TheCornellLab of Ornithology

Exercise: Audio artifacts (clipping)

Summary:
For this exercise we will start with two audio files of a 1000 Hz tone that are at two amplitudes. We will create selections of short duration that will allow us to zoom in on the waveform and compare differences in the oscillations of the sound pressure waveform for each of the two amplitudes. We will then investigate clipping in field recordings of gibbons and katydids.

Learning objectives:

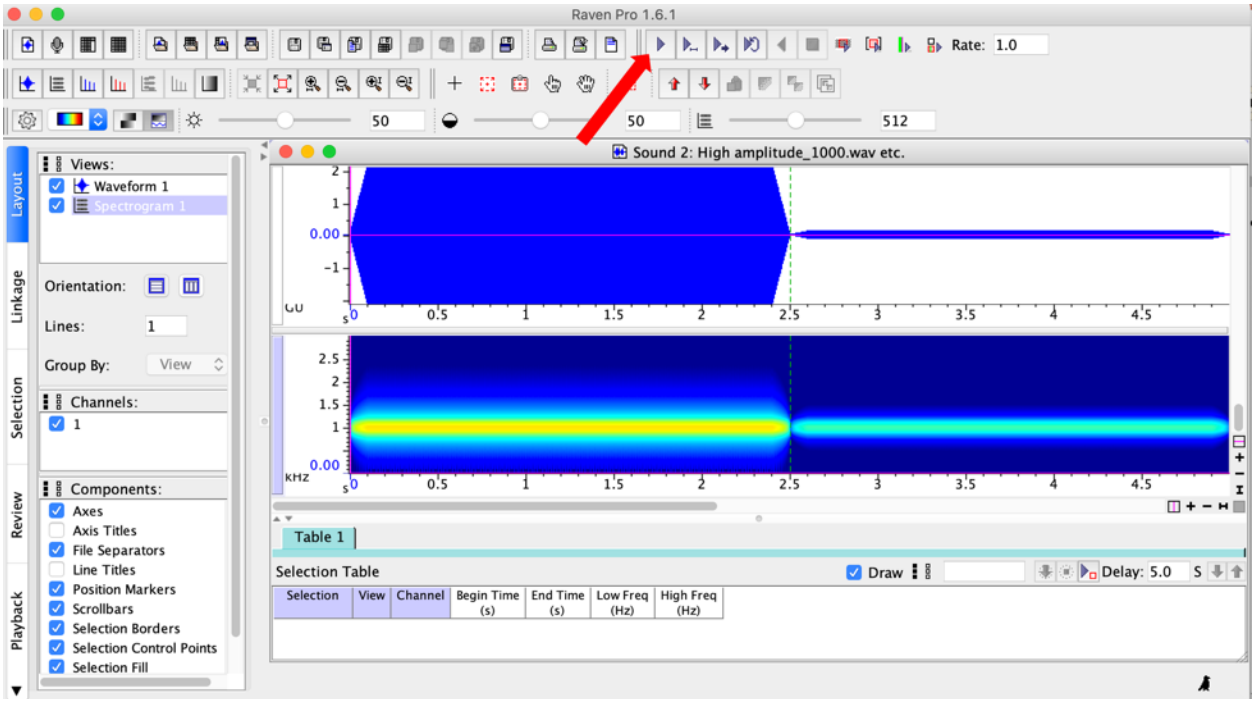
- Understand how different amplitudes are reflected in the waveform
- Recognize clipping in field recordings
- Become familiar with using Raven selection tables and playing sounds

Prerequisite knowledge:

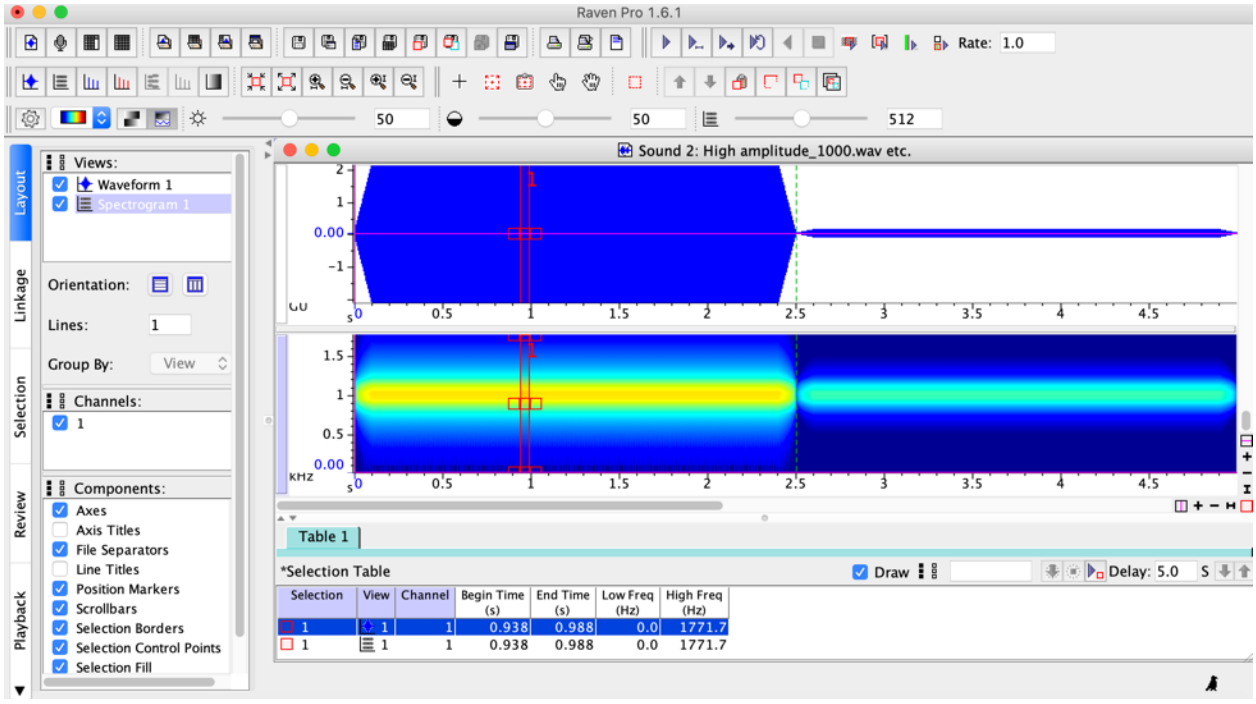
- Assumes knowledge of how to open files and make selections

Part I Exercise:

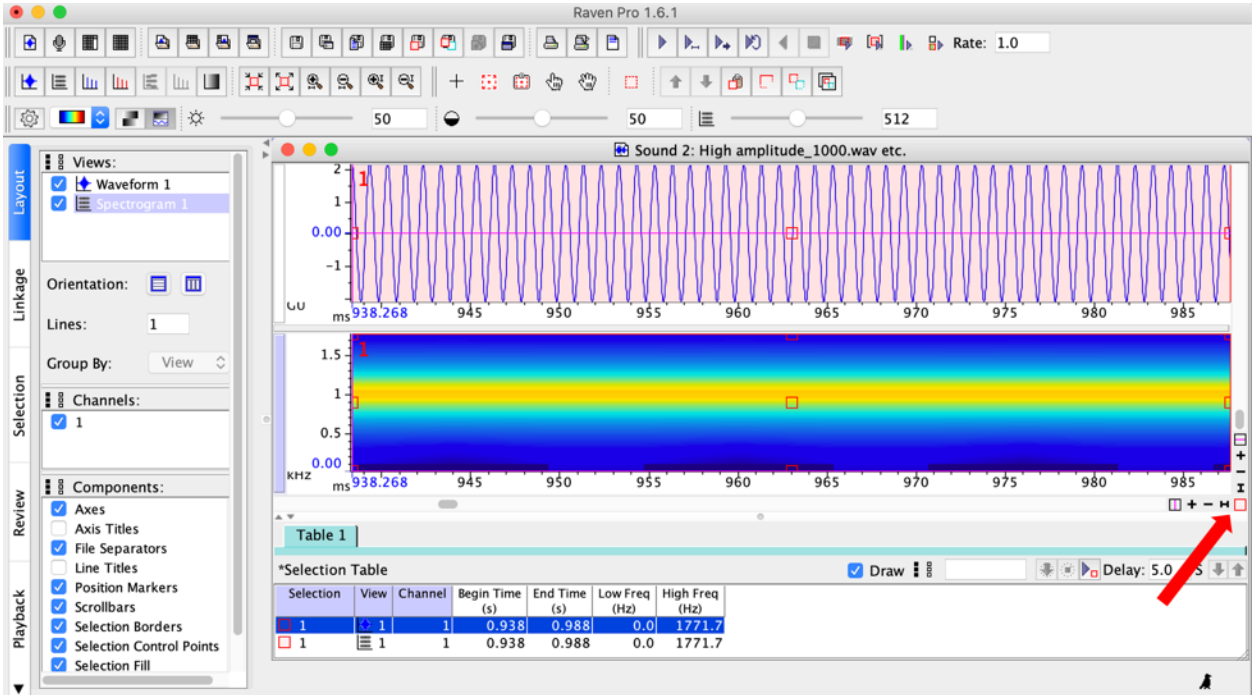
1. Open both sound files *Low amplitude_1000.wav* and *High amplitude_1000.wav* in Raven in the same window. You can do this by selecting both sound files in the File -> Open Sound Files menu, and then ensuring that you have selected 'Open as file sequence in one window' button under the 'Window' tab.
2. To play the sounds you can press the play button as indicated below. Notice what happens to the volume with the transition from high to low amplitude.



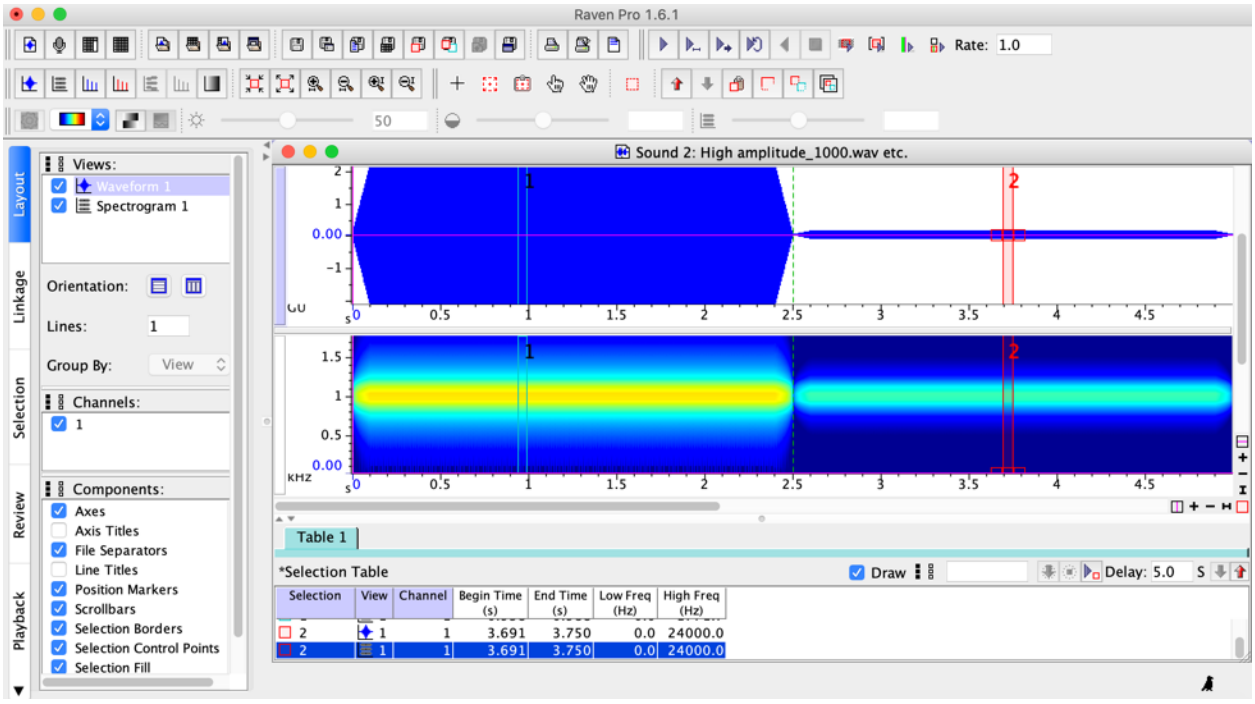
3. Now create a selection within the high amplitude tone. Make sure that selection is relatively short in duration (< 0.09 seconds) to ensure effective visualization of the waveform.



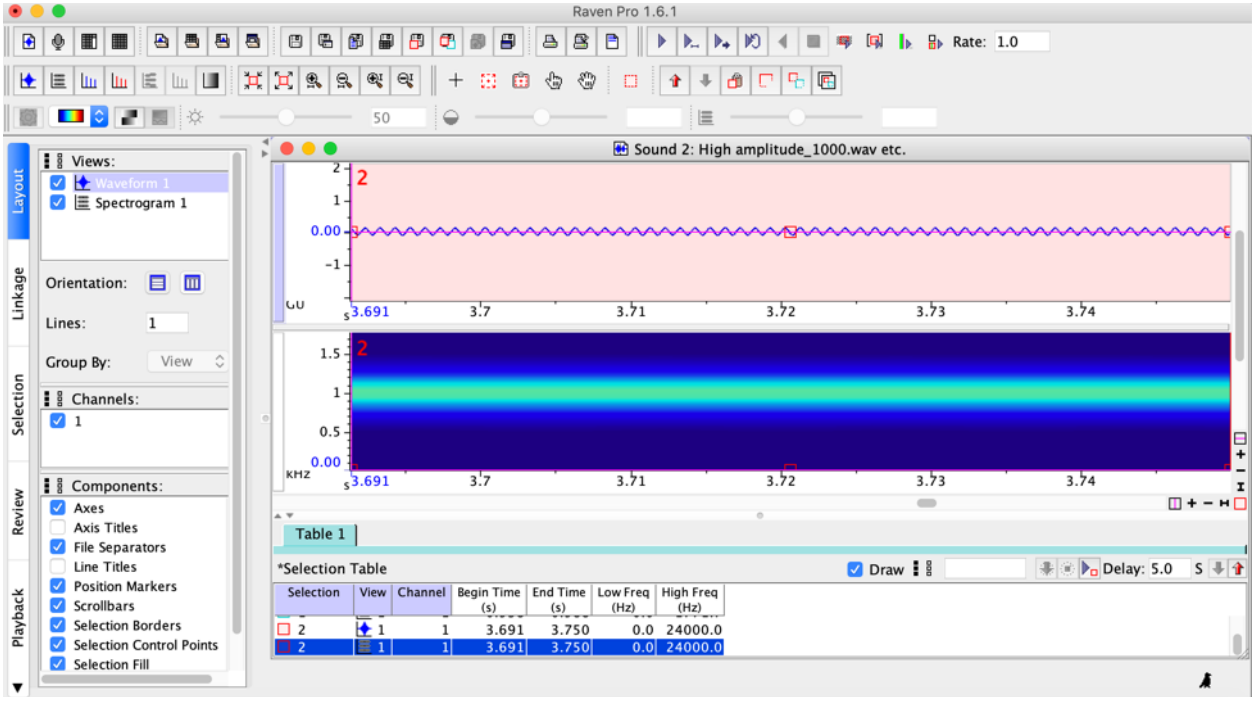
4. Then click on the 'Zoom to selection button' to zoom in on the selection (red arrow below). You should be able to see the waveform in this new zoomed-in view.



5. Now we will create a second selection of a similar duration for the low amplitude tone.



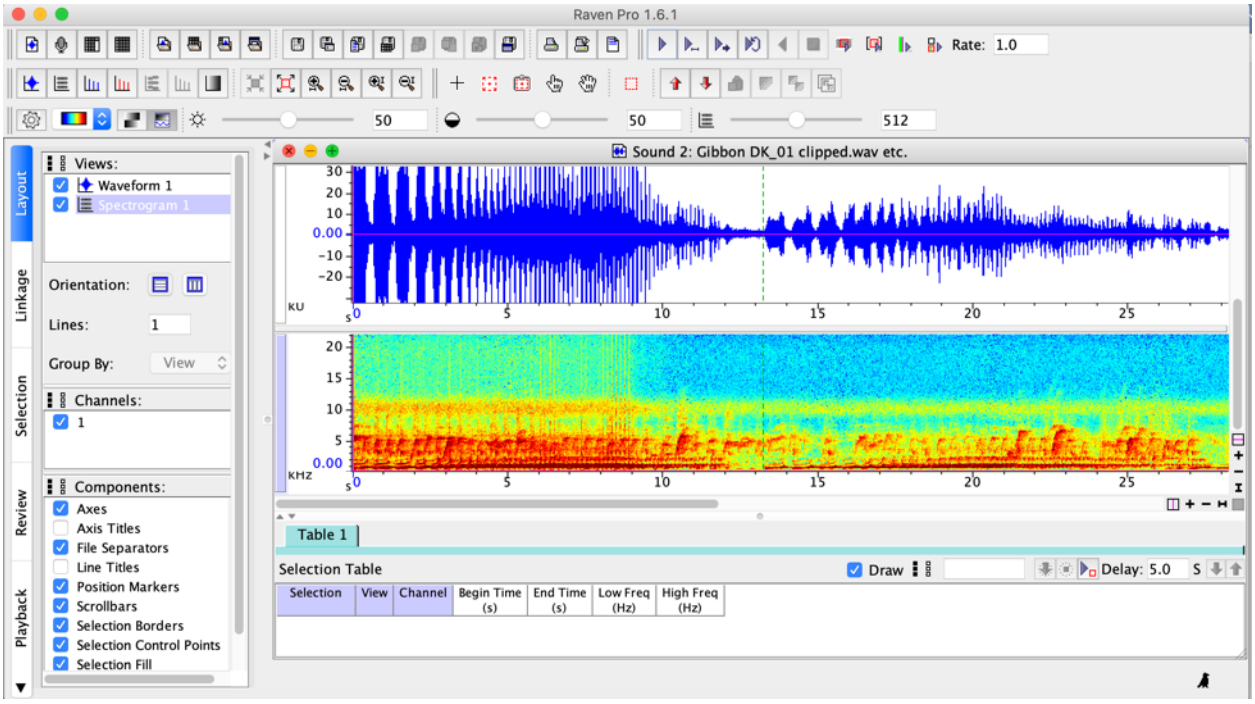
6. Again click on the 'Zoom to selection button' to see the waveform in the zoomed-in view.



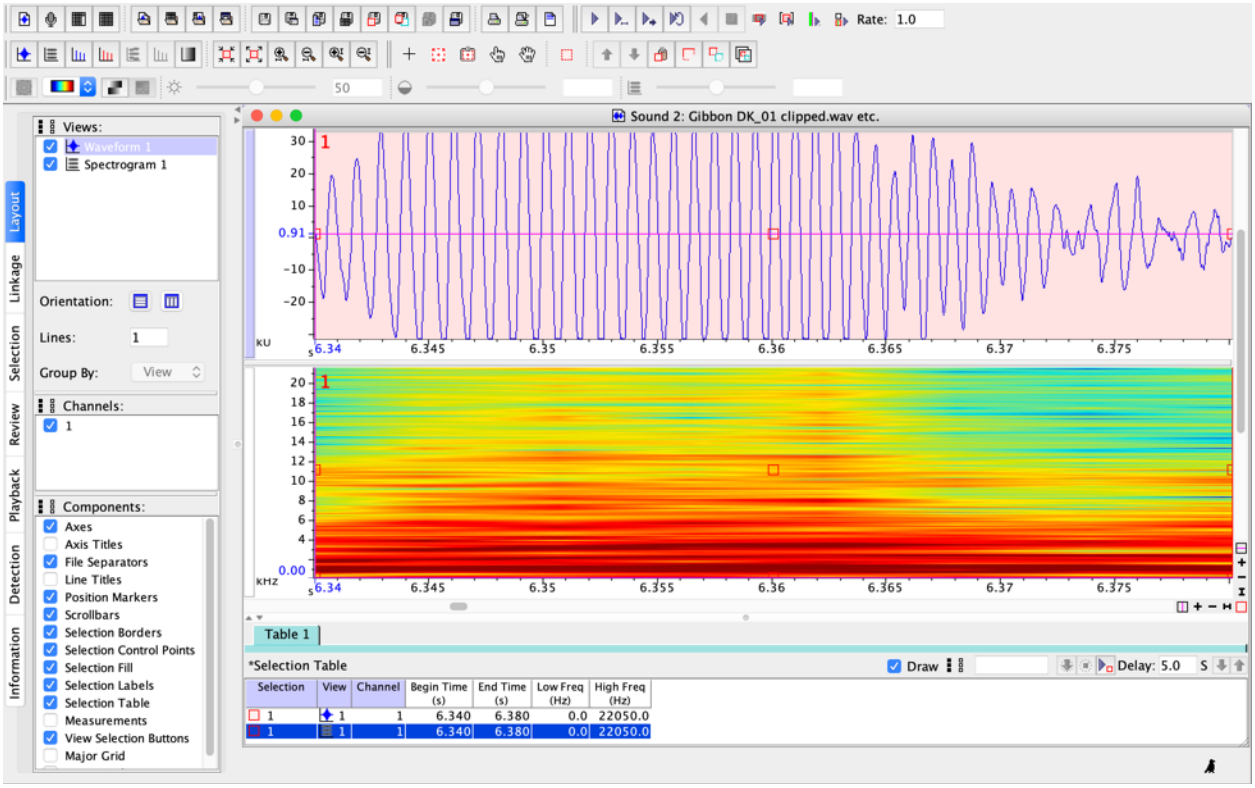
7. What differences do you see in the waveform between the high and low amplitude 1000 Hz tones?

