

## Tutorial: Creating SynchroMuse content using *Audacity*

Level: intermediate/advanced

The purpose of this tutorial is to show you how to create a SynchroMuse-enabled session using the free, open-source audio application Audacity. This tutorial assumes that you are running Windows XP, that your PC includes an available USB port, and have Procyon Editor installed. We recommend that you have a CD burner available as well. Although our goal is to show you how to create your own pieces, this example will show you all the steps I took to create a finished SynchroMuse CD.

Materials needed for this tutorial

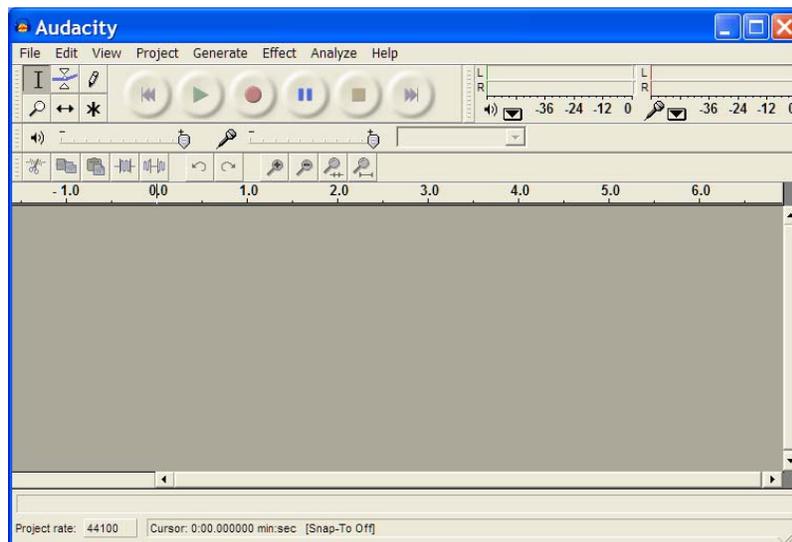
- This document;
- The audio and other documents included with this document in the ZIP file;
- A Procyon outfit;
- Audacity for Windows (version 1.2.6).

We've included all the files needed to reconstruct the steps taken in this tutorial.

To get started, download and install Audacity for Windows, version 1.2.6, from <http://audacity.sourceforge.net/>. Audacity is a robust multi-track audio software with capabilities well beyond what we will cover (but see the documentation on their site if you're so inclined).

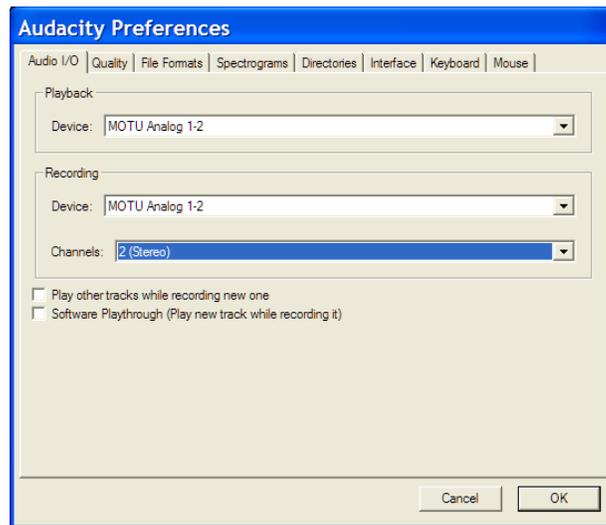
### Configuring Audacity

Once you've installed Audacity, launch it. The main application window looks like this:

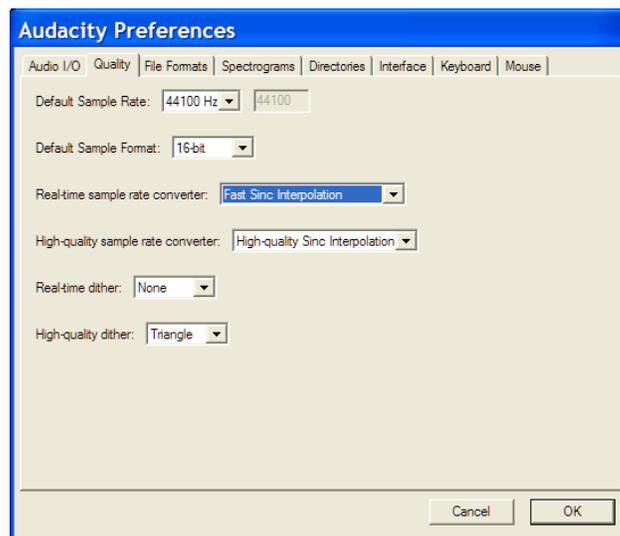


The first step is to configure the audio options, by selecting Edit/Preferences. Click the Audio I/O tab, and note the Playback Device selection. This normally defaults to the standard Windows audio device, "Microsoft Sound Mapper – Output". If you are using some other audio device, for example a USB or Firewire – based interface, select it. You won't need to record anything so the Recording Device setting can be disregarded. You can leave the two check-boxes empty as well.

I'm using a Mark of the Unicorn interface with my computer, which gives the following configuration:

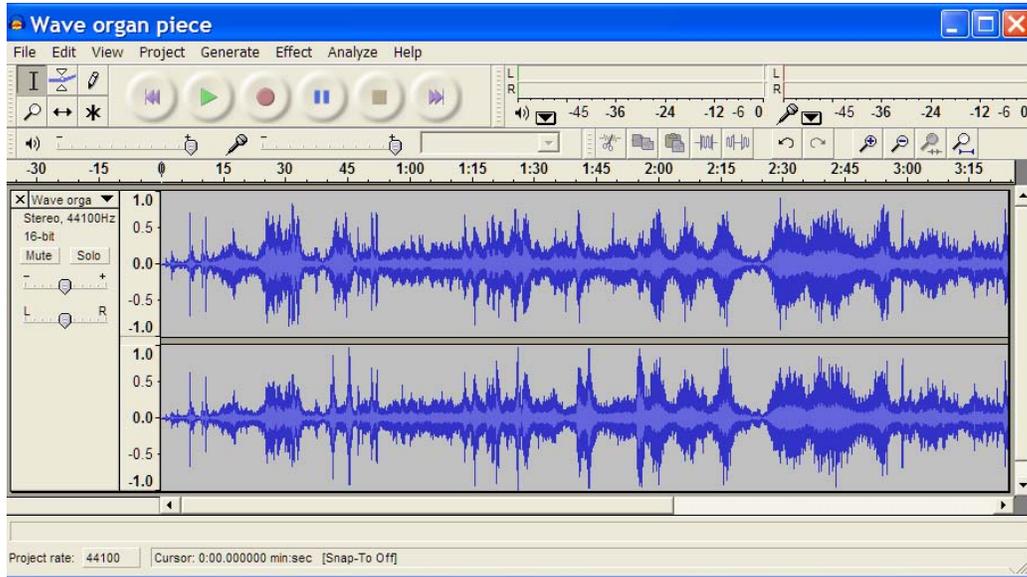


Next, since our goal is to produce a SynchroMuse CD, we'll set the system to 16 bits and 44.1 Khz via the Quality tab:

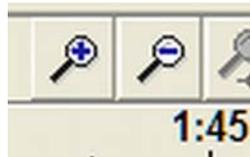


Close the Preferences window.

Next, open the sound file "SynchroMuse Sound.mp3" via the usual File/Open command. Audacity will load the file, which looks like this:



This sample file is about four and a half minutes long; I chose a short example for simplicity's sake. Since we'll be searching for places where the sound changes, it will be helpful to zoom into the sound a bit, which you can do by first making the Audacity window wider (click and drag the right edge of the window towards the right side of your monitor), which exposes the Zoom in and out tools on the toolbar; they look like this:



Click the magnifying glass icon with a "+" inside it to expand the waveform view (zoom in), or the one with a "-" to zoom out.

Next, let's verify that you can hear the audio; press the "play" button (the green arrow on the transport bar). If this works you're ready to start developing your session. If you can't hear the sound, verify that you've selected the right audio output driver; one way to do this is to open "Sounds and Audio Devices" in the Control Panel and open the Audio tab to verify that the device you selected for Audacity is the same as the "Default device" listed there.



