This guide will help you record your carillon performances and make CDs and audio files using your Mac or Windows computer and free software. The guide is divided into four sections:

1. **Inputting sound into the computer**
2. **Recording**
3. **Burning CDs**
4. **Making MP3s**

1. Inputting sound into the computer

This section will require the most figuring out on your own, since everyone's recording equipment, computer hardware, and software are all different. If you are purchasing new equipment, your budget and technical proclivity should determine what to buy. Consult your local pro audio shop or Guitar Center for advice—there are too many options for this guide to make specific recommendations.

At the very least, you need a microphone with a plug that fits your computer's **mic/line in** jack (typically a 1/8" stereo jack). **Plugging straight into the computer's mic jack requires a self-powered microphone** (battery- and AC-powered options are available). It is unlikely that an unpowered microphone will produce an acceptable result. Many models for less than $100 produce good audio, and some will record in stereo—Guitar Center is your best resource. USB microphones are becoming more common and can be a good choice for computer-only use (they will not work with non-computer equipment). See Jeff Davis' discussion on analog recording for information about microphone types—be sure to use an omnidirectional microphone and not a vocal mic.

The advantages to a single-microphone setup include relatively low cost and simplicity of use. The disadvantages include relatively low quality analog audio (due to the quality of audio equipment built into computers) and the inability to mix sounds from microphones in different locations.

A higher-quality and more expensive setup involves having a **digital-analog converter**, which connects the mics to your computer via USB or firewire. Such a setup provides very high quality all-digital connections, and allows the use of multiple microphones for mixing after the recording has been made, which is especially useful for the challenging acoustics of the belfry. Converters start around $100, for which Guitar Center is your best resource. These converters typically accept a variety of inputs (1/4", 1/8", XLR, S/PDIF, optical, etc.), so you can use microphones from older analog setups. The converter will power microphones that accept phantom power. D/A converters (such as PreSonus, M-Audio, etc.) typically come with a suite of software which can be used independent of or together with the software in this guide (ProTools, Cubase, etc).

Using a single microphone, you will need to find an ideal placement which provides good balance between low and high bells, does not receive too much echo from the belfry and nearby buildings, minimizes outside noise and noise from the clavier, carillon transmission, and the wind. This will take experimentation, and the result is largely a matter of taste. Experiment with several microphone placements before making a final decision.

With two or more microphones, contrasting sounds can be recorded to separate tracks and mixed later to produce the desired balance for the instrument and repertoire. Again, placement is a matter of preference and requires experimenting, though consider these factors:

- One mic closer to high bells and one closer to low bells (if the layout permits) allow for the bass/treble balance to be adjusted later, by adjusting the proportional volume from each mic.
- One "dry" mic with line-of-sight to the bells picks up clear individual articulations and little reverberation, and one "wet" mic picking up reflected, blended sound (e.g. outside of the belfry) with less articulation and more reverb.
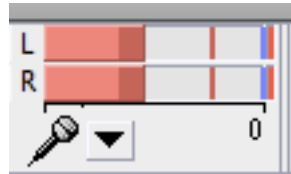
2. Recording

This guide uses **Audacity**, a free, easy-to-use audio editor and recorder. It is available for Mac and Windows at audacity.sourceforge.net. The instructions below assume a single microphone and track, though multi-track procedures are similar. Documentation is available at Audacity's website.

Open Audacity, click the **recording source** pull-down list in the main window to select the input source. If you are using a mic plugged into the microphone jack, you will probably select **Line In**. If your input is not listed, you may need to open the **Preferences** dialog (in the **File** menu in Windows, or the **Audacity** menu on a Mac) select **Audio I/O** from the left column, change the **Recording Device**, and try the pull-down list in the main window again. If you are using an external D/A converter, be sure it is the selected device in the **Preferences** dialog and the number of tracks is set to the number of microphones you are using.

Press the record button (red circle) and a new audio track will be opened. You will see activity on the recording meter (red bars) and on the track's waveform if sound is being recorded. Be careful not to select your computer's built-in microphone. If you press the **Stop** button, the next time the **Record** button is pressed, a new track will be opened. To continue recording on the same track, use the **Pause** button instead.

