrogram colormap by choosing Color Scheme > Reverse Color Map from the spectrogram's context menu, or from the View menu when the spectrogram is active. To display the spectrum of colors in the color map along with their associated intensity levels, you can add a color bar view to the sound window by clicking on the icon in the view toolbar or through the View > New menu.

Views in a sound window are by default linked to each other by color scheme. If you change the colormap or any other item in a view's color scheme, the affected colors will also change in any other views that are linked to it by color scheme.

3. The Standard Gamma II color map is included in Raven courtesy of Research Systems, Inc., a Kodak Company.

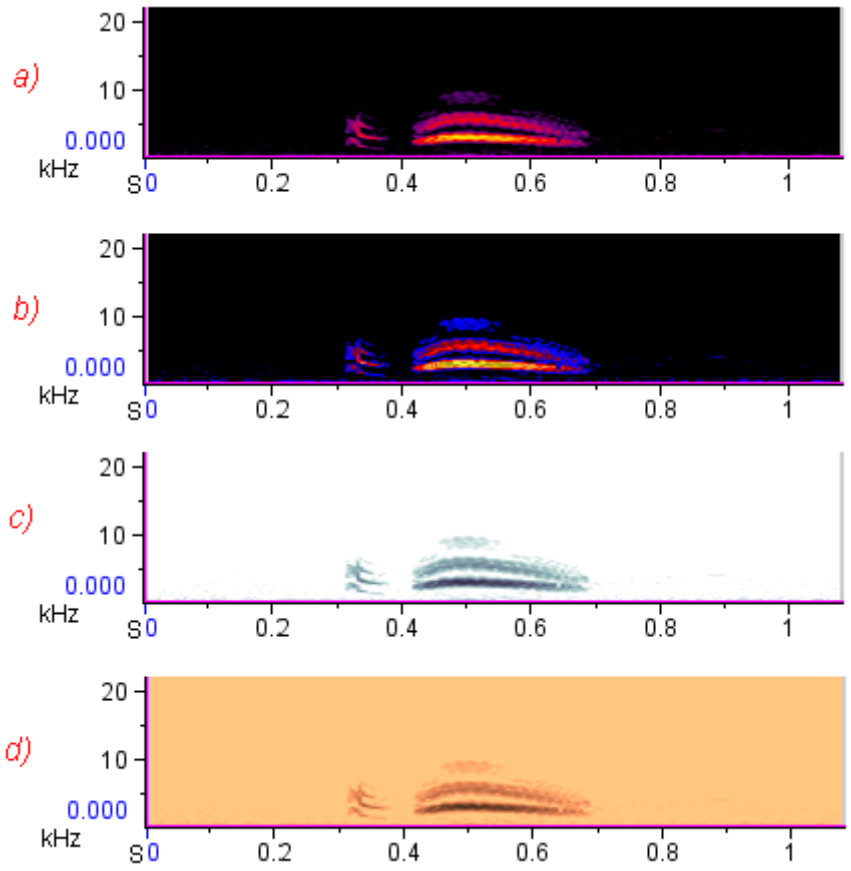

Figure 3.20. Four spectrogram views of the signal "CassinsKingbird.wav", using four different, predefined colormaps. **(a)** Hot. **(b)** Standard Gamma II. **(c)** Bone. **(d)** Copper.

You can reverse the spectrogram colormap by choosing Color Scheme > Reverse Color Map from the spectrogram's context menu, or from the View menu when the spectrogram is active.

In general, if the background of a spectrogram is white, then light colors represent low power. If the background is black, the dark colors of a colormap represent the low power.

Editing color schemes

In addition to selecting spectrogram colormaps, you can also edit a view's color scheme by choosing Color Scheme > Edit... from the view's context menu, or from the View menu when the view is active. More information on customizing color schemes can be found in "Editing color schemes" in Chapter 11 (page 289).