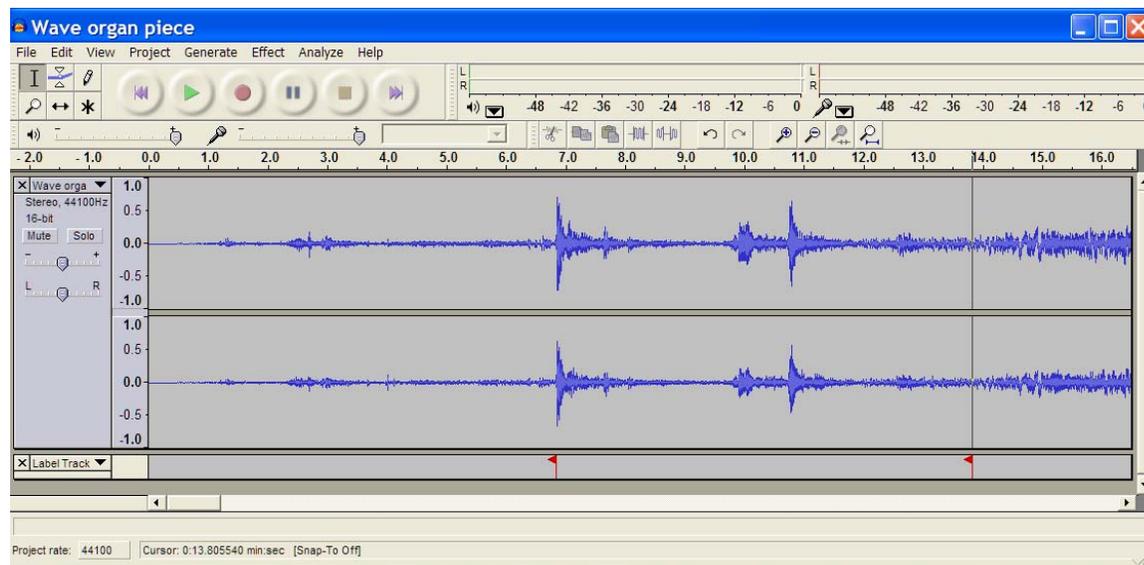
Aside from the green “Play” button, you’ll find the others helpful as well; the button to the left of “Play” returns you to the start of the sound file, while the one on the far right takes you to the very end; the square one stops playback while the one with two vertical bars is the “pause” control. You won’t be using the red “record” button.

### Locating segment boundaries

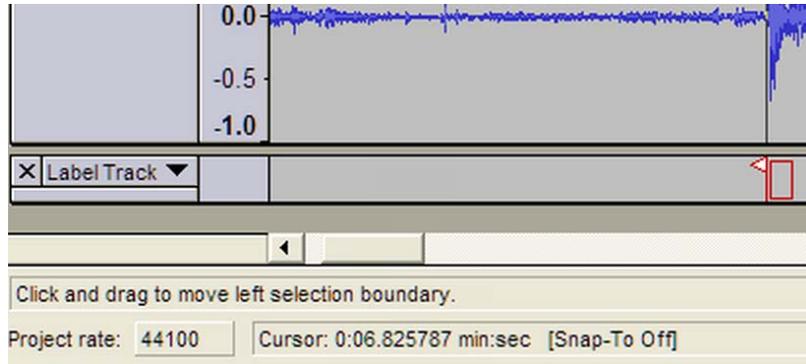
In order to create a Procyon session which synchronizes with the audio, we need to decide when we want the lights to change. To do this we’ll mark (label) the waveform at segment boundaries.

To mark the waveform:

- Left-click the waveform where you want a change to occur; a vertical line will appear.
- Once it is properly located, press Ctrl+B, and a small red flag will appear on the bottom gray bar.



You can view segment times by left-clicking on a flag:



In the image above, I've selected the first flag. You won't need the degree of accuracy shown in the bottom bar—the Procyon is accurate to a tenth of a second, so round the first segment to 6.8 seconds.

For this example, I've created 25 flag labels. Save the entire batch as a text file via the **File/Export Labels** command. If you prefer, you can open the label file I created and insert them into Audacity with the **Project/Import Labels** command. The label file is called "Synchromuse labels.txt".