Part II Exercise:

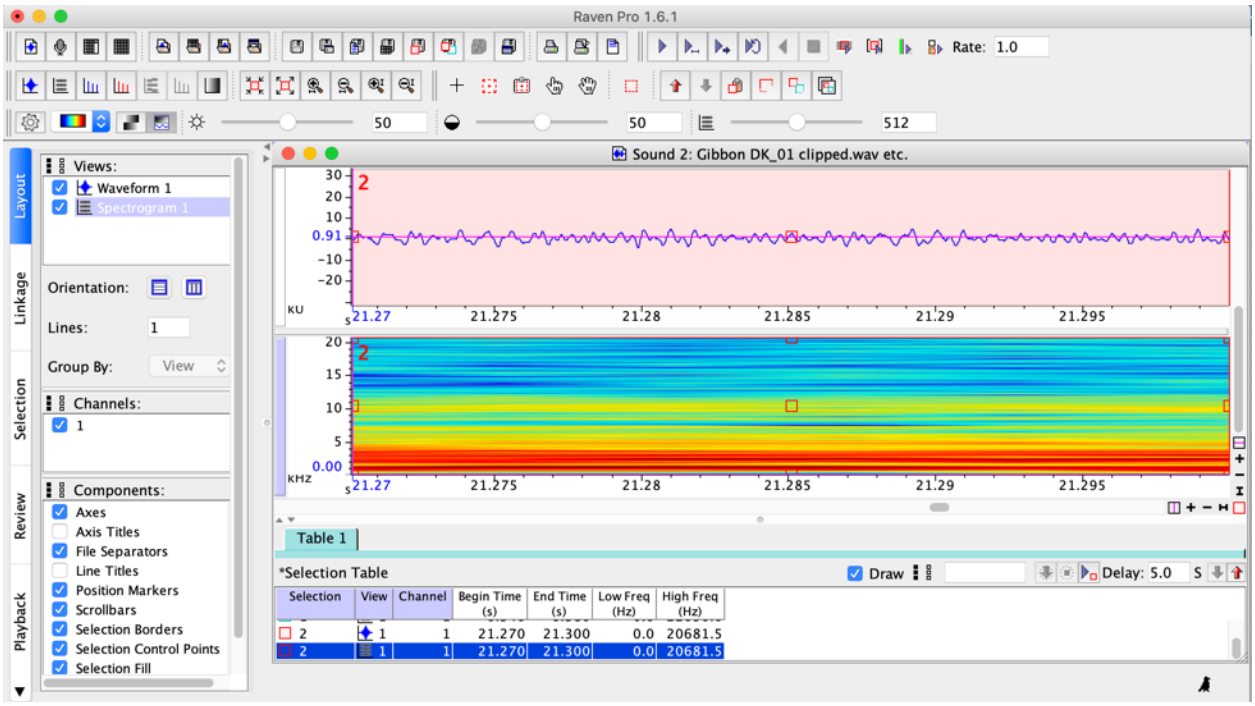
8. Open both sound files *Gibbon DK_01 clipped.wav* and *Gibbon DK_01 not clipped.wav* in Raven in the same window. As before, play both sounds. What do you notice about the sounds when they play, and also in the waveforms?



9. Create a selection between 6.340 and 6.380 seconds (remember you can manually change the time by typing directly into the selection table). Then zoom in so that you can see the waveform.

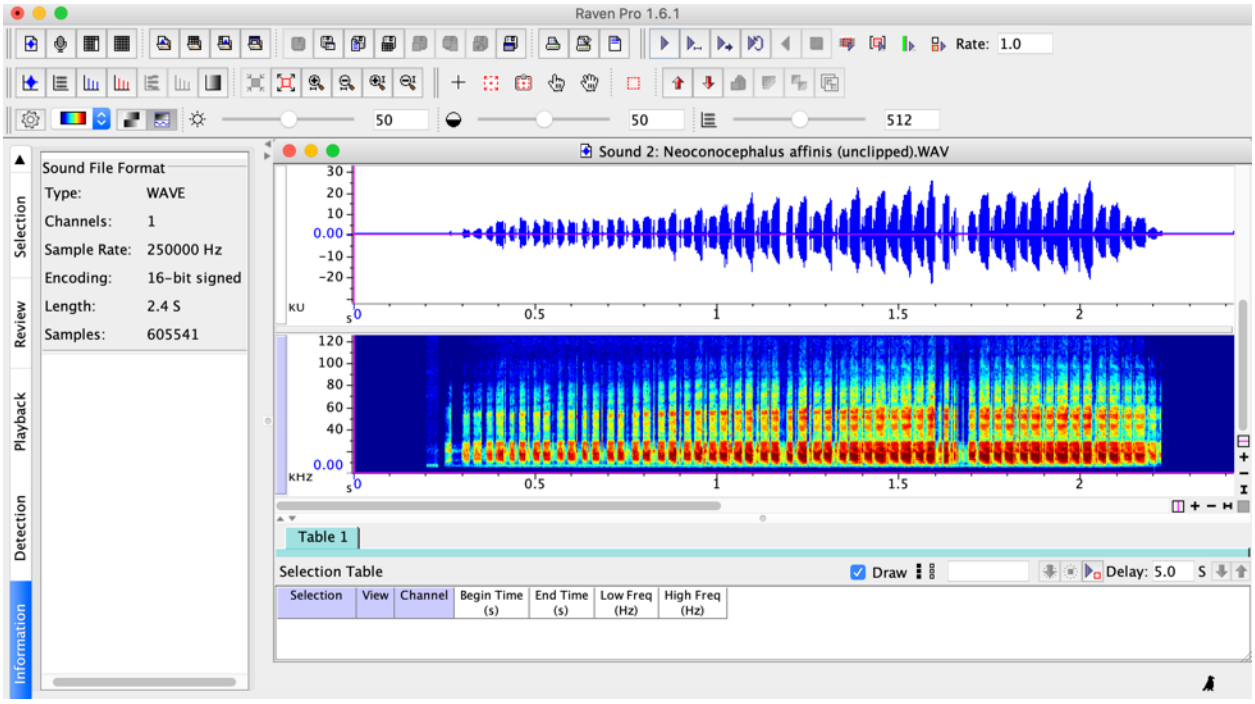


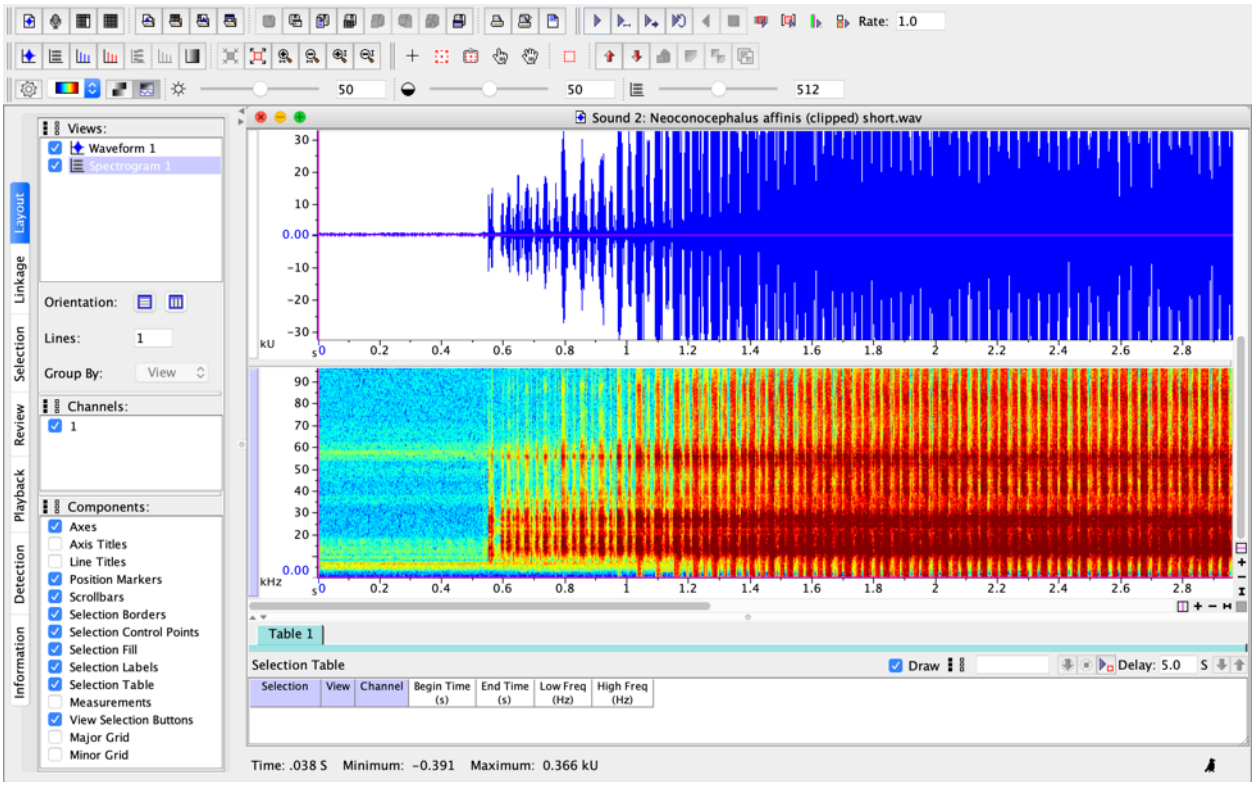
10. Now create a selection of similar duration for the not clipped recording. How do the waveforms of the clipped versus not clipped recording compare?



