Harmonics Encyclopedia Article

Harmonics

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Harmonics

What makes a note from a musical instrument **sound** rich? The volume of the sound is determined by the amplitude of the **oscillations** in a sound wave, the distance individual molecules oscillate. A larger amplitude produces a louder sound and transmits more **energy**. The pitch of a note is the **frequency** or number of oscillations per second. A higher frequency produces a higher pitched note. The richness or quality of a sound is produced by the harmonics.

A pure note consisting entirely of one frequency will sound boring. A musical instrument that only produced such pure notes would not sound pleasing. The harmonics are missing. The harmonics are integer multiples of the fundamental frequency. The first harmonic is the fundamental frequency, 264 cycles per second for middle C. The second harmonic will be twice this frequency, 528 cycles per second, which is an octave higher. The third harmonic will be three times the fundamental frequency, 792 cycles per second, and so on. These harmonics are also called overtones the second harmonic is the first overtone, the third harmonic the second overtone, and so on.

The violin, piano, and guitar all produce sounds by vibrating strings. Playing the same note, say middle C, will produce a tone with a fundamental frequency of 264 cycles per second. Yet all three instruments sound different. Why? They have different harmonics. The amount of each harmonic present is what gives each musical instrument its own unique sound. A well-made instrument will sound richer than a poorly made one because it will have better harmonics. An instrument with no harmonics will sound like a tuning fork with only one fundamental frequency present.

For reasons that we do not understand, sounds composed of harmonics whose frequencies are integer multiples of each other sound pleasing to the human ear. They are music. On the other hand, sounds composed of frequencies that are not integer multiples of each other are dissonant noise to our ears. So turn on the stereo to your favorite music and enjoy the harmonics.