In the next step, we'll transfer the edit point flags into a spreadsheet, for convenience in creating the Procyon segments. I am assuming that you have Microsoft Excel available; if you don't, you can fill in the worksheet by hand, again using the label information.

1. Open the Excel file, "Synchromuse Authoring Worksheet.xls". The top of the worksheet looks like this:

**Synchromuse authoring worksheet**

Segment #	Start	Finish	Length	Notes
1			0.0	
2			0.0	
3			0.0	
4			0.0	
5			0.0	

2. Next, open the file "Synchromuse Labels.txt". The first few entries look like this:

6.825787  
 13.805540  
 17.449381  
 22.170978  
 25.387139

Notice that there are more decimal places than we want to use. Copy the entire list and paste it into the “finish” column of the spreadsheet, starting with segment one. At the bottom right of the column of numbers you just pasted is a small icon called “paste options”. Click on that and select “match destination formatting”. This will automatically convert the numbers to single decimal format.

3. Next, position your cursor in the second segment box under “start” and repeat step 2, they type “0” in the Start segment for segment 1. I’ve formatted the sheet to automatically calculate the segment lengths, and the top of the spreadsheet should now look like this:

Segment #	Start	Finish	Length	Notes
1	0.0	6.8	6.8	
2	6.8	13.8	7.0	
3	13.8	17.4	3.6	
4	17.4	22.2	4.7	
5	22.2	25.4	3.2	
6	25.4	32.5	7.2	

You’re now ready to create a session using your Procyon Editor, using the “length” values to set each segment length. I’ve included the “notes” column for comments about the sort of qualities the segment should have; you can of course ignore it or expand it if you like.

*Tips for creating your Procyon session*

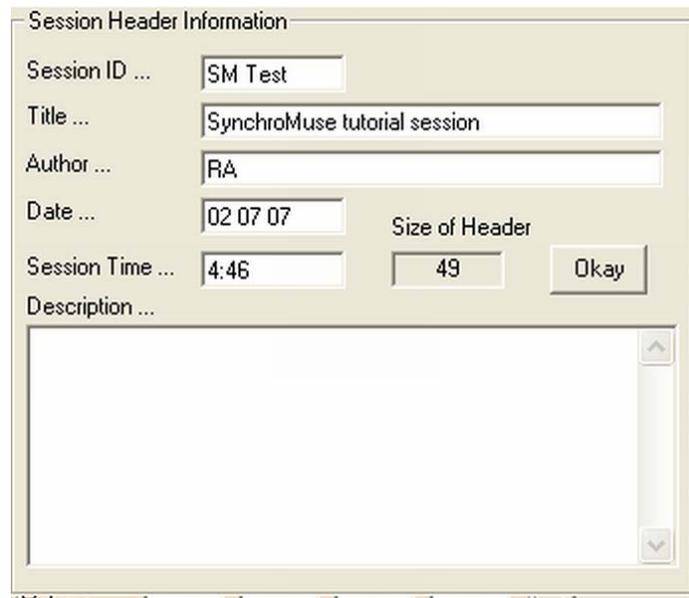
The Editor initially opens a single segment; each time you insert a new one, it inherits some settings from the previous segment (see the software guide for details). So I recommend, rather than building the session by inserting 25 segments and then changing its settings segment by segment (or with the graphic editor), that you make any “global” changes to the session in the first segment. In particular, I’m turning the internal audio off for all segments so your experience will be one seeing the lights change in tandem with the audio file.

While creating your session, you’ll probably want to test it as you proceed. You can do this with rough accuracy by selecting the segment sequence you want to test (say, the first five) in the Procyon Editor, starting playback with the Run Segments command, then starting the audio playback in Audacity. You can either run both from the beginning each time, or if you’ve selected a different set of segments (say, 5 to 10), then you’ll need to pre-position the Audacity cursor at the 5<sup>th</sup> flag before starting audio playback.

## Creating the header file

Sessions created for SynchroMuse must include a named header file, because the Procyon uses this information to determine which session stored in memory to synchronize with the audio file.

