

AUDIO RECORDING GENERAL TIPS AND USING AUDACITY

Section 1. General Audio Recording Tips

We'll start the conversation with some general good practices for audio recording. We are talking here about voice recording. Specifically recording your voice in a clean track that both sounds good and is suitable for use in VSA for Wavemotion Analysis.

I will start by explaining what Wavemotion Analysis is. In VSA, this is a feature created specifically for jaw servos in animatronic skulls and other creatures. Wavemotion Analysis scans the audio track which is loaded in VSA and creates jaw motions automatically based on the amplitude (volume) changes in the audio file you have loaded. It saves the result to whatever VSA track you selected which should be the one for the jaw of your skull. The servo settings must already be set correctly for this to work.

Now that you know what it does, I will give you some general tips on how to make the jaw motion look as natural as possible. It all starts with the recording itself. In this tutorial, we will exclusively use Audacity as our audio recording and editing software because it is a decent editor and it's free. [Download it here](#). You can certainly use all these tips and principles in other editing software if you already have some and are more familiar with them.

The first and most important thing to do is to start with the best recording possible. The first link in that chain is your microphone. If you have a decent microphone you are halfway there to creating a great audio file. Obviously, you can use any microphone, but quality will matter, and you want the finished product to sound good when your audience hears it. I HIGHLY recommend getting a decent USB microphone. They have their own built-in sound cards which are generally higher quality than those found in basic laptops. My personal recommendation and the mic I use is a Samson C01U USB Studio Condenser Microphone. In general, Condenser microphones are very good at picking up sounds very close to them and ignoring sounds much further away (unwanted background noise) Here's what mine looks like.



You can get these at very reasonable prices on ebay. The older models like the one shown are fine. You don't need the pro model. I frequently see these in the \$30.00 to \$50.00 range on ebay. Try to find one that comes with the stand. You don't want to hand-hold the mic while you're talking because it will introduce noise into the recording from adjusting your grip on the mic. Put it on a stand like the one shown or a freestanding mic stand. If it's on a table, don't be touching the table or tapping your fingers. It will pick up the vibrations and make a noisy recording

This is my preferred Microphone. You can do a great job with less expensive ones as well. Ask people you know if they have recommendations or go to a store and see if you can try some out. Here's a [LINK](#) giving you some other suggestions.

This type of microphone has a front and a back side. Talk into the front side, not the top or the back. On this mic, and most similar mics, the front side is the side with the power light on it.

Start by finding a quiet place to record. No refrigerators, air conditioners, forced hot air heating systems or other noises going on nearby. Get as quiet an area as possible. Then get close to the mic. No further than 10" away, but don't direct your mouth straight into the mic unless you are using a pop screen on front of it. I record very close to the mic but aim my mouth at a 45° angle across the front of the mic. This way the air that shoots out of your mouth as you speak doesn't directly hit the mic element and cause that thud or popping sound you hear when novices use microphones. These can be corrected later if it happens, but you'll get better sound if you avoid it in the first place.

Remember that when using Wavemotion Analysis, the jaw will react to any noise on the audio track, including doors opening and closing in the background, the thud sound when you bump the table while recording, and any sound effects you may add. Music and sound effects must be added after the jaw programming is done. We will go through this step by step.

So now you should have your microphone picked out, and you're set up in a quiet room with Audacity running and you have written and practiced a script. Your goal is to get the loudest recording of your voice possible without going into the red and causing distortion and the least amount of background noise possible. To do this, you don't want to shout, you just need to set your mic levels right and get very close to the mic.

Once you have recorded your track, the waveform produced in Audacity should look roughly like this:

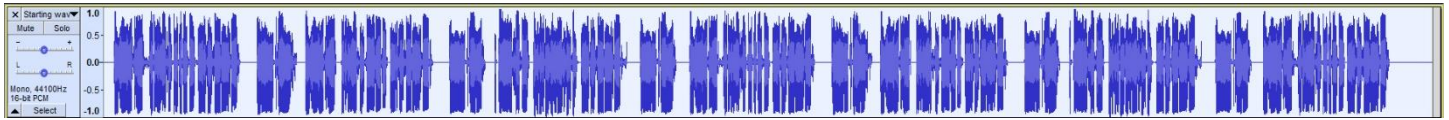


You see at the high spots it nearly touches the top and bottom of the waveform window, but not quite. If it touches the top and bottom or extends past the limits, the rounded edge of the waveform is sheered off and it becomes square. The result is distorted sound. With Wavemotion Analysis any point where the waveform touches the top and bottom of the window will open the jaw to its maximum level possible with the VSA settings for the jaw. The flat line in the middle results in the jaw being closed or in its minimum and default position. Smaller sections of the waveform result in smaller motions of the jaw.

So, in a perfect world, that would be all you need. You could load that waveform into VSA, run Wavemotion Analysis and it would be perfect. But this is not a perfect world, so you will need to make some adjustments in the file. The image above shows a file that I have already removed background noise from, so that's not an issue, but if you understand how the process works with Wavemotion Analysis, you'll understand why we need to 'exaggerate' the motion.

When you see those quick spikes that go all the way up, the program will tell the jaw servo to open all the way for those few milliseconds, then come back down just as quickly. That's fine for the program, but the servo has physical limitations and can't move that fast. The result is, that it never gets all the way up before it's told to come back down. So it abandon's trying and switches to the other direction so it can stay in sync. The result is less motion in the jaw and can result in your skull looking like it's mumbling to itself rather than speaking to a crowd. There are several tricks you can try to correct for this. You can try any of them or a combination and go with whatever works best. The easiest thing to try first is to change the maximum servo setting for the jaw. Add 100 to it. If the maximum allowed was 490, make it 590 and try Wavemotion Analysis again. Delete the results of the first try in VSA before running it again, of course. This way, the jaws's target for the loudest sounds is now 590. It won't get all the way up to 590, but it will get farther than when the target was only 490 resulting in more motion for the jaw. After the jaw has been programmed but before you run it, go back into setting in VSA and change it back to the original maximum level (because that was set for a reason) and play it back. It will still open wider than before but will stop when it hits the maximum level (If it gets that high) so as not to open too far. This should result in a better look.

Also, you can process the audio file. We will go over this in detail, but if you adjust your compression settings in Audacity right, you can create an automatic gain control on the waveform leveling off all the jaw motions and causing the jaw to spend more time opened wider, but still go down to zero at the end of each word or syllable. Doing that will give you a waveform that looks like the one below. This is the exact came clip after using the compressor in Audacity.



Remember that the jaw servo seldom really has the time to go all the way to the maximum setting before being told to come back down, so the difference will not be as extreme as what you see in the waveforms, but they should result in a better, more natural looking jaw motion. You can play with different levels of compression and combining these two methods until you get the results you want. Once you get the jaw programmed, it will stay that way no matter what audio file is loaded into VSA.

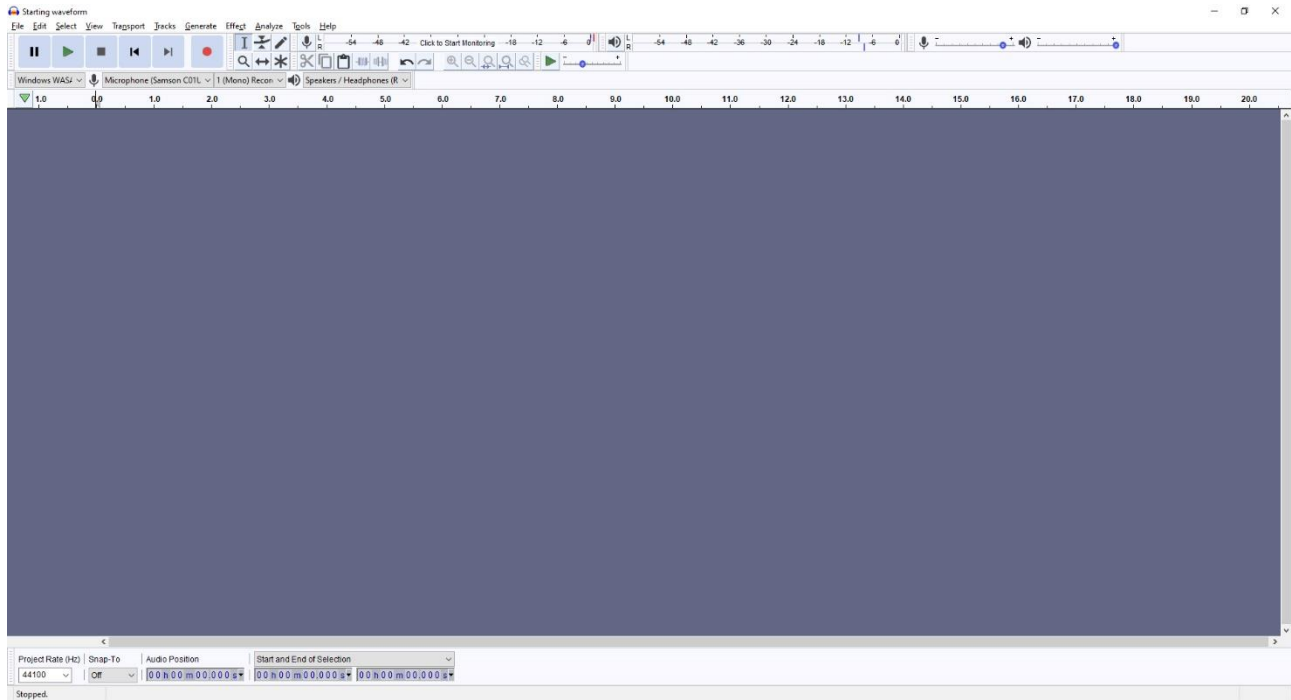
To wrap up this section, you want to make your natural sounding audio track using the tips and practices for recording that I've gone over at the beginning. Save that file. Make a copy of it and use the copy to modify with compression. You'll want to retain the original to put back into VSA after programming the jaw so the audience hears the natural sounding file, not the over compressed one. ALWAYS USE .wav FILES. Do NOT use .mp3 files. This has nothing to do with the quality of the files. MP3 files contain non- audio information embedded in the file. It tells the player what compression was used, what bitrate, the name of the artist, title, and other ID3 tag info. That extra data creates a silent gap at the beginning of the file which changes in length depending on the amount and type of info stored. It's enough to throw the recorded motion and the audio out of sync. WAV files do not do this, so that's why we use them. VSA has a limitation as well. It must be a 16-bit WAV file. They may fix this in the future, but if you try a 32 bit or any other bit file, it will display in VSA as a solid red bar and sound like static. Save all wav files as 16-bit PCM wav files.

OK, so let's get into the Audacity Tutorial section.

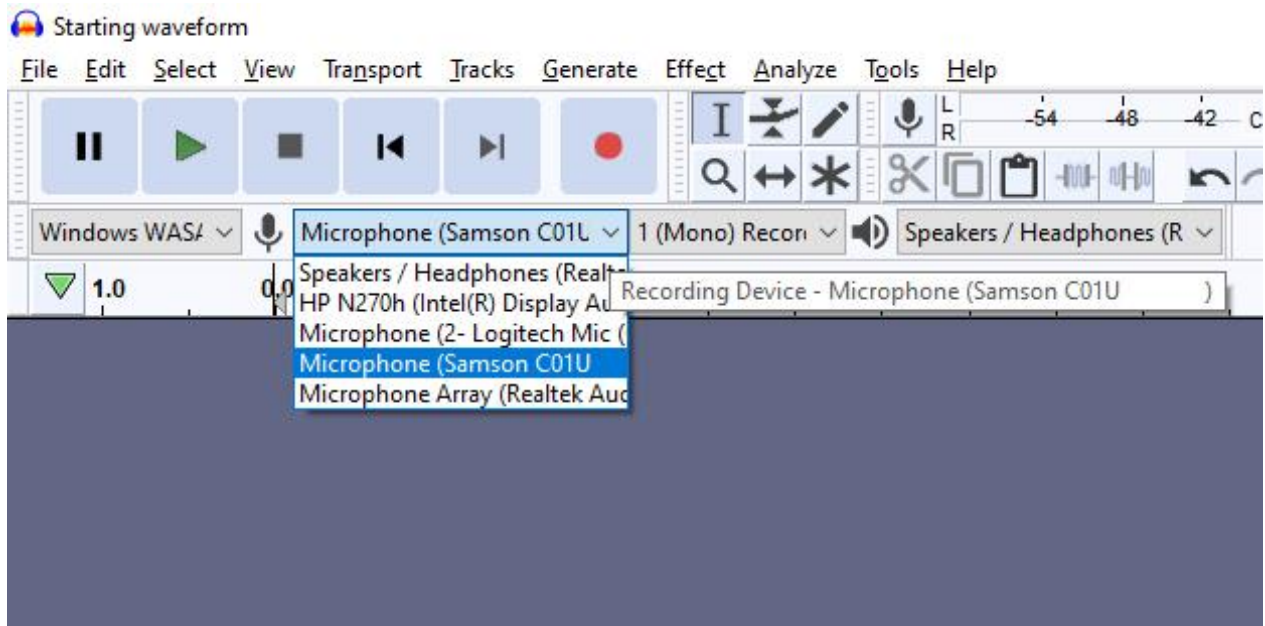
Section 2. Getting Started with Audacity

In this section, we will go over all the functions of Audacity that you will need to know in order to create files to use for your skulls in VSA. Be sure you have your microphone connected to your computer before you start Audacity.

