The three **Autocorrelation** algorithm options measure the extent to which your audio sample data repeats itself. This algorithm does this by taking two copies of the sample data and then moving one forward by one sample. These two copies are then multiplied together and all the values are summed. This is repeated for two samples difference, and so on, up to a number of samples that you specify using the size option.

Autocorrelation gives a small result if the waveform is random (such as white, pink, or Brownian noise), and a large result if it is repetitive (like a decaying, held, musical note).

By looking at peaks for this algorithm's data plot, your key frequencies can still be determined, even if there's a lot of noise in the data sample. Figure 9-15 shows the Standard Autocorrelation algorithm using 2048 and 4096 data sample sizes. Note that the cursor snaps to each peak frequency.

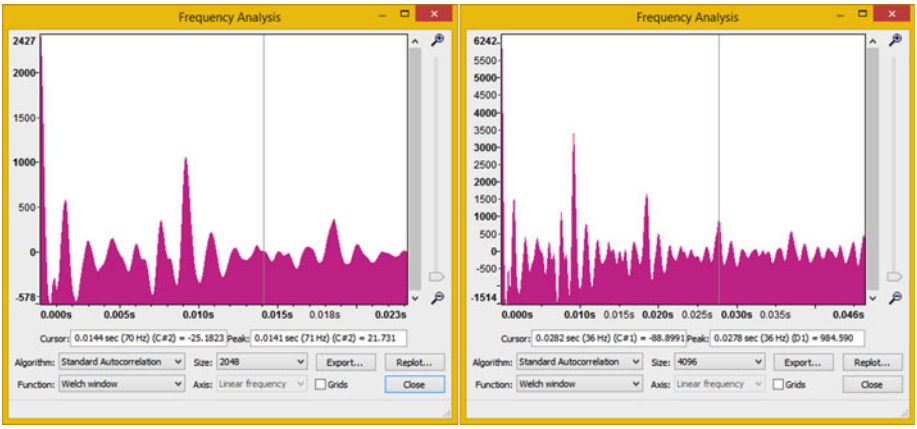

Figure 9-15. *A Welch function at 2048 or 4096 can simulate waves*

The Cepstrum algorithm for an audio signal is related to the Spectrum algorithm, but represents a rate of change across the different spectrum bands.

This algorithm is useful for ascertaining spectral properties in vocal tracks and can be used to identify speakers by their different vocal frequency characteristics!

Figure 9-16 shows the Cepstrum algorithm at a 256 samples size, using the Welch function data display. Notice that I have resized the window in the X (width) dimension to space out these data curves so that their peaks are more visually ascertainable. You should leverage this feature because you can also resize this window in the Y (height) dimension if you need to fit a different spectral data graphing view. All in all, the Frequency Analysis dialog is a very powerful data visualization tool.

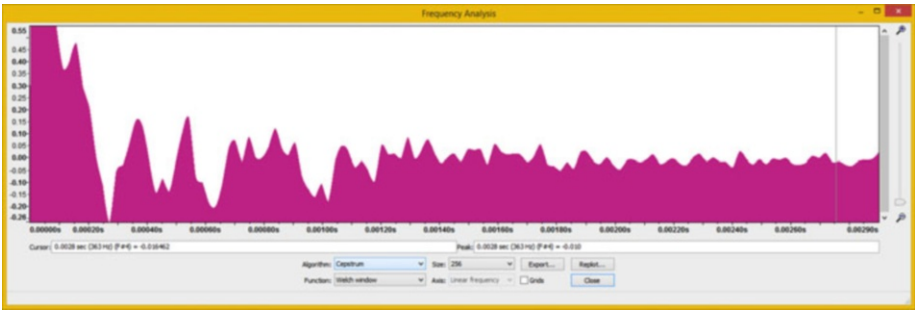

Figure 9-16. *A Cepstrum algorithm, at 256 frequency sample size*

Be sure to experiment with all the different settings and features that this Plot Spectrum tool can provide for your digital audio editing.

Summary

In this chapter, you explored the Analyze menu and various algorithmic analysis tools, including the visual analysis of frequency spectrums using the Plot Spectrum tool, and tools that create Label Track data and export sample analysis data in numeric format. You looked at how to analyze progressively smaller data samples to drill down into visual analytical data representations. And you looked at the three different algorithm categories that you can use to analyze your data.

In the next chapter, you learn all about **digital audio data compositing** concepts and principles via Audacity's **Tracks** menu.