Sound Window Presets

You can save information about the layout of a sound window in a *window preset*, which you can later apply to another sound window (or to the same

window). A window preset includes information about the size of a window, what views are displayed, whether or not the selection table is showing, and other properties (Table 3.1).

Table 3.1. Window properties saved in window presets.

window size
view types, parameters, color schemes, positions, scales, sizes
spectrogram parameters
spectrogram brightness and contrast
selection table visibility and size
measurement list and annotation columns
selection label configuration
selection label visibility
axis visibility
major and minor grid visibility
line title visibility
position marker visibility
view selection button visibility
scrollbar visibility

To save a window preset, first configure the properties listed in Table 3.1 the way you want to save them, then choose View > Window Preset > Save As... . When the Save Sound Window Preset dialog box appears, enter a name for the preset, and click OK.

Window presets must be saved in the folder `Presets/Sound Window/` within the Raven program folder. You can also create additional folders within the `Sound Window` folder by clicking on the New Folder icon within the Save Sound Window dialog. These folders will appear as sub-menus in the Window Preset menu, with each submenu listing the presets in the corresponding folder.

To apply a window preset that's already been saved to the active sound window, choose View > Window Preset > *Preset-name*. When you apply a saved preset, the active window is redrawn with the properties specified in the preset, and any additional views are calculated as needed. If any of the open selection tables contain annotation columns, Raven will display a dialog where you can choose to keep, replace, or merge these columns with those in the preset.

You can specify a window preset to apply when you first open a sound file in the Configure New Sound Window dialog box (Figure 1.3, page 4). You can change the name of the default window preset by editing the Raven preferences file, as described in "About Raven preferences" in Chapter 11 (page 299).

If you make changes to the properties of a window to which you've applied a preset, you can save the changes to the current preset by choosing View > Window Preset > Save "*Preset-name*".

Window presets take precedence over other presets that affect the appearance of the contents of a window. Thus, if you apply a window preset, spectrogram parameters, the measurement list, and the color scheme are all set as defined in the specified window preset, even if they were previously set to different values by choosing spectrogram, measurement, or color scheme presets.

Multiple-line views within sound windows

Raven can display views that have a time axis (i.e., waveforms and spectrograms) across multiple lines (Figure 3.21). The values shown on the time axis of a multiline view start at the left end of the top line, go to the right end of that line and continue on from left to right on subsequent lines, like lines of text on a page.

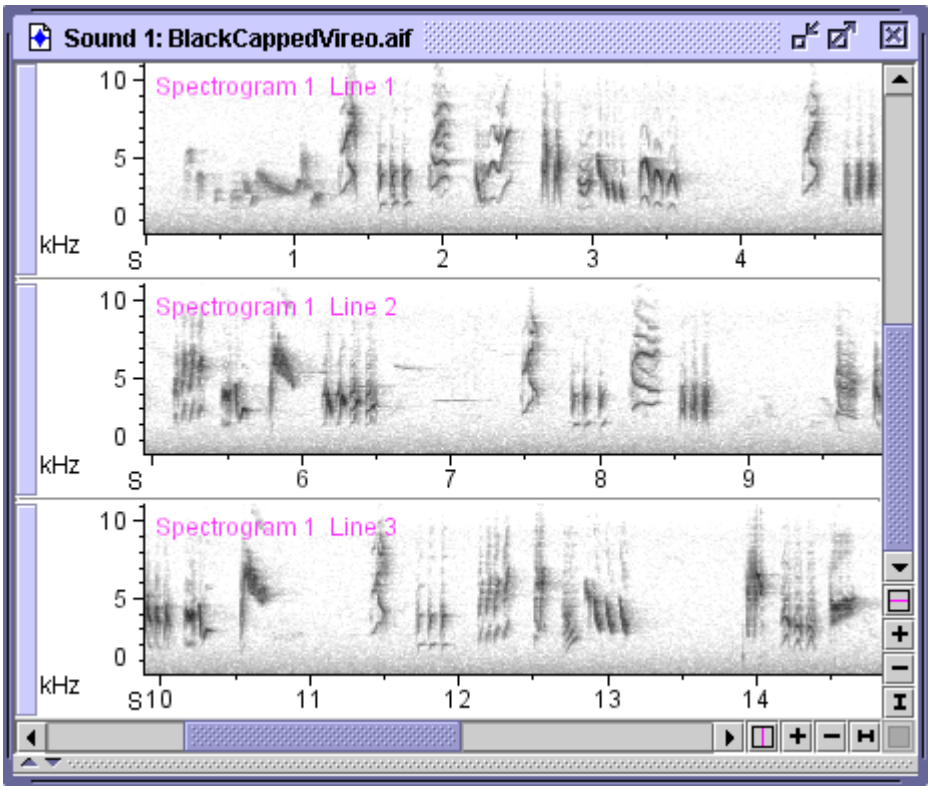

Figure 3.21. A spectrogram view with three lines. Note the continuity of the time axis from one line to the next.

On the side panel, the Layout tab's Lines box shows you how many lines there are for the selected view. To change the number of lines, select a waveform or spectrogram view, change the number in the box, and press <Enter>. By default, all waveform and spectrogram views in a sound window are linked to each other in the number of lines displayed. You can unlink the number of lines property as described in "Linking and unlinking views" on page 62.

The scale of the time axis doesn't change when you change the number of lines displayed. To rescale the axis so that the view fills the available lines, click on the horizontal Zoom-to-All button at the right end of the horizontal scrollbar.

Grouping views with multiple lines

In sound windows with two or more views and two or more lines per view, you can change the way the lines and views are grouped in the window. By default Raven displays all the lines for one view, followed by the lines for the next; this is called grouping *by view* (Figure 3.22). The alternative is to see all the first lines for all views, followed by all the

second lines for all views, and so on; this is called grouping *by time* (Figure 3.23).