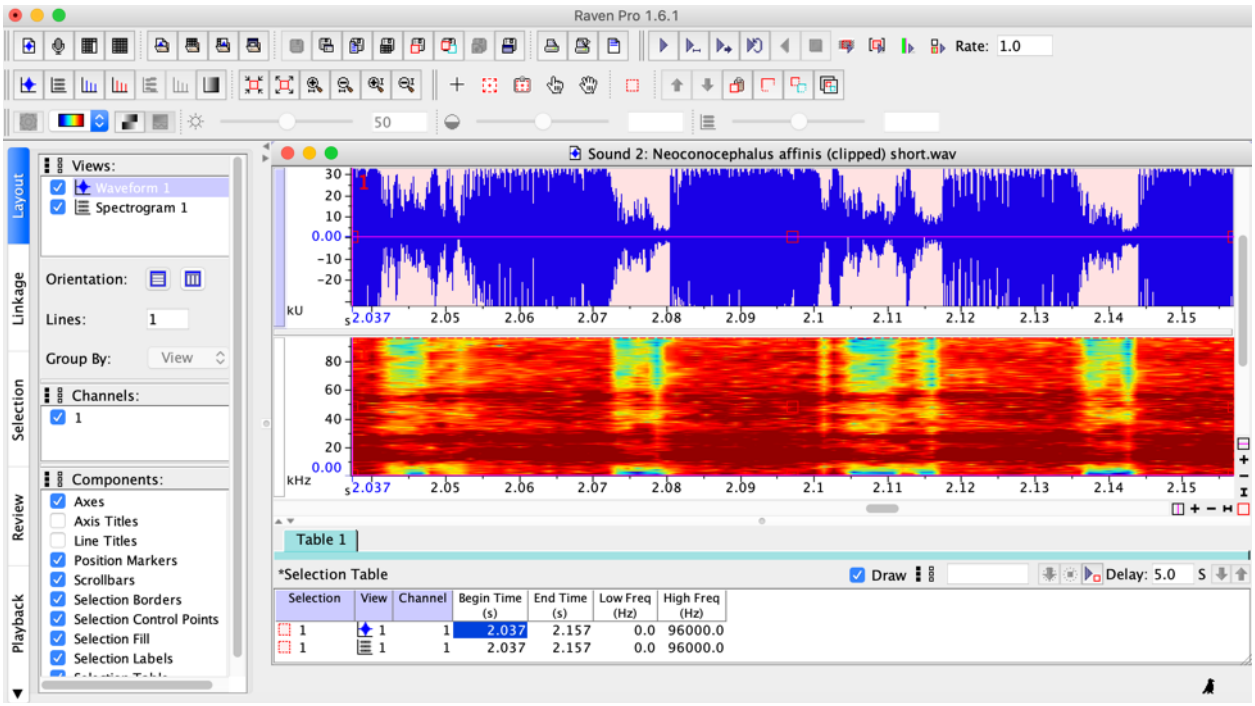
Part III Exercise:

11. Open both sound files *Neoconocephalus affinis (clipped) short.wav* and *Neoconocephalus affinis (unclipped).wav* in Raven in the different windows (note they will not open in the same window because they were recorded at different sampling rates). As before, listen to both sound files. What do you notice?





12. Now create a selection within the clipped recording (< 0.12 s) and zoom in so that you can see the waveform.



Synthesis

1. Explain verbally how that difference shows up in the waveform when there are two tones at the same frequency, but we hear one is louder than the other.
2. How can you identify the presence of clipping in field recordings? Can you do it based on the spectrogram only?
3. What are the differences between the spectrograms of the clipped and unclipped katydid recordings? Would it be appropriate to estimate spectral or temporal features from the clipped recording?

Answers

1. We would see differences in the amplitude of the waveform (the height of the peaks and valleys) but the spectrograms would be similar in shape, with more intense color (representing higher amplitude).
2. Clipping can be determined by inspection of the waveform only. In the spectrogram, the sudden appearance of sound across all frequencies can sometimes be a clue to the presence of clipping.
3. The clipped katydid recording does not exhibit the same pulsed structure in the spectrogram as the unclipped recording. Presence or absence of calls can be determined using clipped recordings, but other features should not be estimated from the spectrograms of clipped recordings.