CHAPTER 10

The Compositing of Digital Audio: Using Tracks

You now have an understanding of how to use algorithmic tools in Audacity to not only process your audio sample data for what it sounds like, but also for visual analysis. Now it's time to go back to what I call "manual editing tools," given that the algorithms do the work for you once you direct them with a setting or two (or sometimes half a dozen). In this chapter, you will look at the concept of tracks, accessed using the **Tracks** menu in Audacity. You encountered the Label Track in Chapter 9, and you go over the other track types in this chapter.

Tracks in digital audio editing software provide similar functionality to layers in digital image compositing software, as they allow you to separate content (or features) into their own containers for more content editing workflow flexibility.

Layers in digital image compositing software allow you to create image composites. Similarly, tracks in audio software allow you to create **digital audio composites**.

You'll finish looking at the **Label Tracks** features first, move on to Time Tracks, and then look at related features such as **envelopes** before you get into Stereo Tracks and **Mono Tracks**. You'll discover how to work with tracks, from basics such as resizing to more advanced "moves" such as turning Stereo Tracks into Mono Tracks.

Audio Compositing and Utility Tracks

By adding either Stereo or Mono Tracks to your project, you can "composite," or layer, digital audio assets together to create complex audio assets. For instance, you can add background music or sound effects and mix them in with your vocal tracks. There's also what I call "utility" tracks, which allow you to add things like **selection sets**, **labels**, and **envelopes** to your Audacity project. These features are in Audacity's Tracks menu.

Label Tracks: Text Label Subsample Selection

You already got a head start in Chapter 9, when you used the Analyze menu's Regular Interval Labels function (see Figure 9-1) to create a **Label Track**. Let's finish learning about this Label Track type by taking a look at the **Tracks ➤ Edit Labels** menu sequence,

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which opens the Edit Labels dialog and allows you to do all the Label Track label editing in one central location. As you can see in Figure 10-1, there's an extra **vocal** label, which is shown highlighted in the lower-right corner of Audacity. Click the **5** in the dialog, which selects this unused label entry, and click the **Remove** button to delete it from the Label Track view pane.

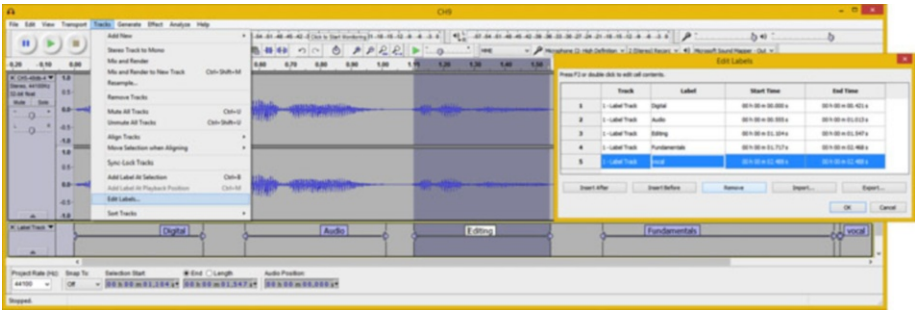

Figure 10-1. *Use the Edit labels dialog and delete vocal label*

As you can see in Figure 10-2, the vocal label is gone. Also shown in Figures 10-1 and 10-2 is that if you click a label name, Audacity selects that label's range (which I call a "selection set") if you have set the label range using dots and arrowheads, as you learned in Chapter 9.

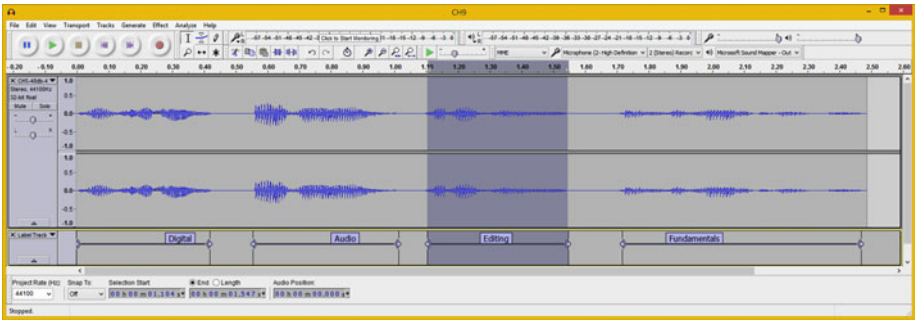

Figure 10-2. *Label can also be used for subsample selection set*

Thus, you can use Label Tracks to define **selection sets**.

Time Tracks: Project Time or Rate (Pitch) Warping

Let's look at another utility (tool) track in Audacity called a **Time Track**. Whereas the Label Track is logically at the bottom of your project, as shown in Figure 10-3, the Time Track should logically be placed at the top of the project. To create a Time Track, use the **Tracks ➤ Add New ➤ Time Track** menu sequence. Audacity automatically positions your Time Track at the top of the Audacity project.