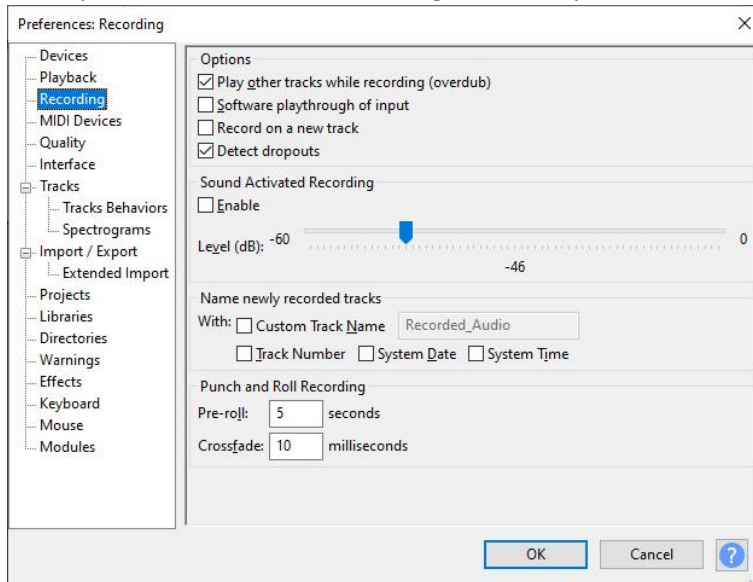
1. When you open Audacity, it should look like this:



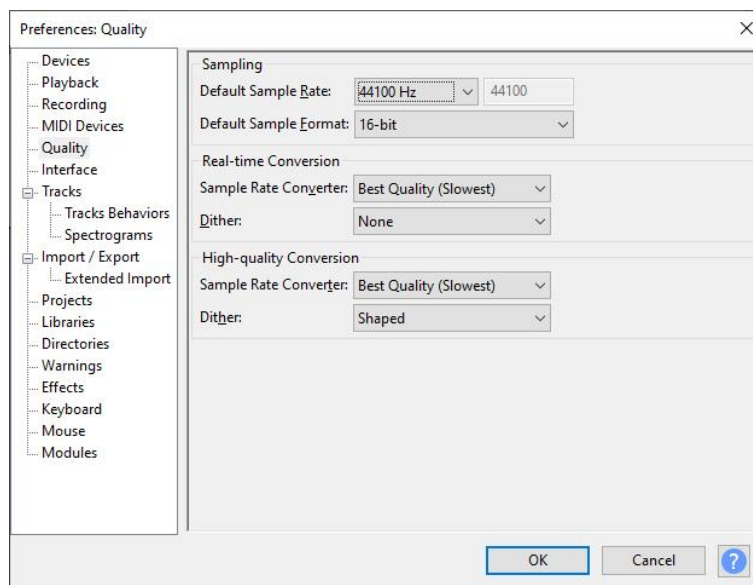
2. Select your microphone. There may be multiple microphone sources connected to your computer. Webcams have mics for instance. Select the source for the microphone you will be using. For me, it is a Samson C01U.



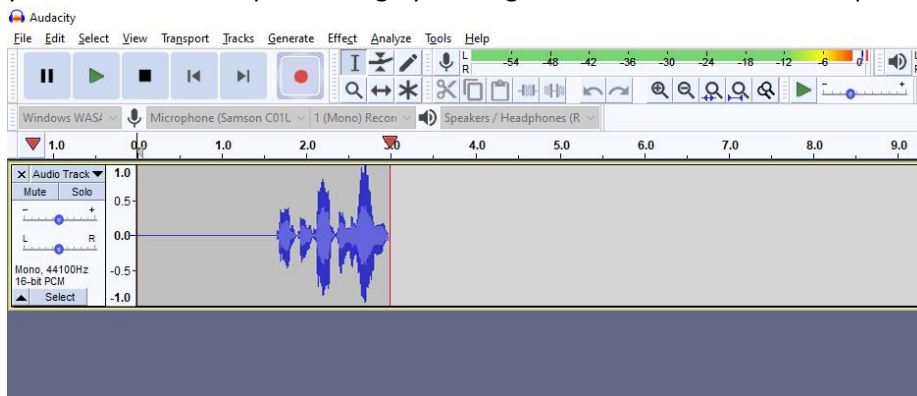
3. Next, you will need to set some preferences. Use the menu and go to Edit/Preferences (or click CTRL+P). In the list of preferences, select “Recording” and set up the screen as shown here:



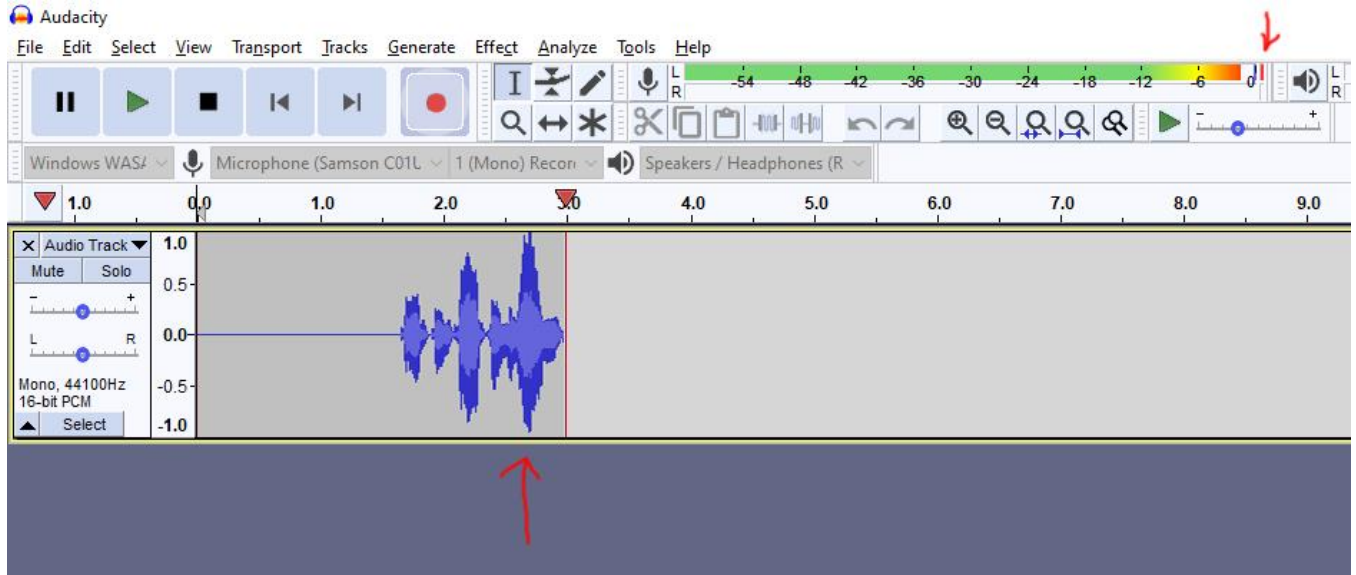
4. Click on “Quality” in the left-hand menu and set it up as shown below. This is for VSA which requires 16-bit audio. You only need to do this once. It remembers your preferences automatically each time you start Audacity.



