**“Parameters”**This tab lists the various acoustic parameters that Luscinia calculates for each element and allows the user to show or hide them.  
“View elements” shows or hides elements entirely. If this is not selected then no other parameters will be shown.  
“View syllables” is similar, but for syllables instead of elements.  
“View signal” shows in green the region of the spectrograph that makes up the element.  
“View harmonicity”. Harmonicity is a measure of how well the signal conforms to a harmonic model based on the estimated fundamental frequency. In other words, it illustrates whether a signal is noisy or not. Noisy signals will show a lower pink line superimposed over the spectrograph than more harmonic ones.  
More technically, harmonicity is calculated as follows: for each spectrum (column of the spectrograph), the algorithm finds the intensity at each frequency band in turn. If the frequency lies outside the range of the element (ie outside the ‘green blob’), then the intensity is assigned 0. Next, the phase of the frequency relative to the fundamental is calculated as the remainder of the focal frequency divided by the fundamental frequency. If this value falls outside the range 0.25-0.75, then this is considered to be a frequency at which you would expect to find some signal. The harmonicity is calculated as the proportion of the intensity of the spectrum that is found in the bands in which it is expected to be found.  
“View Wiener entropy”. Wiener entropy is an alternative measure of the noisiness of a signal. It is defined as the ratio of the geometric mean to the arithmetic mean of the power spectrum. In Luscinia, only the selected part of the spectrum (the ‘green blob’) is included in the calculations. This means that Luscinia provides a slightly more accurate measure of Wiener entropy for noisy signals. If the signal is harmonic, and there is significant background noise in between the frequency bands, however, this will reduce the accuracy of this measure.  
“View amplitude” shows the decibel-scaled peak amplitude measurements for the element (ie. the maximum intensity value in the part of the spectrum that falls within the “green blob”)  
“View bandwidth” shows the bandwidth of the signal at that point in the signal (note that often bandwidth is used to refer to the difference between maximum and minimum frequencies of the entire signal!). The bandwidth is calculated as the frequency difference between the first and final maximum intensity in the signal.  
“View peak freq” Peak frequency is the first of four frequency measurements. The peak frequency is defined as the frequency of maximum intensity. In other words, Luscinia searches through the highlighted area of a given spectrum, and picks the frequency with the highest amplitude.  
“View fund freq” Fundamental frequency is thought to be related to the psychological concept of pitch, and can be described as the common denominator frequency of a harmonic signal. Estimating fundamental frequency is a considerable computational challenge, and has been the subject of much research effort. Luscinia uses a rather simple approach that loosely borrows its rationale from the statistical concept of “minimum description length”: minimizing the sum of the complexity of a statistical model and the deviance between the model and the actual data. A description of the algorithm can be found [here](http://luscinia.sourceforge.net/page26/page30/page30.html). In addition, a smoothing algorithm is used to remove octave jumps (fundamental frequency extraction algorithms tend to emphasize frequencies one octave (= 2 x frequency) either side of the true fundamental frequency).  
  
“View mean frequency” Mean frequency is calculated by summing for each frequency band the frequency multiplied by the spectrograph intensity and dividing the total by the sum of the intensities for the signal. A more detailed algorithm can be found [here](http://luscinia.sourceforge.net/page26/page35/page35.html).  
“View median frequency” The Median frequency is defined in Luscinia as the frequency band below which 50% of the intensity in the signal is found. The (simple) algorithm behind this calculation is described [here](http://luscinia.sourceforge.net/page26/page36/page36.html).  
  
“View \*\*\*\* freq change” The next four options allow the user to view the frequency change for each of the four frequency measures. Frequency change is defined as the slope of the spectrograph at that point. It is expressed on an arctan scale (where 0 means decreasing in frequency infinitely quickly, while 1 means increasing in frequency infinitely quickly and 0.5 means not changing in frequency over time). It is calculated by carrying out a linear regression of the spectrograph, pivoting around the frequency measure of choice, and limited to +- 10 spectrograph cells around the focal point in any direction.  
  
“View vibrato amplitude” and “View vibrato rate” For these two acoustic measures, “vibrato” refers to the rapid, often sinusoidal frequency modulation of an otherwise tonal signal (a quality that has also been referred to as buzzy in previous literature). Luscinia carries out a short-term FFT of the peak frequency contour to estimate these parameters of buzziness. For more on this algorithm, see [here](http://luscinia.sourceforge.net/page26/page24/page24.html).