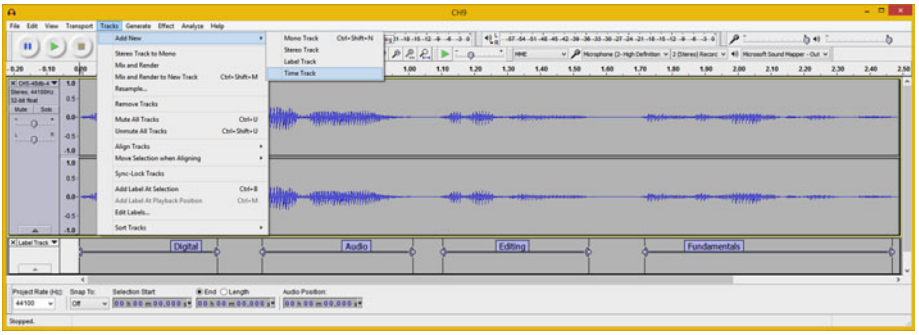

Figure 10-3. *Use Tracks menu and Add New ➤ Time Track submenu*

As you can see in Figure 10-4, the new Time Track, which is labeled at the left side of the track (as are the Stereo Track and the Label Track), is now at the top of your Audacity project.

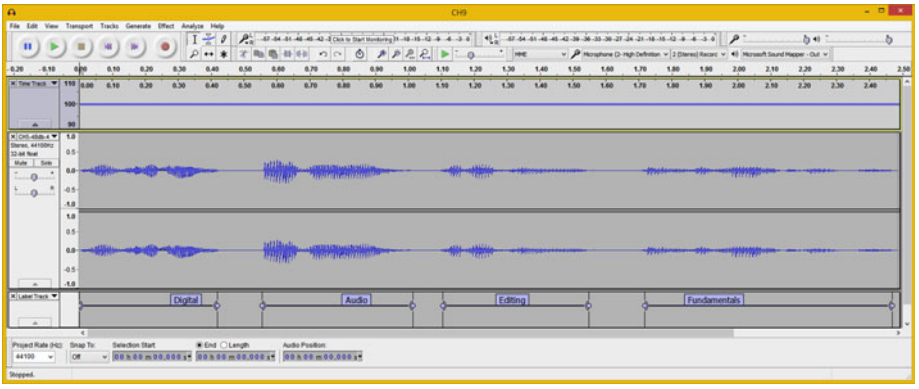

Figure 10-4. *A Time Track is added to the top of your project*

Anything that you do in this Time Track affects your entire project, just like the Label Track. You can close a track at any time by clicking the **X** in the upper-left corner of the track. Click in the **gray area** at the left to select that track.

Resizing and Using a Time Track: Add a Pitch Shifting Envelope

To resize the Time Track, place your cursor on top of the line that divides the area between your Time Track and Stereo Track, until the cursor turns into a **double-headed arrow**, and then click and drag downward. To affect the **Time Track control data**, which is shown as a blue line in Figure 10-4, you use the **Envelope Tool**, which is shown circled in red in Figure 10-5.

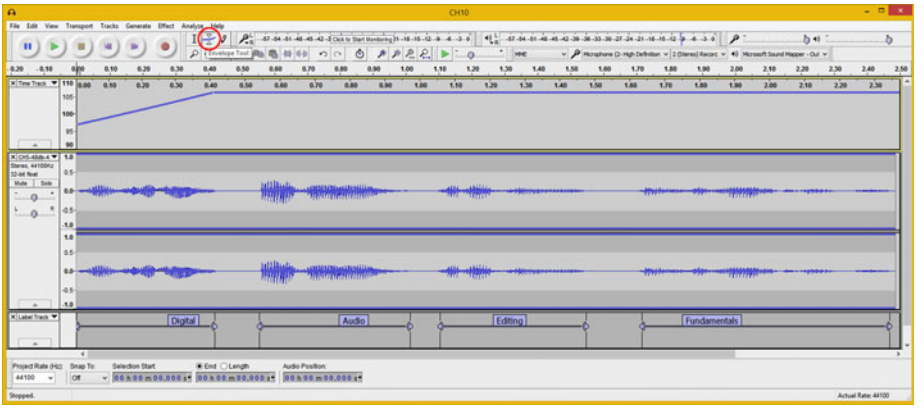

Figure 10-5. *Use the Envelope Tool to add control points to line*

Click to insert a **control point** on your left end of the Timeline, and then one at 0.40, and then drag the left control point down to a level of 97, as seen in Figure 10-5. This starts your sample at a higher pitch and then ramps it to normal, using a diagonal line.