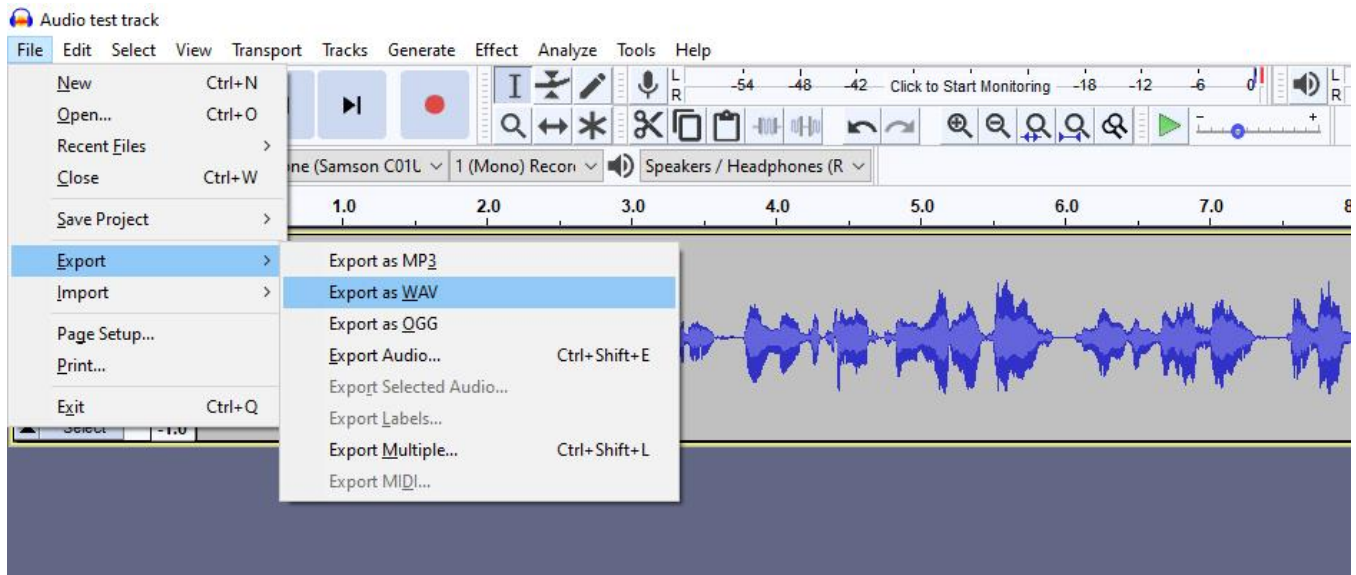
5. Now it's time to start recording. Get your mic and script set up and ready to use, then click the button with the red dot located in the transport area at the top of the screen. It will create a new track and start recording right away. As you talk into your mike, you will see the waveform being created as you go. It should look like this as you talk. You can stop recording by clicking the button with the black square in the transport section.



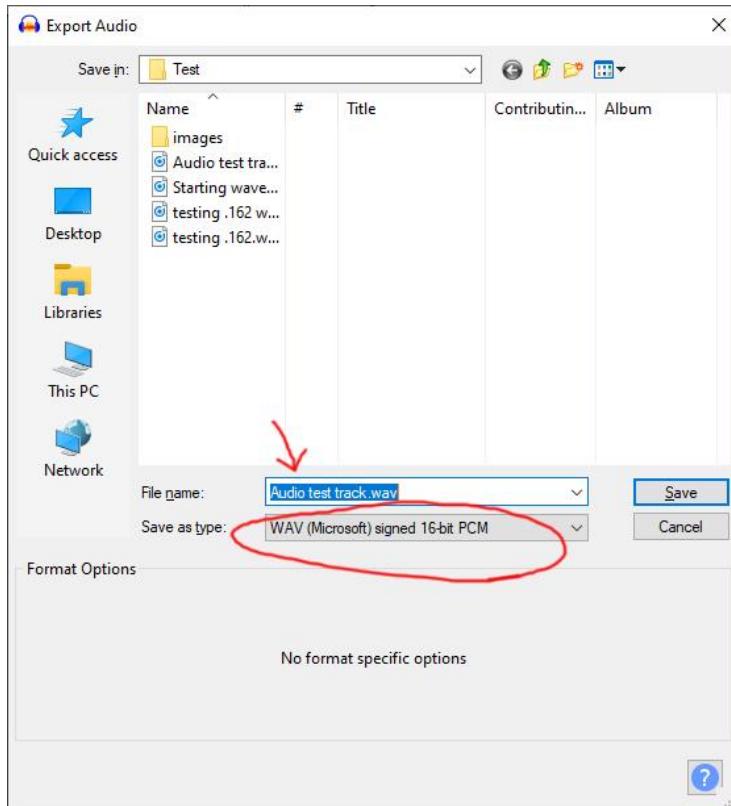
6. The section of audio recorded above has a problem. I was too loud and it caused clipping to occur. You can see the spot in the waveform where the peaks exceeded the width of the waveform envelope. The arrow at the bottom pointing up shows you the spot. The smaller arrow at the top pointing down towards the VU meter shows a small red line just after the 0 in the VU meter. The red line will remain there once it's triggered so that you know that in at least one spot during your recording the audio was clipped causing distortion. Before re-doing the whole track, you should listen to the section where the clipping occurred and determine if the distortion is noticeable. If not, leave it alone. If you can't hear it, it's likely that no one else can either. If it is noticeable, you can re-record the track or just re-record that small section and add it back in later.



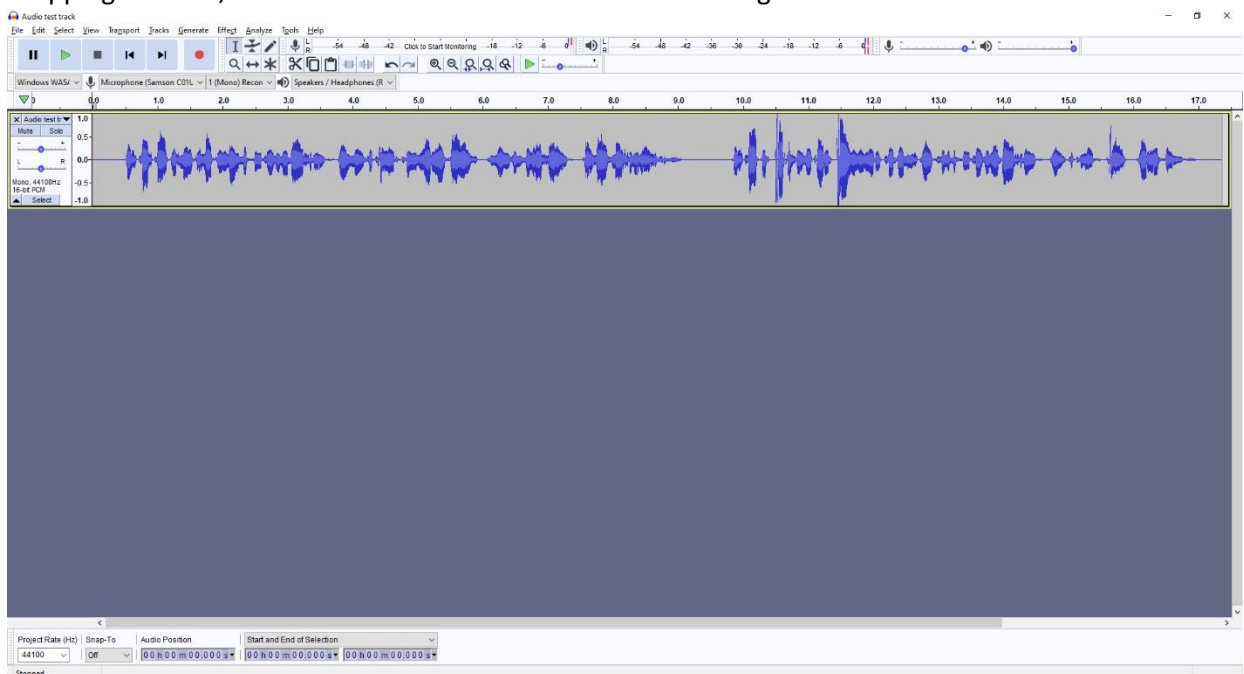
7. Once you've finished recording, you need to Export the file as a wave file. Using the menu tabs as shown below, prepare to export and save the file.



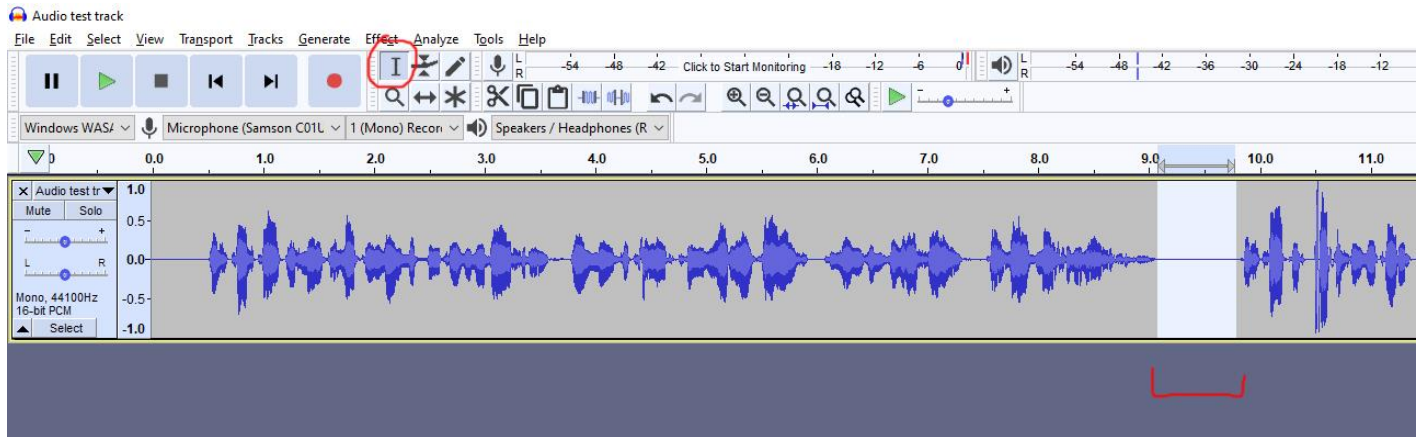
8. You will get the box below after you click on “Export as Wav”. The red arrow points to the file name. Create whatever name you want. I circled the “Save as Type” box. It should be a 16-bit PCM Wav file. If it isn’t, go back and review step 4. If all is good, and you have navigated to the right folder to save it in, click “Save”. This is the last step required to create an audio file. Next we’ll move into how to modify that file for use in VSA with Wavemotion Analysis.



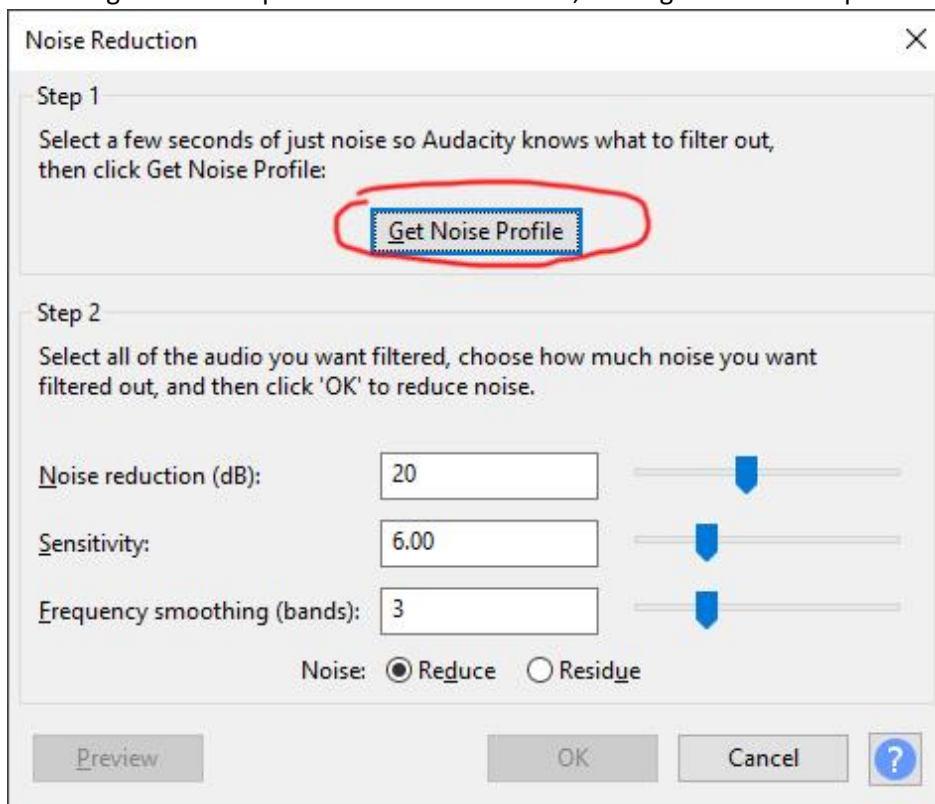
9. Now that the file is saved, we can work on editing the file to optimize it for the jaw servo and WA (Wavemotion Analysis). You can grab the test file that I am using at [THIS LINK](#). Once you unzip the audio file, you can follow along with the exact file I’m using, or, you can make your own if you prefer. You will want to load the audio file into Audacity. You can drag and drop it into the workspace and it will make a new track for it. If you prefer to use the menu, go to File/Import/Audio and navigate to the file that you want to use. Dragging and dropping is easier, however. It should look like this after loading the file:



10. The first thing we want to do is to clean up the background noise. I had several things running in the room when I recorded this and there's a bit of noise there. You can see that the playback meters never go all the way down in the breaks between words. Using the selection tool (Circled in red below) click on the audio file and hold the mouse button down. Slide the mouse over to create a selection area of just background noise also as shown in the picture below about the middle of the file if you're using my file, or use any seemingly blank space in yours.



