Adjusting spectrogram parameters and display in Raven Pro

A concise guide

Although the initial default spectrogram that Raven displays when you open a sound file is often acceptable, it can almost always be improved. In most cases, you can get a better image by using spectrogram parameters different from the defaults. Brightness and contrast settings can also make a big difference, as can simply the vertical and horizontal scale. This document provides tips on how to make these adjustments.

These are basic guidelines to get you started, not religious injunctions. You may want to deviate from the suggestions here for specific reasons. The point is to pay attention to how the spectrogram looks and think about whether it could be improved.

Spectrograms are like shoes— one size does not fit all!

1. Listen

Listen carefully to your sound. Depending on the frequency range or modulation rate, you may find it helpful to listen to the sound played pack slower or faster than normal. Particularly for mid- to high-frequency bird sounds, slowing playback down to ¼ or 1/10 normal speed will often reveal details of structure that you can't hear at normal speed. If you're using spectrograms to describe details of sound structure, the spectrogram should show visually all of the details that you can hear.

2. Adjust the vertical and horizontal scale (zoom)

If your sound only occupies part of the frequency band of the spectrogram, zoom in to that band. Why waste part of the image space showing nothing but background? Zoom in time so that you could potentially see all of the details you can hear (at whatever playback rate is most informative).

3. Adjust brightness and contrast (preliminary)

You have a limited range of grayscale values available to you between white and black. Why waste part of that on background noise? Use the brightness / contrast sliders to adjust the image so that the background is mostly white and only the highest-intensity parts of your signal are black. You can do a more careful adjustment later, after adjusting spectrogram parameters.

4. Adjust window size (preliminary)

Using the window size slider in the toolbar, try window sizes both shorter and longer than the default. The goal here is to find a window size that lets you *see* what you can *hear* when you listen to the sound at an informative speed, and gives an acceptable tradeoff between sharpness in time and frequency.

TIP: If the signal you have open is very long and Raven is slow to make changes to the spectrogram when you change the window size, copy a smaller piece of it (e.g., a single call, song, or syllable) and paste it into a new window. Use this smaller piece to experiment with spectrogram settings more quickly.

5. Turn smoothing off

Turn off spectrogram smoothing (using the button in the toolbar, to the left of the brightness slider). This will enable you to see the individual cells of the spectrogram (if you're zoomed in enough), which is helpful in the following steps to refine the spectrogram parameters.

6. Adjust spectrogram parameters

6.1 Adjust Frequency Grid Spacing

Remember that Frequency Grid Spacing is determined by DFT Size, which is always a power of 2 (e.g., 256, 512, 1024, etc.). Larger DFT Size results in finer Frequency Grid Size, which determines (a) the vertical dimension of the boxes in an unsmoothed spectrogram, and (b) the precision of frequency measurements. By default Raven chooses the smallest DFT Size that is ≥ the Window Size parameter (in samples). This may result in coarser Frequency Grid Spacing than you want, either for spectrogram image quality or measurement precision. You can adjust the Frequency Grid Spacing to be as fine as you want, but remember that finer grid spacing yields a spectrogram matrix with more cells in it, so it will take longer to recompute, and you might run out of memory. Play around with different settings to find what works.

6.2 Adjust Hop Size

Remember that Hop Size is the width of the boxes in an unsmoothed spectrogram and determines the precision of time measurements. By default Raven displays Hop Size in Samples; switching the units to normal time units (ms or s) is generally more useful. By default Raven determines the Hop Size based on 50% Overlap of the Window Size. Consider using a higher Overlap (e.g., 75% or even higher) to get a better image and more precise measurements.

7. Final adjustment of Window Size

7.1 Lock Hop Size and Frequency Grid Spacing

Remember that by default Raven adjusts the Hop Size and Frequency Grid Spacing in response to changes in Window Size (Hop Size based on the specified % Overlap of spectrogram windows, and Frequency Grid Size is based on the DFT Size which must always be larger than the Window Size). In order to prevent the Hop Size and Frequency Grid Spacing you chose above from changing in the next step, click the Lock icons next to Hop Size and DFT Size. Again, finer resolution means a larger spectrogram matrix that may be slow to compute or may run out of memory.

7.2 Adjust Window Size one last time

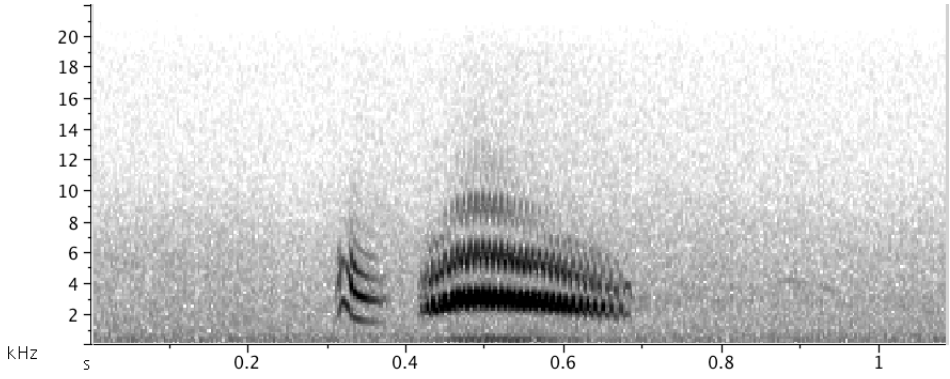
What you're looking for here is the (subjectively judged) best tradeoff you can find between smearing in the time and frequency dimensions. If you decide you need to change it drastically from the value you selected in step 4 above, you may want to unlock the Hop Size and Frequency Grid Spacing, and just repeat all steps starting at step 4.

8. [optional] Final adjustment of brightness and contrast

To get finer control of the brightness and contrast of the spectrogram image, right-click on the spectrogram image and choose Configure Brightness and Contrast. In the dialog that appears,

1. Adjust the Floor setting so that most of the background of your signal appears as white. Watch the fainter parts of your signal to make sure they don't disappear.
2. Adjust the Ceiling so that only the highest-intensity (darkest) parts of your signal are black.

BEFORE:



AFTER: