Announcements

- Open https://datahub.ucsd.edu/hub/user-redirect/git-pull?repo=https%3A%2F%2Fgithub.com%2Fgquer%2Fdsc-96_winter19

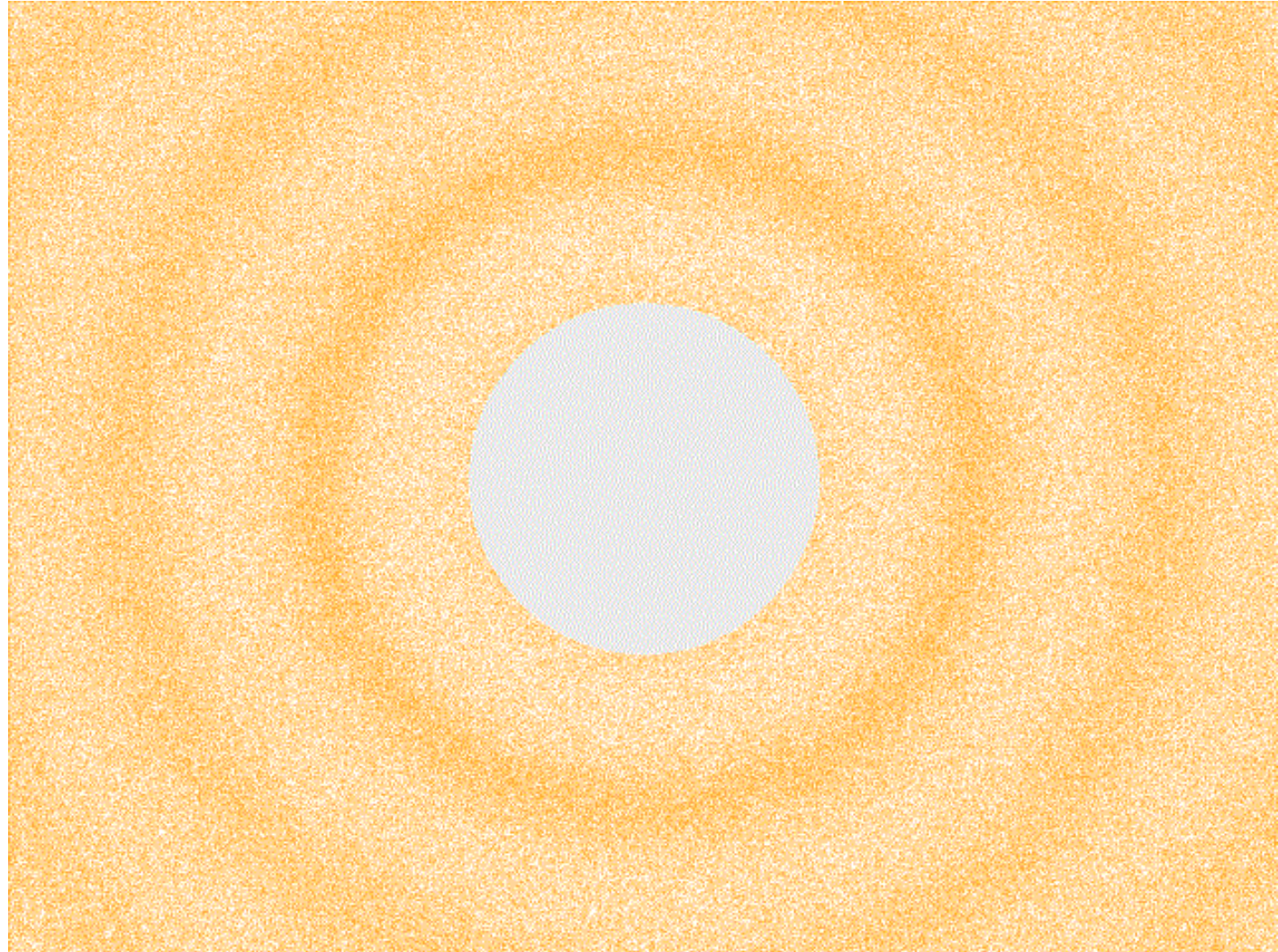- **Readings**: 07_audio/readings.md **due on Friday 2/22 at 6PM**

Audio is Data!

DSC 96
Thanks to Colin Jemmott

Sound

Sound is a vibration that propagates as an audible longitudinal wave of pressure, through a transmission medium such as a gas, liquid or solid.

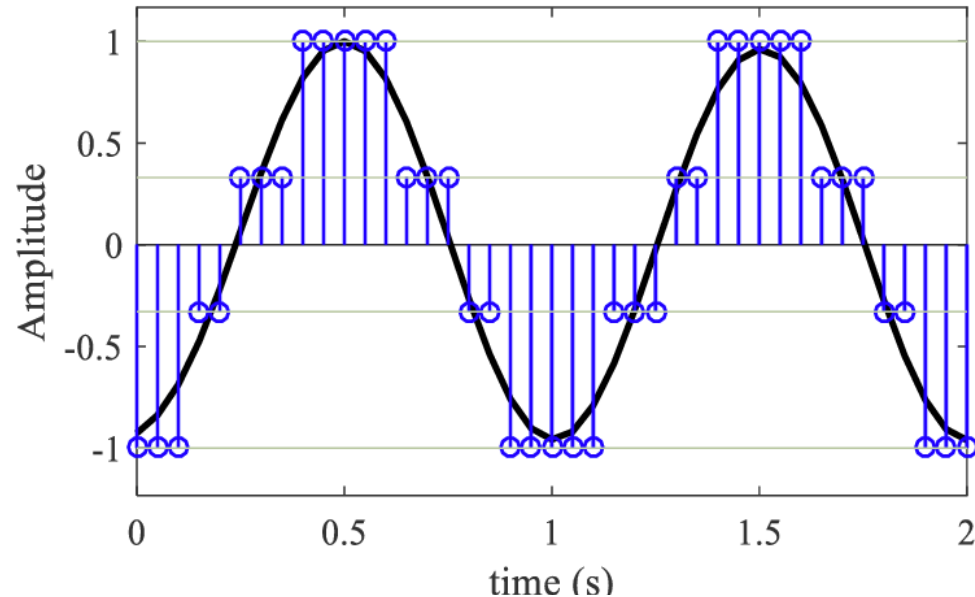How hard you shake it is related to loudness and how fast you shake it is related to frequency.
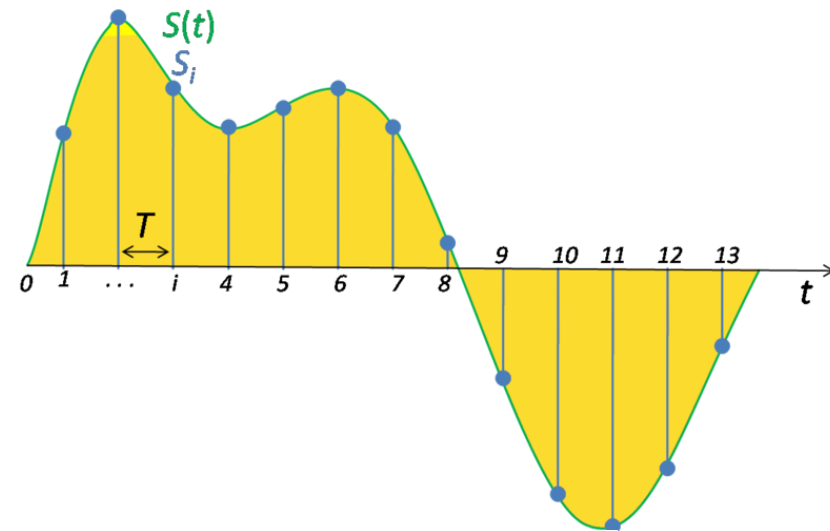
Time-based Sampling

Sound is continuous in time and amplitude ("analog")

**Recording** is transducing and storing sound waves.

Nyquist-Shannon sampling theorem: sample at more than twice the bandwidth and you can make a perfect reconstruction.

Noise

Audio is linear, in the sense that when two signals combine they just add.

Noise is unwanted sound, and is often measured as a power ratio called Signal to Noise Ratio (SNR)