Recording meter

Clipping indicator

Playback meter

Playback volume

Recording volume

Recording source
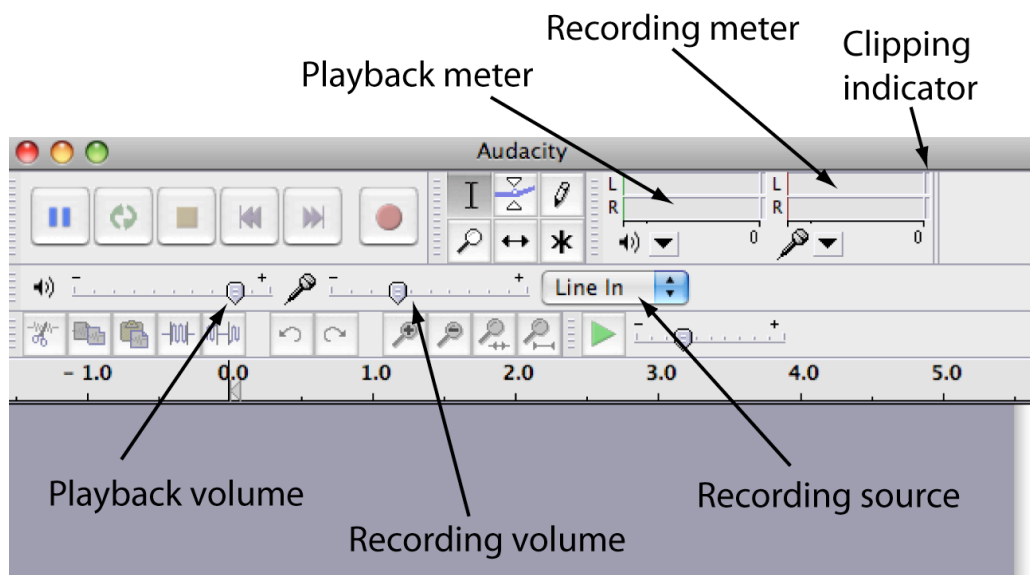
Set the **recording volume** as high as possible, but so that the loudest recorded sound does not cause **clipping**, which results in a distorted recording. Clipping is indicated when the small boxes at the right end of the recording meter turn red (see below). Finding the correct level will take some experimenting, and you will need someone else to help unless you can play the carillon as loud as possible while adjusting the volume. Find the loudest passage in your recital and play it while monitoring the recording meter. Adjust the **recording volume** so that it is as high as possible without clipping. If the clipping indicator lights up, you can reset it by clicking on it. Click inside the recording meter to toggle **monitoring** the input without recording. **You must readjust the recording level any time the microphone(s) are moved.**

Recording meter indicating clipping has occurred

Note: There are several places to adjust volume among recording software, operating system, and hardware. Each of these must be set properly for a successful recording. For example:

- A microphone may have its own volume knob.
- Windows and Mac both have their own built-in volume settings, which can be found in Control Panel and System Preferences, respectively.
- External sound cards and digital-analog converters usually have knobs for adjusting volume, and often have software control panels that also set volume.
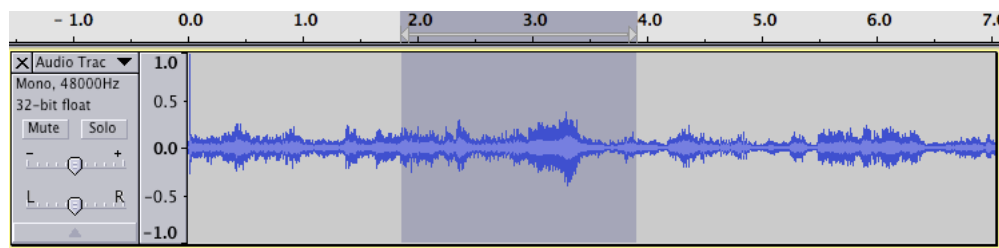

Waveform with selection

Once you have recorded some audio, save your Audacity project through the **File** menu. The resulting .aup file contains your workspace, tracks, and creates a folder containing the raw audio. You will need to **Export** audio from the project in order to use it for a CD or MP3. **Select** sections of the waveform to review the recording and prepare to export a clip. Click a point on the waveform and drag the mouse to select a section of audio. You will probably need to zoom out first in order to select several minutes of recorded audio corresponding to one piece. Once a selection has been made, press the play button to play the selection only, and adjust the start and end of the clip by hovering the mouse over the selection's edge until the cursor turns into a hand, click and drag.

When you are satisfied with a clip, select **Export Selection…** from the **File** menu. From the **Format** pull-down near the bottom of the Save dialog, select **WAV, AIFF, and other uncompressed types.** Click **Options…** and select **WAV (Microsoft 16 bit PCM)**. This exported .wav file will be very large and very high quality for burning to CD; name it according to the piece and save to a place where you can find it later.

In the next sections, we will use iTunes to import .wav files, burn CDs, and make MP3s.

