The Overtone Series

Every natural musical tone is a complex combination of many tones of different pitches and amplitudes. The pitch of the tone is called the "fundamental". All the other components of the musical tone are called "overtones". These overtones are some multiple of the fundamental frequency of the musical tone. The arithmetic is simple but the effect is complex and wonderful.

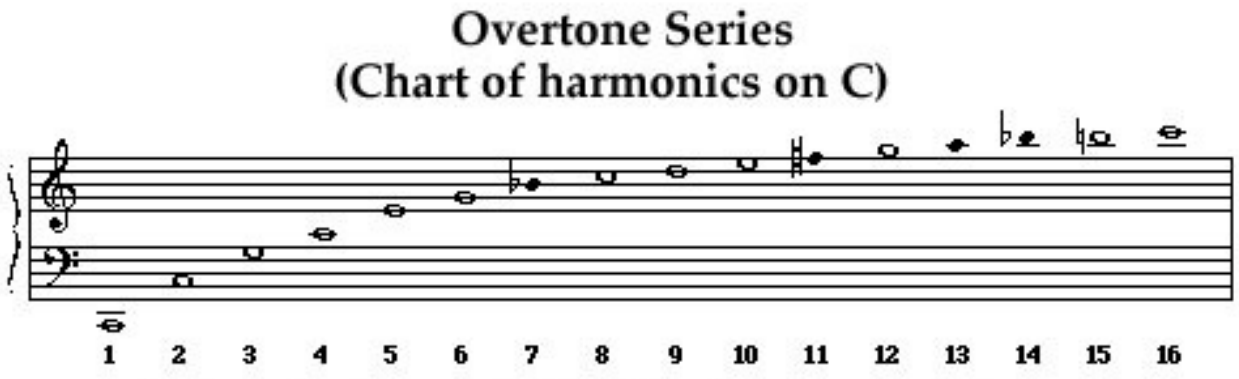
There are many demonstration videos on youtube that will allow you to hear the overtone series. Get onto www.youtube and search on "overtone series".

The strength and pitch of the overtones determines the timbre (French for *color* – pronounced tam-bur). The overtones allow us to distinguish between a fiddle playing an "A" and a trumpet planning the same "A". The fundamental frequency produced by both instruments is identical. But the overtones of each instrument are unique.

After some tedious arithmetic you will discover that the overtone series spills out as shown in this table.

Overtone Number	Interval from Fundamental	Pitch on the Fundamental of "C"
0	Unison	C
1	octave	C3
2	Octave plus a 5th	G3
3	Two octaves	C4
4	Two octaves plus a 3rd	E4
5	Three octaves plus a 5th	G4

The overtone series of "C" displayed on the musical staff looks like this:



Notes on the Overtone Series

- Most of the quality of a music tone is determined by the first six or seven overtones
- Round sounding instruments, like the flute, tend to have mostly even numbered overtones.
- Harsh sounding instruments, like the oboe, tend to have mostly odd numbered overtones.
- A standard practice in recording studios is to examine the spectrum of a vocalist and reduce or delete harsh sounding overtones.
- The overtone series will become important when learning about how chords are built. In fact the first five overtones actually define the major triad.
- Electronic synthesizers create sounds using the overtone series. A pure fundamental tone is generated. Then overtones are added to simulate a natural instrument or create an entirely new voice.