11. Use the main menu and go to "Effect/Noise Reduction" a box will pop up that looks like the one below. Click on the button circled in red that says, "Get Noise Profile". The box will disappear. What that does is it makes a kind of 'noise print' of what is in that space. The next step will take that profile and apply it to the whole file removing that sound profile from the entire file, making all the blank spaces silent.

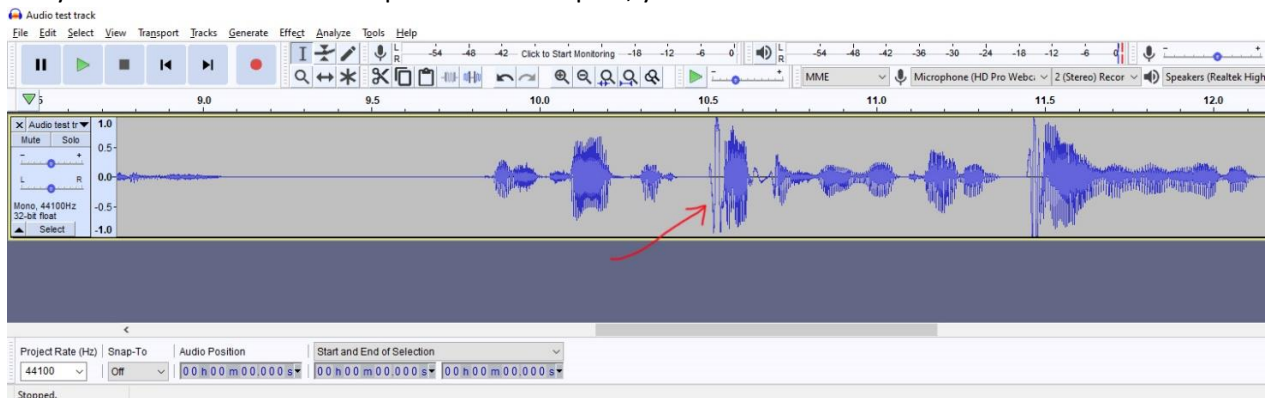


12. To apply this profile, you need to move the cursor to any spot in the audio file and double click it. That will highlight the entire file. Go back to the menu and go to "Effect/Noise Reduction" again. The same box will pop up. This time, unlike the image above, the "OK" button will not be greyed out. Click that OK button. It will process the whole file. As you play it, you will see that all the gaps in the file now register as silent on the VU meter. It does take time for the VU meter to fall, but the silence is actually instant. To see the result, highlight just the same area again as you see in the image for step 10. Click the play button in the transport section and you will see that the whole gap is silent and does not register on the VU meters at all. That's the first step. Next we'll try to fix the popping sounds where I say words that begin with "P" directly into the mic.

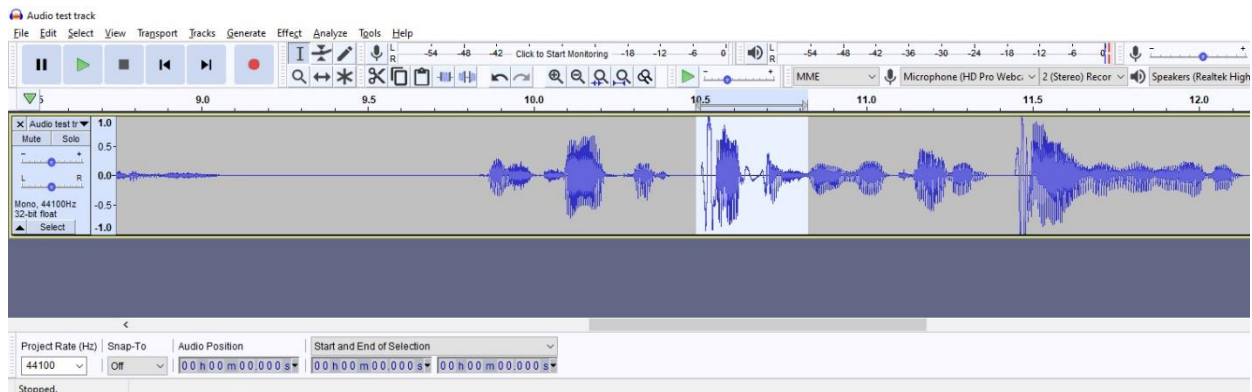
13. Now we're going to remove those pops. The best way to do this is in the first paragraph of this tutorial. Be careful when you record and don't aim your mouth directly into the mic. But let's say, like in this test track, that didn't happen and for some reason you can't go back and re-record it. Here is a simple way to fix it. If you're listening on cheap laptop speakers you may not hear how bad these pops sound, but put on headphones, or use a pair of speakers that can put out some bass, and you will hear the pops in all their glory. First thing is to zoom in on the part of the file that's a problem. In my test file, the first bad pop happens at about 10.5 seconds in on the word 'purposely'. You can find the Zoom control in the image below circled in red.



