

The Overtone Series

These materials have been assembled with the aid of information from *The Pianist's Search*, by Adam Domash.

When we sound a note on the piano (by vibrating its wires), make a violin string vibrate, make our vocal chords vibrate or make a column of air vibrate in a wind/brass instrument, the vibrations occur in sound waves that travel back and forth from end to end of the thing that is vibrating. At certain points, the sound waves intersect and at these points of intersection, new, faster rates of vibration occur. Each new rate of vibration produces a secondary, higher-but-softer pitch, or frequency. These frequencies are called *harmonics*, or *overtones*. They occur in a pattern, which is called the *harmonic series*, or the *overtone series*.

The initial (bottom) pitch is called the *fundamental*. In the diagram below, the fundamental is a low C beneath the bass clef. The pitches above it are that pitch's overtones. The overtones go on and on, and up and up, and get quieter and quieter. This diagram only shows the first seven overtones.

For reference, these overtones have been labeled in terms of major scale degrees that they correspond with above the fundamental tone (in this case, the key of C major).

There are two significant aspects to the overtone series:

1. Different instruments are designed to emphasize or suppress certain overtones, which affects the timbre or color of that instrument. Metallic instruments (like trumpets) for example, emphasize the higher overtones of their notes, and the color is sharper. Wooden instruments (like the clarinet) emphasize the lower overtones (and suppress the higher ones), which gives the instrument a softer, mellower tone.
2. The lower overtones, which stand out more, contribute to the construction of a major triad. By the fourth overtone, the root, fifth and third of a triad relating to the fundamental are present. This is one reason why the major triad and the consonant intervals associated with it are so significant in common practice music.

Generally speaking, the tones in the overtone series can be related to the tones of the major scale (except the 6th overtone, which can be somewhat associated with a minor scale 7th degree). Imagine the fundamental of the series being the same as the tonic of the scale. On the overtones diagram, the bottom row of ordinal numbers refers to how those overtones correspond with the degrees of a major scale. Regardless of what the bottom fundamental/tonic is, the major scale degrees will correspond in the same way:

