BAIN MUSC 336
*Introduction to Computer Music*

# CHAPTER 1
## *The Digital Representation of Sound, Part One: Sound and Timbre*

"All things that make sound move, and in some very metaphysical sense,
all things that move (if they don't move too slowly or too quickly) make *sound*."

– Burk et al., *Music and Computers*

## Terms & Concepts

| | | |
|---|---|---|
| **1.1 What is Sound?** | Absolute/relative change | **1.4 Timbre** |
| Time-domain plot | Ratiometric change | Spectra |
| Sound as a function | Fixed arithmetic change | Spectral features |
| Compression/rarefaction | Watt | Tone color |
| Newton's Third Law | Decibel (dB) | |
| Input/output relation | Anechoic chamber | Amplitude Envelope |
| Graph | | - Attack (A) |
| Visualization of a function | **1.3 Frequency, Pitch and Intervals** | - Decay (D) |
| Deformation/perturbation | | - Sustain (S) |
| | Frequency (physical) | - Release (R) |
| Sample | Pitch (psychophysical/cognitive) | - Transients |
| Sampling | | Trapezoidal envelope (ASD) |
| Continuous/discrete | Range of human hearing: | |
| Transducer | ca. 20 Hz – 20,000 Hz | Spectrum |
| Basilar membrane | Infrasonic range (0-20 Hz) | |
| Time-to-frequency conversion | Presbycusis | Spectral components |
| Digital signal | | - Partials |
| Raw data | Waveform | - Harmonics |
| | Periodic waveform | - Overtones |
| **1.2 Amplitude** | Wavelength | |
| Physical/acoustic measurement | Wave cancellation | Sinusoids |
| Psychophysical/cognitive | | Tuning fork |
| Attribute | Speed of sound (345 m./sec.) | |
| | $w = s * p$ | Fourier components |
| Sine wave/pure tone | $f = 1/p$ | Fourier analysis |
| Amplitude envelope | | Gibbs ringing |
| Phase cancellation | Linear scale | |
| Chirp | Logarithmic scale | Spectral histograms |
| | Octave | |
| Amplitude, intensity and loudness | Base-2 logarithmic perception | |
| Energy | Fletcher Munson curves | |
| Logarithmic perception | Mid-frequency range sensitivity | |

**Reference**

Burk, Phil, Larry Polansky, Douglas Repetto, Mary Roberts and Dan Rockmore. 2011. *Music and Computers: A Theoretical and Historical Approach*, Archival Version. Available online at: <http://music.columbia.edu/cmc/MusicAndComputers/>.