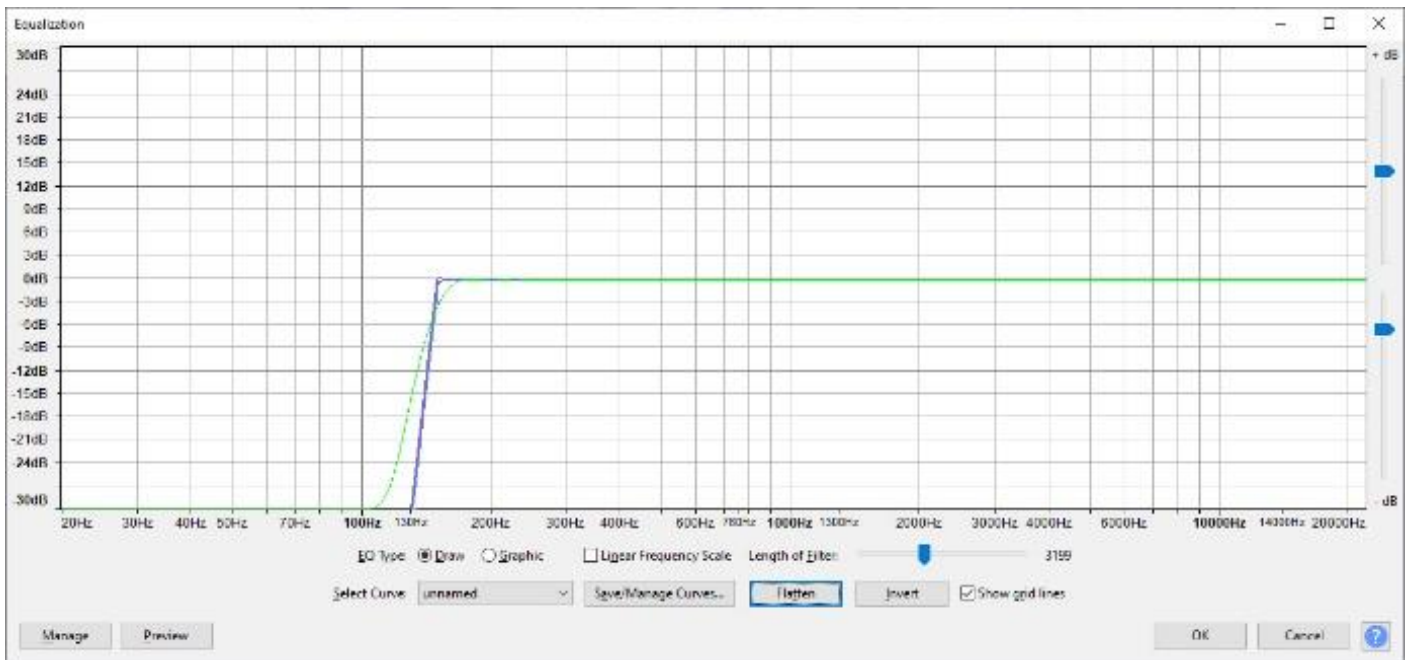
Click that until you zoom in pretty close, then use the scroll bar at the bottom to slide your view over to about 10.5 seconds into the timeline. It should look like the picture below. You can see the messed-up section of the waveform where the arrow points. You can see another section a bit further ahead at about 11.5 seconds. Just like you did to isolate the noise print back in step 10, you will want to isolate the section that contains the pop.



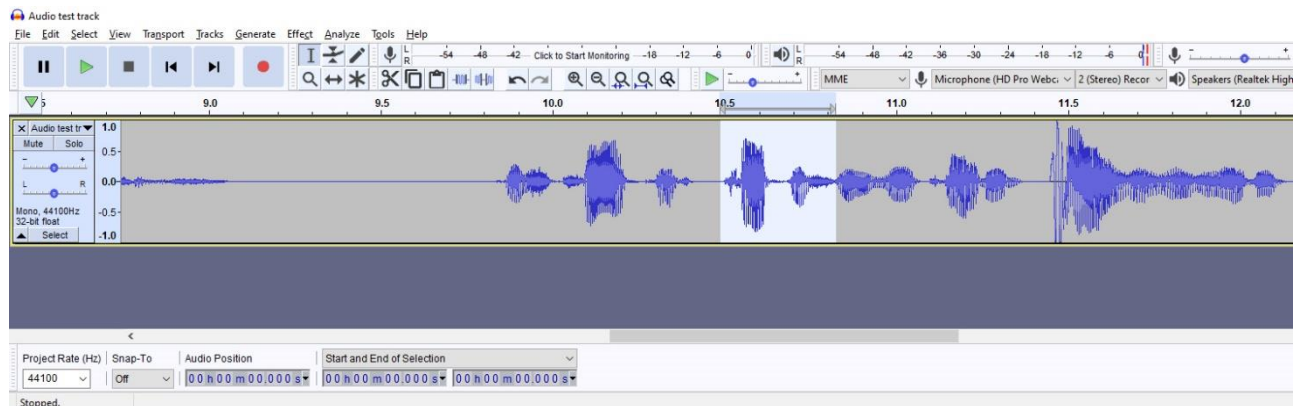
14. Once selected as shown below, go to "Effect/Equalization".



A new box will pop up that looks like the image at the top of the next page. When you open it up, the blue line will be flat across the middle. You will need to click on that line right around the 130Hz Mark. This will create a dot on the line. Click again on the blue line just before the first dot you made. Drag that second dot you made all the way down to the bottom. That will block all frequencies below 130Hz. That's where most of the popping sounds live. Your graph should look like the picture on the next page now.

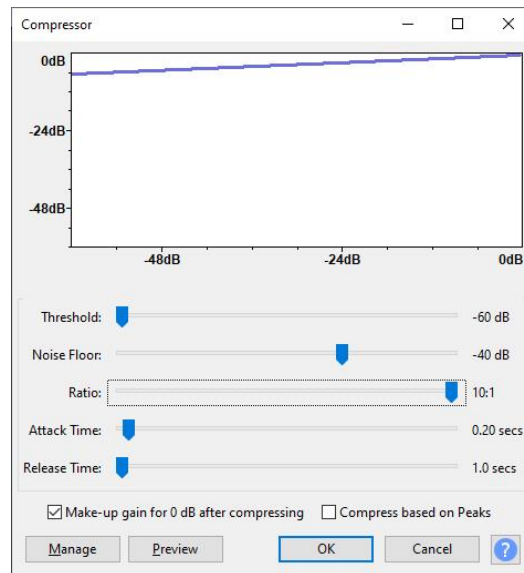
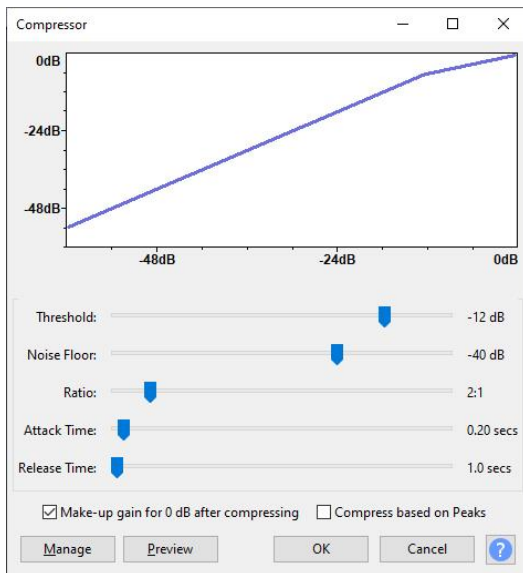


15. Click OK and process the Equalization. That should fix the first pop. If it worked right, the file should now look like this:



Listen to the file and hear how much better it sounds. Repeat that same process for the next two pop sounds at 11.5 seconds and at 15.6 seconds. Listen to the file each time to make sure it's fixed to your satisfaction. It won't be perfect, but it should be close enough so that most people would never notice. If you want perfect, go back and record the clip over again.

16. At this point, you'll want to save this file. Unless it needs more work, this would be the file that you save for later. It will be the one loaded into VSA last so it will be the one that the audience hears. You have taken a poorly recorded file and improved it enough for the public to hear it. It will sound like natural speech and will not be over-compressed. I recommend exporting this file from Audacity and giving it a file name like "Audio for Public ", or something like that. Refer to steps 7 and 8 for exporting audio.
17. Now for adding the compression to make it better for WA in VSA. Highlight the entire file like you did in step 12. The original file should still be in Audacity. Once it's highlighted go to "Effect/Compressor". A new box will pop up that looks like the first image at the top of the next page. You will need to change it by moving the sliders so that it looks like the second image at the top of the next page. Once you've changed it, click OK.