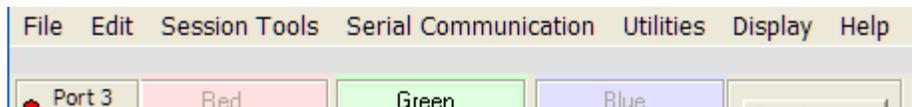
To create your header file, click the “edit session header” button on the right side of the Procyon window, which brings up the following window. Note that I’ve already entered the name for the session:



The screenshot shows a dialog box titled "Session Header Information". It contains several input fields: "Session ID ..." with the value "SM Test", "Title ..." with "SynchroMuse tutorial session", "Author ..." with "RA", "Date ..." with "02 07 07", and "Session Time ..." with "4:46". There is also a "Description ..." field which is currently empty. To the right of the "Session Time" field, there is a "Size of Header" field showing "49" and an "Okay" button.

Any information you enter into this window becomes a part of the session stored internally; however, the header file takes up space in the Procyon’s internal flash memory (49 bytes in this case). So writing long descriptions will reduce your overall storage space.

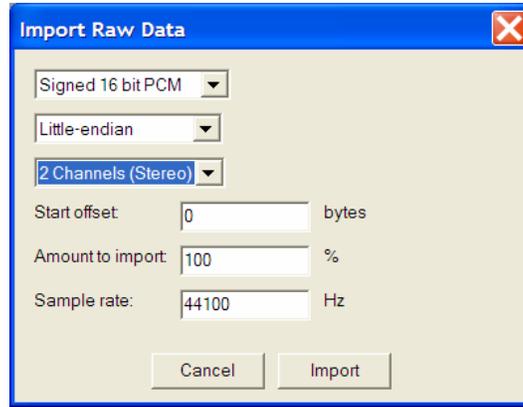
Next, we create the “Digital/audio synchrony” (DAS) audio file. To do this you must first type the word “enhance” (without the quotes) in the gray bar between the drop down menus and color channel information, which unlocks additional features:



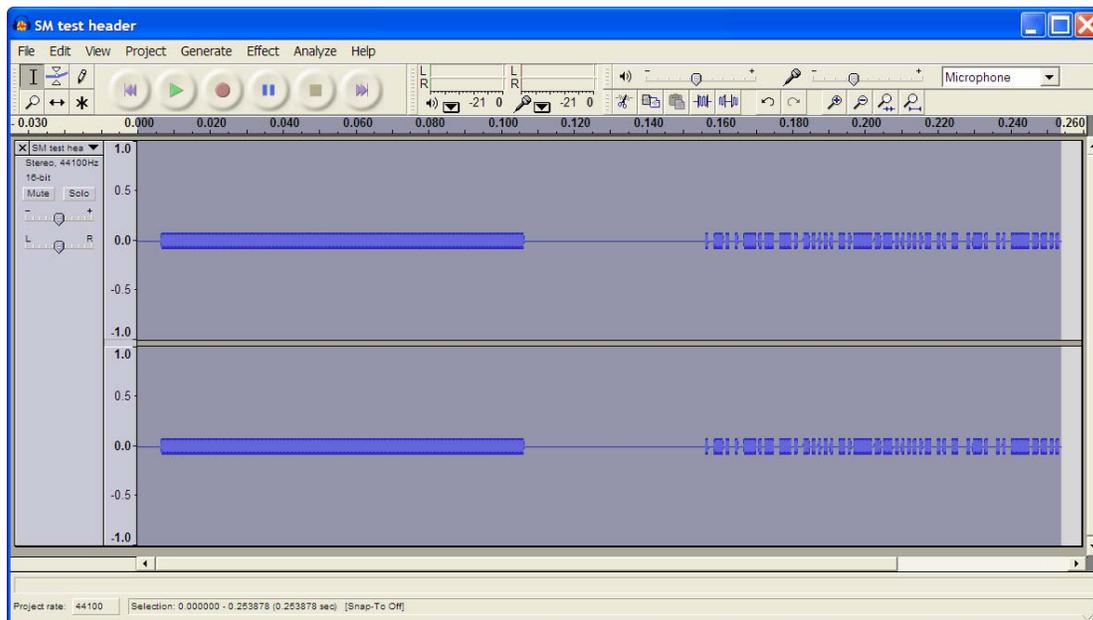
You won’t see the letters as you type them.