Let's do something complex with the tool, and chipmunk some of these samples, as is shown in Figure 10-6.

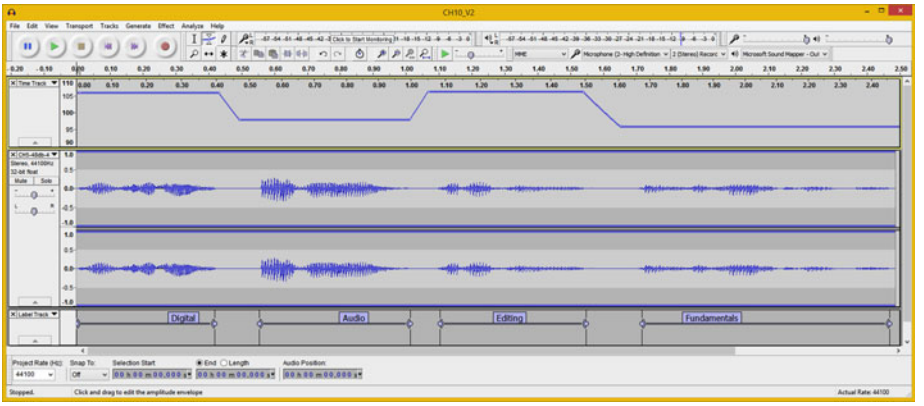

Figure 10-6. *Time Track envelope applying different pitch rates*

As you can see in Figure 10-6, I added control points so that I could increase the playback rate (pitch), for some of the subsamples. I changed this rate during the periods of silence in between the subsamples, and then decreased the playback rate, which I did twice, using different pitch (rates) for each subsample. You can clearly see what I did by using the Envelope Tool in the Time Track. And now if you play the project, each subsample uses a different pitch.

You can also use the Envelope Tool in the Stereo or Mono Tracks; however, in these tracks, it affects the amplitude, not the frequency of the waveform! Let's look at that next.

Using Other Track Envelopes: Control Amplitude, Not Frequency

As you can see in **Stereo Tracks**, you have the same control data ribbon, or spline, that you have in your Time Track. These blue lines appear whenever you select the Envelope Tool. You can manipulate them in the same way that you do in the Time Track: using control points that can be entered by clicking the line, or anywhere in the Track for that matter. In the Mono and Stereo Tracks, these control data lines control amplitude, so if you wanted to peak the volume for each of your subsample portions in your voice-over, it would look something like what's shown in Figure 10-7.

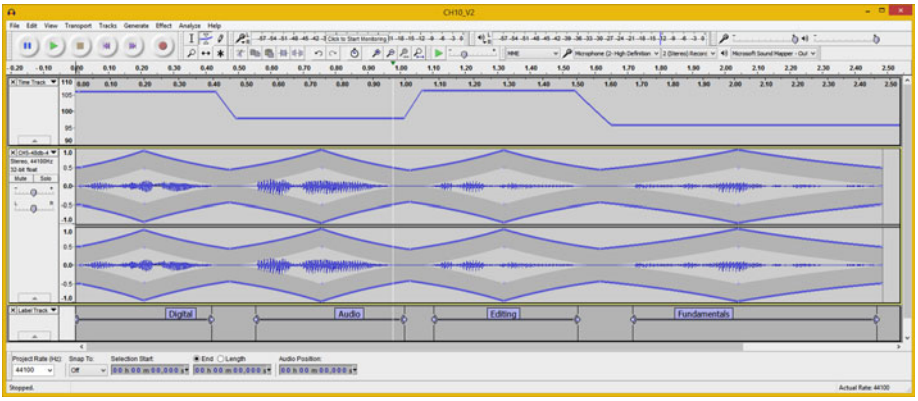

Figure 10-7. *Using Envelopes for Stereo Track to control volume*

Next, let's implement a different envelope configuration to provide the same effect that the Silence Audio Tool or Noise Reduction algorithm accomplished previously.

There are different approaches to achieving the same result using professional new-media content-production software packages. This is a third way to silence noise by using amplitude.

Using the amplitude envelope to turn down the volume between data samples effectively does the same thing that the tool-based and algorithm-based approaches did, so you can reduce noise by using an envelope, an algorithm, or a tool. Not bad for a fundamentals book, eh?

In Figure 10-8, you can see that I've aligned these envelopes, as well as the labels, across all four tracks. Also, notice in Figures 10-7 and 10-8 that if you put the cursor in the top time indicator bar (above all the tracks), it turns into a down arrow that indicates where you are in the project; the line attached to it is either white (see Figure 10-7) or yellow (see Figure 10-8).