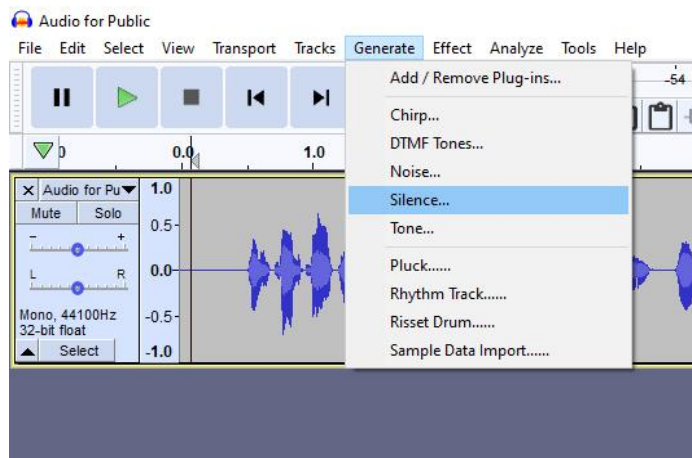


18. Finally, this will give you the file that you want to use for programming the jaw as seen below.

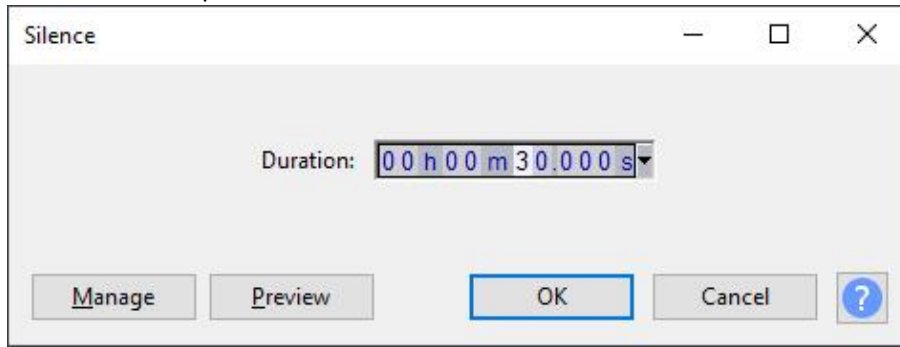


This file should work well to use with WA. Refer to the very beginning of this tutorial to refresh your memory on how to tweak the jaw motion in VSA. Save this compressed file and name it something like “Audio for Programming”.

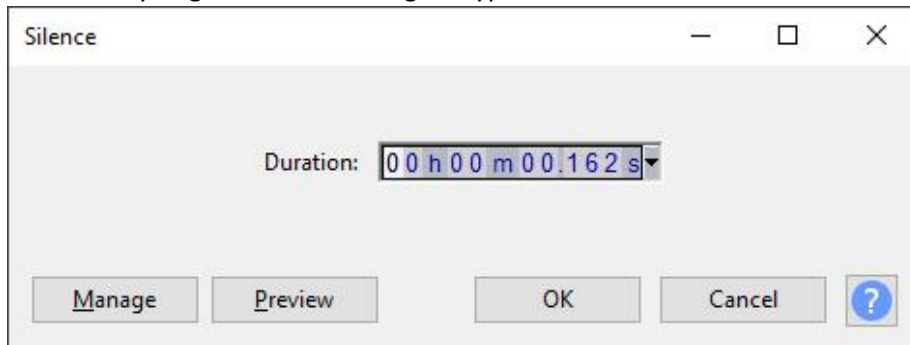
19. There is one last step. You need to add an offset to the file you will use for the public. Here’s what happens. You’ve used a file to program the jaw. All the motions were captured and saved in the VSA file. Now when you play that file, (The one you programmed with) the audio is just louder and more even. It is still in the same place in sync with the programmed motions. This is a problem. It takes time for the programming to be processed by VSA, encoded into a DMX stream, sent to the controller card, decoded and sent to the servos, and finally it takes the servos time to react and move. Each of these are only a few milliseconds, but added all together it’s enough to notice that the jaw movements are happening after you hear the audio, not at the same time. We need to shift the audio forward. To do this, you need to remove the file you just exported from Audacity. Reload the “Audio for Public” file that you saved. Do not click on the file. If you already did, set the cursor at the very beginning of that file as seen below, as far as it can go. From the menu, go to “Generate/Silence”.



20. A new box will open. It will look like this:

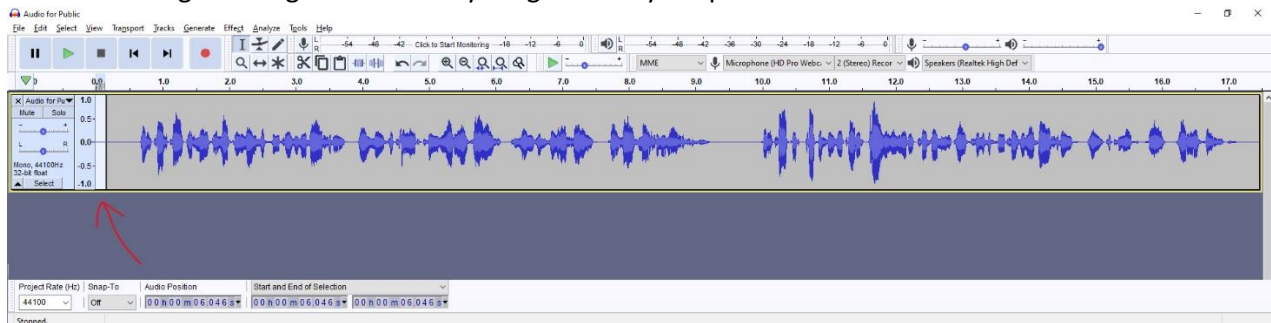


Make sure that the Duration is set for hh:mm:ss + milliseconds in the dropdown list if it doesn't come up that way. Double check that. Then click on the first number that is not a zero. In this case, it's the 3 after m. Silence is set for 30 seconds in this example. After clicking on that number (3 as shown here), type a zero. Keep typing zeros until you get to the last 3 digits. Type in 162 in the last three boxes. It should now look like this:



Click OK.

21. The file should now look like the image below. You can see it was shifted over to the right. You can see the white section where it added silence to the file where the red arrow is pointing. Export this file again and overwrite the "Audio for Public" file. Load that one into VSA and use it after the jaw programming was done with the "Audio for Programming" file and everything should sync up.



If you need help with loading audio files into VSA or using WA (Wavemotion Analysis) refer to the tutorial named SETTING UP YOUR FREE ROUTINES TO PLAY ON YOUR COMPUTER.pdf in your documents. If you still have questions, feel free to contact me and I will help you through it.