Notes on multi-track recording:

- Audacity can record each microphone's input to a separate track for later editing. It may do this automatically, or you may need to adjust some settings in the converter's own software control panel, or in Audacity's preferences. It is important to set this up properly, else later mixing may not be possible.
- Adjust individual microphone volumes to a desirable balance using the converter's volume knobs or software control before recording—fine adjustments can be made later.
- Audacity may record two microphone inputs to one **stereo track**, which will have two waveforms on one track (see below). Split this track into two mono tracks by clicking the triangle to the right of the track name and selecting **Split Stereo Track**. You will then be able to adjust the volume of each microphone independently, and the separate mics will not be considered left and right channels.
- The **Gain** setting on each track determines the volume at which the track is played back and **exported**: To change the relative volume of two microphones, move one of the gain sliders. If the slider is not visible, you may need to make the track vertically larger by dragging its lower edge downward (especially after splitting a stereo track). For the best quality, lower the gain on one track rather than increasing it on another. If you do increase gain on any track, be sure the resulting balance does not cause clipping overall. Adjusting the volume of sections of track—as opposed to the entire track with the gain slider—is possible using the **envelope tool**.
- When **exporting** from multiple tracks, **be sure to select audio from all tracks**. This is a bit awkward in Audacity—select a clip in one track, then hold down the shift key and make a selection in the other track, which should select the same clip from both.
- While different carillon literature may sound best with different balances (i.e. more reverberation for Gary White, less for Bach), it is a good idea to keep the same balance for any given recording session, like an exam recital.
- For the adventurous, **Ardour** is a feature-rich, cross-platform, open-source audio workstation. It is available from ardour.org.

Gain   Menu, split function

Stereo track
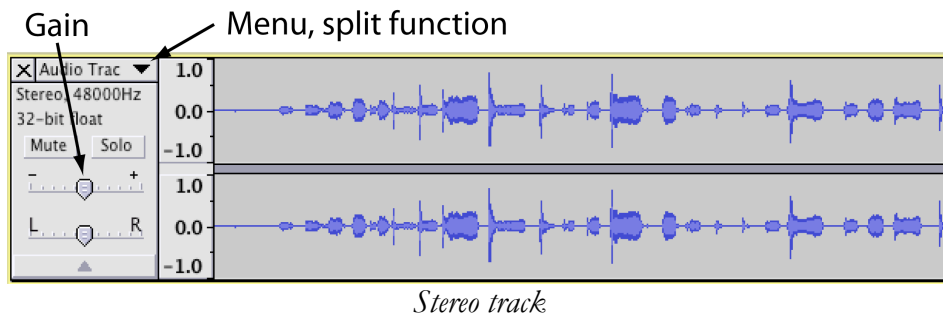
3. Burning CDs

This guide uses **iTunes** because it is free, available for Mac and Windows, and legally makes MP3s (most free software, like Audacity, does not). It can be downloaded from apple.com/itunes/.

Import your .wav files into iTunes by dragging them onto the program window or going to **File > Add to Library…**. To burn tracks to a CD, first create a playlist: **File > New Playlist**. Drag your recordings into the playlist, ordering how they play on the CD by dragging them up and down. Once you are satisfied with the tracks and order, click **Burn CD** from the bottom right of the iTunes window while the playlist is selected. Be sure to use a CD disc and not a DVD, and that **Audio CD** is selected before clicking the **Burn** button. If you get errors in burning, try turning down the **Preferred Speed** in the burn dialog to 8x, 4x, or lower. Alternately, try a different brand of CD—some CDs do not work well in certain brands of drives.

4. Making MP3s

While .wav files are good for making CDs, they are very large; MP3 files are better for emailing, posting on the internet, or transferring to an iPod. In your iTunes music library, right-click anywhere in the column headings (Name, Album, Composer, etc.) and check **Kind.** Notice that your imported recordings are **WAV audio files**. After converting to MP3, your new files will appear alongside the .wav files with the same title.

Open iTunes **Preferences** (**Edit** menu in Windows, **iTunes** menu on a Mac), **General** tab, click the button labeled **Import Settings…**. Under **Import Using**, select **MP3 Encoder**. For **Setting**, use **Higher Quality (192 kbps)** for general use. You can adjust this for higher quality or smaller sized files. Click **OK** and **OK** to exit the Preferences dialog and **select** the tracks to convert to MP3. You can Ctrl-click in Windows or ⌘– click on a Mac to select multiple tracks, or Shift-click on either to select a range of tracks. Select **Create MP3 Version** from the **Advanced** menu, and your new MP3 tracks will be created. Note that they will appear as duplicate entries in the music library, except for **MPEG audio file** under **Kind**.

To locate the files on your hard drive, right click and select **Show in…**

Feel free to contact me with any questions:

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