

# MUSIC THEORY.aargh©

## The Overtone Series-1 (Session 16)

By Dr. Ona Pinsonneault

We have been tossing around the term “**Overtone Series**” for some time. Historically it has affected many different aspects of music from the organization of harmony to the building of instruments, including handbells. A very short description of the construction and generation of sound follows and in succeeding columns we will examine more closely how “overtones” have been used in our music.

Every audible pitch has “overtones”. When a pitch (vibration) is generated other vibrations act in sympathetic motion with the audible pitch, or “**directly produced tone**”. Some of the vibrations are very audible while others are inaudible to the human ear. These individual **partials** (pitch in an overtone series) are not distinguished separately but are heard by the human ear as a blend that characterizes **timbre** or tone color.

This is a diagram of the overtones generated by the pitch **A2**, the lowest pitch in this chart.

(Partial numbers 1-16 are given. Partial 7, 11, and 14 are approximate pitch notations. Exact notation of these pitches is not possible in semitonal music.)



When **A2** is the directly produced tone it generates all of these overtones, plus more, to infinity. Most charts of overtones do not exceed the 16<sup>th</sup> partial because their diagram is not helpful in the theories of Western Music.

A440 (or handbell **A5**) is the common tuning note for orchestras. The **frequency** (the sound wave created) of this pitch is 440 cycles per second. **A4**'s frequency is half that, or 220; **A3** is half again at 110 and **A2** is 55. All of these pitches are octaves in a 2:1 ratio. Likewise **A6** is 880, double **A5**. Partial 3, or **E4** is in a ratio of 3:2 with the directly produced tone at 330 cycles per second. Notice that its' octave, partial 6, is also an E (660 cycles per second) as is 12 (1320 cycles per second), multiples of 2. Other octaves in the series are seen at 5 and 10, and 7 and 14. If we were to diagram partial 18 it would be a **B6** an octave above 9.

When you examine the first eight partials in this overtone series you begin to see many fundamentals of music that are used in tonal music. You can see a Major triad (partials 4, 5, and 6). You can see a Dominant seventh chord (partials 4, 5, 6, and 7). You can see that the lower partials are further apart than the upper partials. You can *almost* see a Major scale from partials 8-16.

The physics of sound has been discussed as early as around the time of Pythagoras in the sixth century. People have been developing concepts using the principles ever since. We will examine some of the uses in the upcoming Clapper Chatter newsletters.

Until next time,

Dr. P

[Ona.Pinsonneault@normandale.edu](mailto:Ona.Pinsonneault@normandale.edu)

August 2014