

### **Measuring the effects of Opening the Jaws and Throat**

It is possible to show the effects of opening the jaws and the throat on the sound with the frequency analysis function of the PC software program Cool Edit 2000. The frequency analysis graph shows peaks along the horizontal axis which correspond to the frequencies of the harmonic series of the fundamental note. The height of the peaks corresponds to the relative loudness (decibel level) of each frequency. This particular form of frequency analysis has the appearance of an oscilloscope screen. In fact, during playback of a previously recorded sound the frequency analysis can react in real-time, providing what is fundamentally a constantly changing oscilloscope display.

This type of acoustic analysis can be used to measure progress toward development of a full, resonant sound as the relative number and decibel levels of upper partials in the sound can clearly be seen. The visual appearance of partials in the sound is one of the few non-subjective measures of tone color.

All musical examples were performed by the author on a sterling silver Powell handmade flute, serial number 5586. A Radio Shack Optimus® unidirectional condenser microphone, model number 33-3017, was used to record into a Pentium 200-mmx computer with a Creative Labs Sound Blaster AWE64 Gold sound card.

Figure 3.11 shows a screen shot of a low G played with a straight tone (no vibrato) and with relatively closed jaws and a relatively closed throat. There appears to be significant harmonic activity only up to the fifth partial. Relative levels of the second through fifth partials appear somewhat suppressed.

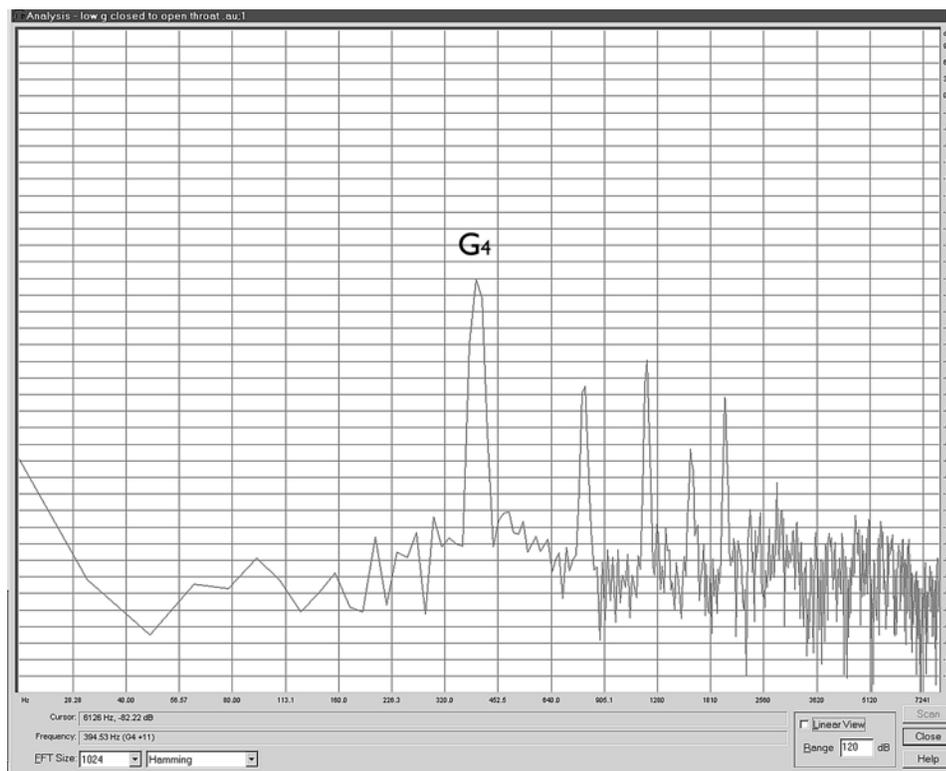


Figure 3.11. Frequency analysis of low G. The low G was played with relatively closed jaws and throat. The horizontal axis represents frequencies, while the vertical axis represents the relative loudness in decibels. The vertical spikes represent frequencies corresponding to the notes of the harmonic series. The second through fifth partials are apparent in the sound, but appear somewhat suppressed.

The low G was held while the jaws and throat were gradually opened. Particular emphasis was placed on lowering the base of the tongue straight down. The resultant frequency analysis is shown in Figure 3.12 and shows the typical results achieved through opening the jaws and lowering the base of the tongue. This action increases the size of the resonance cavities in the mouth and throat. This, in turn, seems to generate more harmonic activity in the sound. The loudness of the partials in relation to the fundamental is increased, as is the total number of partials in evidence. To the listener the resultant sound should seem fuller and brighter.

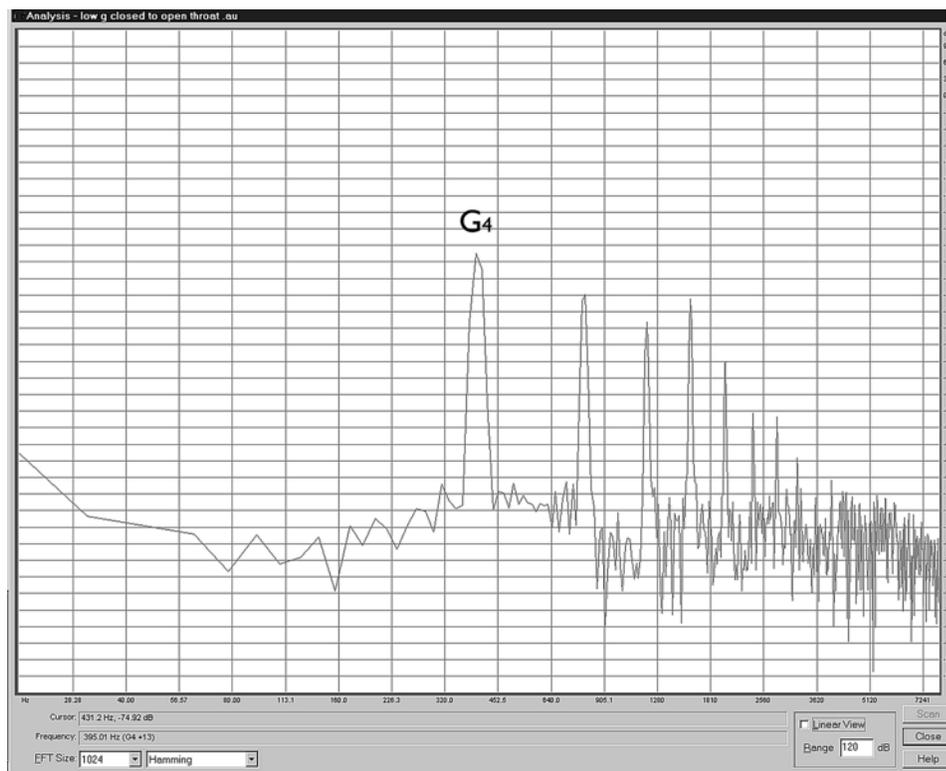


Figure 3.12. Frequency analysis of low G. The low G of Figure 3.11 after opening the jaws and throat more. There is evidence of increased harmonic activity both in loudness relative to the fundamental and in the total number of apparent harmonics in the sound.

The flutist/reader is encouraged at this point to make and save recordings in a computer in order to measure quantitatively any changes in the flute sound brought about through practicing the exercises in this paper. Long tones and scales without vibrato, including a three octave chromatic scale, are suggested as the easiest means of developing a basis for comparison. One of the goals of the exercises in this paper is to increase the fullness of the sound. For the purposes of this paper, fullness will be associated with sounds that exhibit a minimum of six partials and whose upper partials remain relatively loud with regard to the fundamental. Thus, the low G of Figure 3.12 would appear to be fuller than the low G of Figure 3.11.