COSC 4P98 Lecture notes: **Granular Synthesis**
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Granular synthesis

- Reference: Microsound, C. Roads, MIT Press, 2002.
- light: wave model vs. particle (photon) model
- granular synthesis treats sound as composition of 1000's of grains (atoms, particles)
    - each lasts a brief moment (1 to 100 ms)
    - minimum perceived amount if approx 50 ms
- combines time information (start time, duration, envelope, waveform shape) with frequency domain info (period of waveform inside grain, spectrum of waveform, etc)
- an amplitude envelope shapes each grain
    - prevents "clicking" from abrupt grain start/stop amplitudes, which will cause distortion
    - can also create new resonances (strong harmonic areas)
- many parameters can control granular synthesis, and they can vary grain-by-grain
    - start time
    - duration
    - envelope
    - pitch
    - location in sample file (if sampled)
    - shape of waveform (if generated)
    - direction of sample

- Types of granular synthesis
    - a) Fourier grids: treat STFT windows as grains
        - permits time stretching and pitch shifting
    - b) Asynchronous granular synthesis ("granular clouds")
        - statistical distribution of grains on a freq vs time plane
        - parameters include: start time, duration of cloud
        - grain durations
        - density of grains per second (may overlap)
        - frequency limits
        - movement of cloud in pitch/time/waveform space
        - and lots more!
    - c) Time granulation of samples
        - like AGS but purely on sampled waves
        - can do on files, or realtime audio (eg. Ableton)
        - Note: Ableton Live's "Granular delay" effect is granular synthesis, but used on incoming signal
            - a "window" of input is used to generate the grains
        - Other applications process an entire wave file.
- Uses
    - Powerful composition and synthesis tool
    - Experimental sounds

- o Also practical: pitch, time stretching/compression
- o lots of control parameters: opportunities for unique interfaces