Test signal

Test signal plus noise
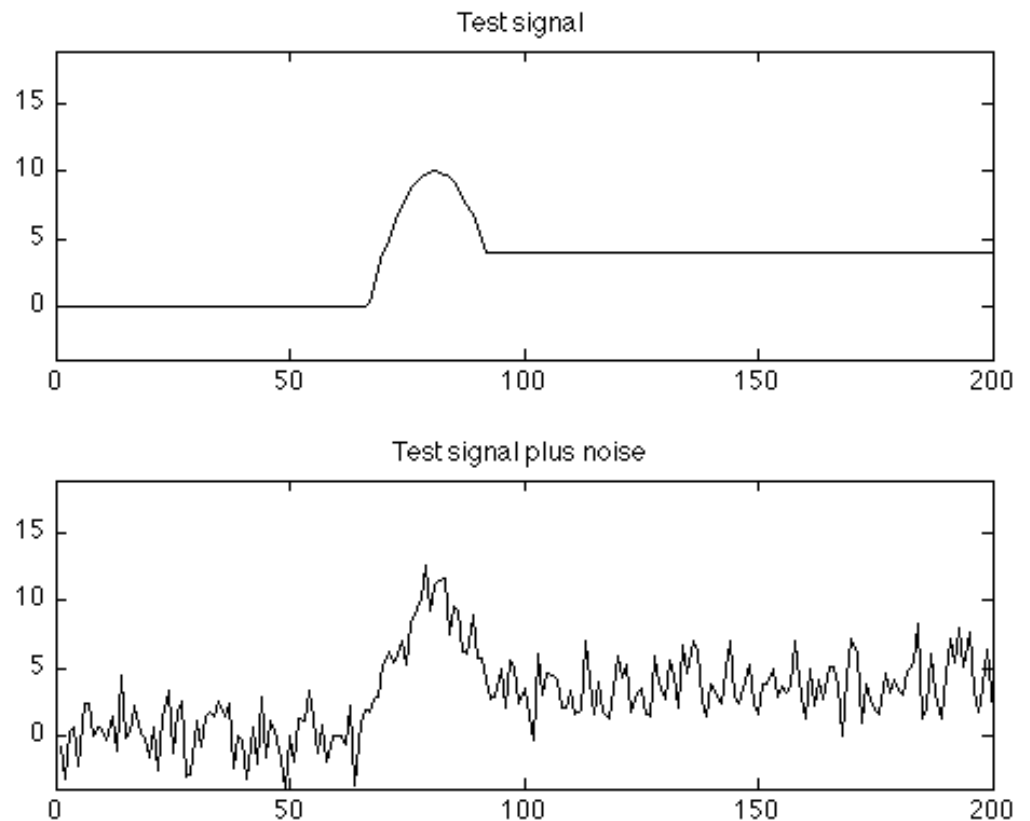
Time and Frequency
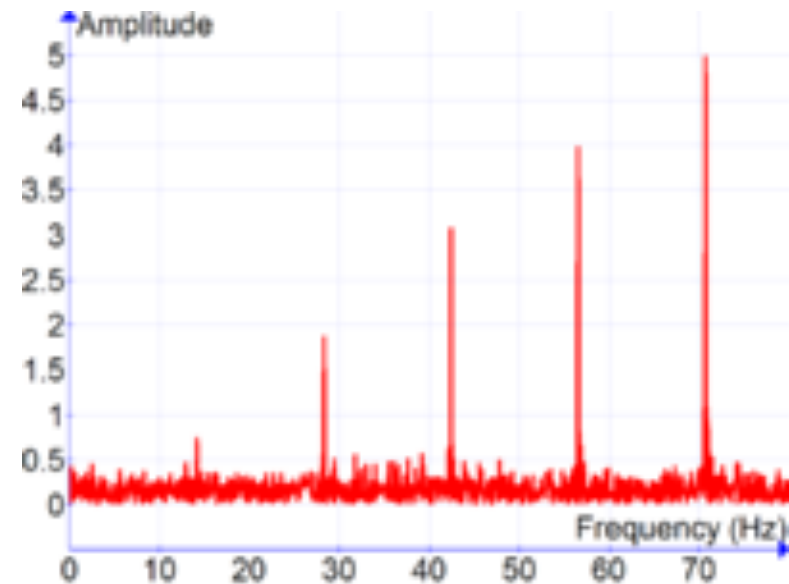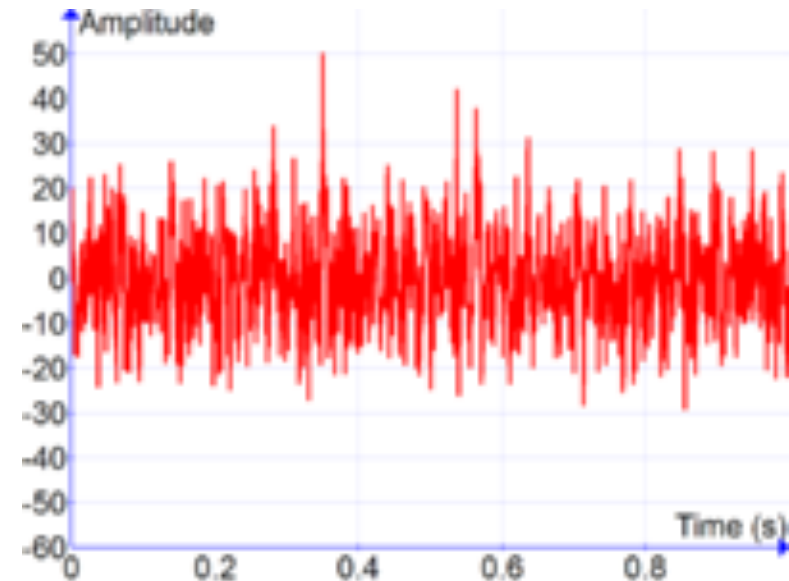
Frequency is measured in Hertz, units 1/s

Humans generally hear from 20 Hz to 20 kHz

Frequency is generally perceived as pitch.

Amplitude and pitch are independent.

Tones have distinct frequencies, while noise and impulses have broad frequencies.

Average male voice is 120 Hz, average female voice is 210 Hz. Middle A on a piano is 440 Hz.

Formats

Examples: WAV, FLAC, mp3, AAC, ...

Differences:

- Compression (lossy versus lossless)
- Streamable
- Decode vs encode difficulty
- Proprietary

Today's Exercise

Making sounds from scratch!

Using Python you will make:

- A simple tone
- An amplitude modulated tone
- Noise
- A short song!