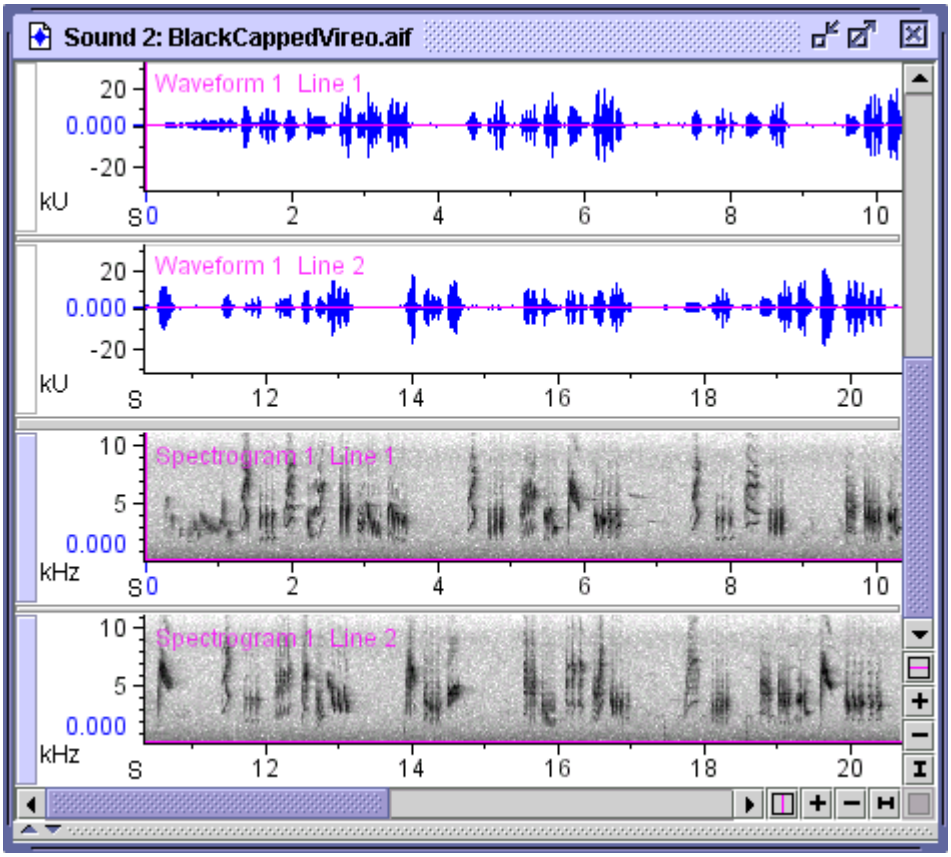

Figure 3.22. A sound window containing two views, each with two lines, grouped by view. All lines of the waveform view are in the top group, all lines of the spectrogram view are in the next group.

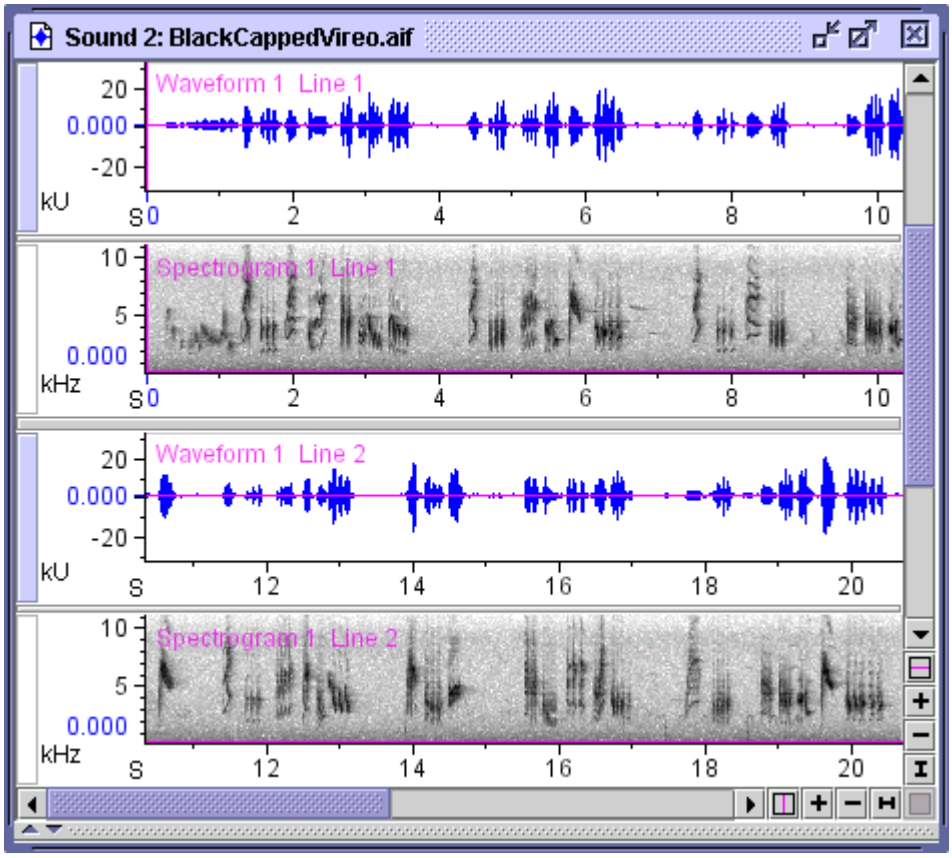

Figure 3.23. The same two views shown in Figure 3.22, but grouped by time. The first lines of both views are in the top group; the second lines of both views are in the next group.

To change the grouping, choose View or Time from the pull-down menu labeled "Group By", in the side panel's Layout tab.

The horizontal separator bar that Raven displays between top-level groupings (i.e., between views in View grouping or between lines in Time grouping) is wider than the bar used between second-level groups.