Next, select **Session Tools/Make DAS .raw file**. This creates the digital audio file needed for SynchroMuse to work. ***This file must have exactly the same name as***

*the Session ID in the Make Header section.* Save it somewhere convenient, and open it in Audacity using the **Project/Import Raw Data** command. Or, you can open the file we've included, called "SM test header.raw". This will bring up a dialog box which allows various settings to be used; be sure they are set as follows:



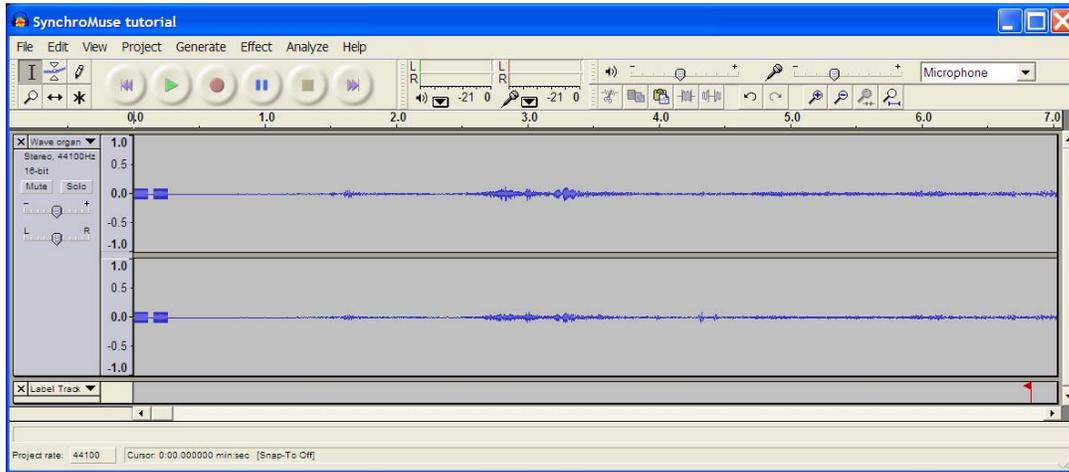
The file looks like this when you open it:



The first part is a 19.6 kHz signal, which is used for calibration purposes, followed by the data packets; the entire file is about a quarter second long. The next step will be to copy the file and paste it at the beginning of the audio file.

To do this, select the entire SM test header file using **Ctrl+A**, then copy it via **Ctrl+C**. Next, open the labeled audio file (if it's not already open) and position the cursor at

the very beginning of the file. Then paste the digital data using **Ctrl+V**. The resulting file will look like this:



Save the resulting file using the **File/Export as WAV** command in Audacity.

Finally, transfer the session to your Procyon via the Session Tools/Upload Session to Procyon.

To play the file, either plug your computer's audio output into your Procyon and play it directly, or burn it to a CD and play it into the Procyon. Be sure you are in dAS mode before so doing.

## Summary

The steps required to make a SynchroMuse CD are:

1. Open your audio file in an application, such as Audacity, which allows you to view and listen to the waveform, and to label segment boundaries.
2. Create a list of segment timings.
3. Create a Procyon session with those timings.
4. Name the session via the session header; this is important, because it is how the Procyon determines which session to play with your audio track.
5. Make a dAS file and attach it to the beginning of your audio track, and save it as a WAV file. Burn the resulting WAV file to CD.
6. Upload your custom session to your Procyon.
7. Play the resulting CD through your Procyon, in dAS mode.

## Going further

If you are considering making one or more CDs for commercial distribution, the disc will typically include more than one track. Although you could create a single long session for the entire CD, ideally each track will include its own dAS header, so your users can play it in any order.

If for example, your CD includes ten tracks, then there will also be ten sessions associated with those tracks, which you can arrange into an album for convenient USB upload. Or, a set of four CDs may have (say) 20 sessions associated with them.

The session created in this tutorial was "simple", in that frequencies varied little, and most changes were to RGB brightness values only. You will find that a little experimentation with the other parameters (for example, DC offset, to create color "wash" effects) will increase the subtlety and overall aesthetic interest in the session, in addition to more closely matching the session to your intended goal.