Working with more than one sound

Raven lets you work with more than one sound at a time. When more than one sound window is open, the tools in Raven's toolbar (e.g., New View buttons, brightness, contrast, and playback controls) and in the side panel's Layout and Playback tabs always refer to the *active window* (the one window in which the title bar is colored). The side panel's Linkage tab shows views for all sounds that are open, since Raven lets you link views of different sound windows to each other. You can activate a sound window by clicking anywhere in it with the mouse. You can also activate a

window by choosing its name from the Window menu, or by clicking on the name of one of its views in the side panel's Linkage tab.

Tile/Cascade windows

When you have multiple sound windows open, Raven can arrange them neatly for you on the desktop. If you choose Window > Tile Windows, Raven resizes and repositions all of the windows so that they are all the same size and fill the desktop (as nearly as possible) without overlapping each other. Choosing Window > Tile Windows Horizontally arranges the windows in a row such that they are all the same width and fill the desktop. Similarly, choosing Window > Tile Windows Vertically arranges the windows in a column such that they are all the same height and fill the width of the desktop. See Figure 3.24 for examples of these tiling options.

If you choose Window > Cascade Windows, Raven resizes and repositions all of the windows so that they are all the same size and as large as possible, overlapping so that their title bars are all visible (Figure 3.25).

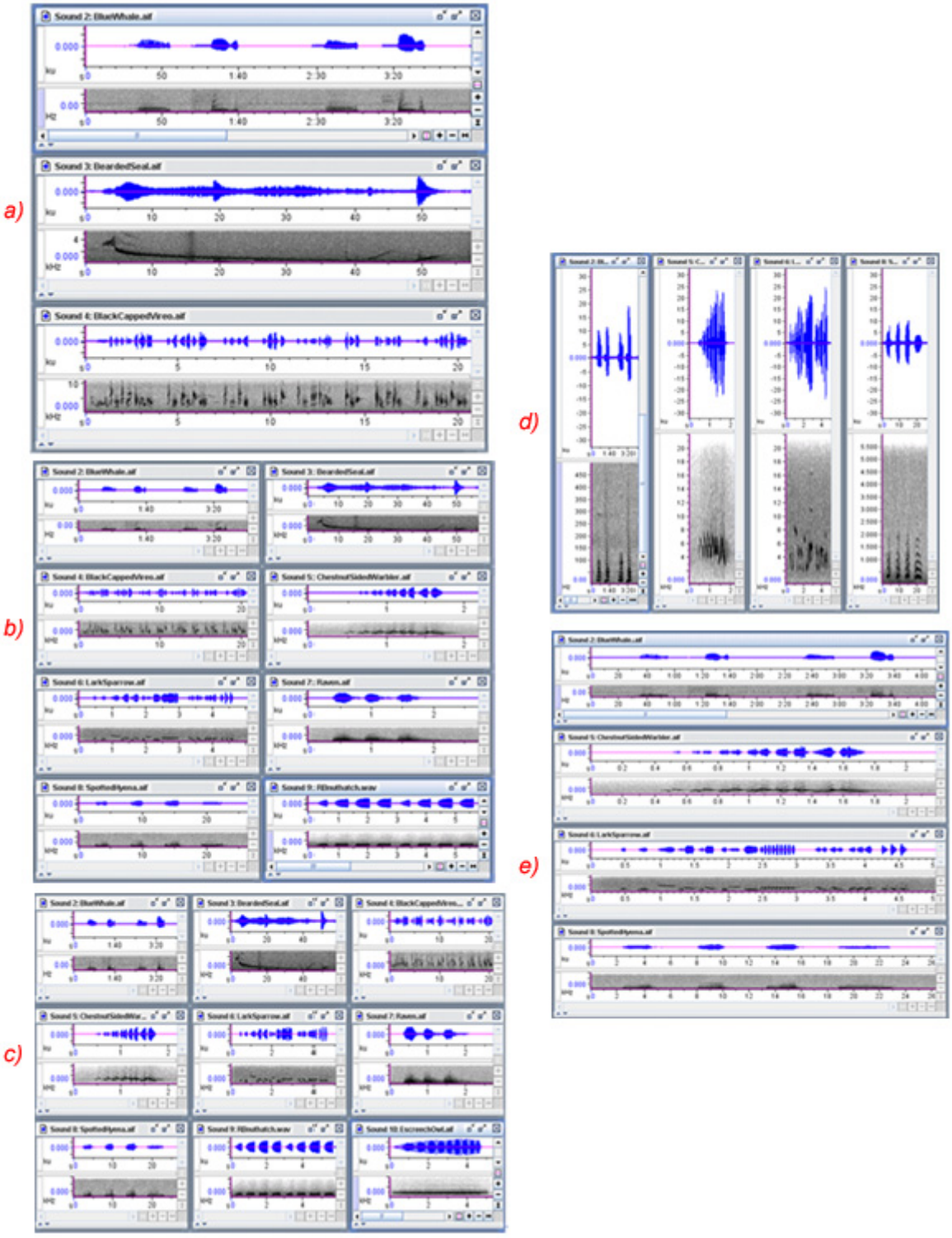

Figure 3.24. Examples of tiled sound windows **(a)** 2 to 3 sounds will be tiled in one column **(b)** 4 to 8 sounds will be tiled in two columns and **(c)** 9 to 12 sounds will be tiled in three columns. **(d)** 4 windows tiled horizontally. **(e)** 4 windows tiled vertically

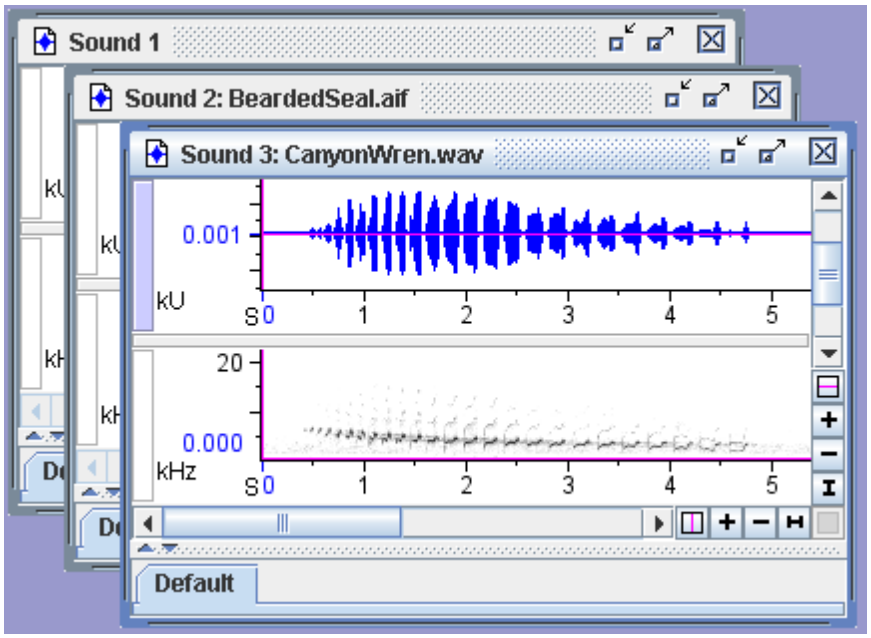

Figure 3.25. An example of cascaded sound windows. Here, the windows are stacked on each other with all title bars visible.

Apply current window layout to all windows

To apply all of the active window's layout to all currently open windows, choose View > Apply To All. Window layout includes all of the information that would be stored in a sound window preset, including window size, view visibility and scale, spectrogram parameters, and spectrogram brightness and contrast. A complete list of window properties affected by the Apply To All command is given in Table 3.1.