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Final Paper

CSCI 392 - Independent Study

Spring '14

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Oscillation Station

Modulation synthesis is the manipulation of wave forms in frequency and amplitude, allowing for numerous signals to be produced in a variety of cadences, timbres, tones, melodies, etc. The final piece is an amalgamation of three movements, each employing different concepts of audio signal synthesis. The final also employs psycho acoustic design through the use of audio effects and wave layering.

Audio synthesis is still quite young, with most of it's pioneering roots grounded in the early part of the 20th century. One form of signal creation, Frequency Modulation, was only invented in the past 40 years and is the basis for many modern synthesizers. FM was first implemented by John Chowning at Stanford University in 1973. Unlike Amplitude Modulation, FM allowed a much deeper and rawer sound wave, yielding a far more complex result. The difference between AM and FM seems miniscule, considering AM's wave form varies from peak to peak and FM's varies it's frequency over time. Wave impulses have a click sound when the frequency between waves is decreased enough to allow the listener to discern individual wave spikes. Varying frequency between clicks can produce different notes. FM allows the time between spikes to decrease, causing the impulse clicks to sound like they are speeding up with each click until the individual clicks are no longer discernible and the only noise emanating is a

long buzz which gains a pitch.

Psycho acoustic design has reached new levels thanks to audio synthesis. Concepts, not possible without electric enhancement, can now be used by musicians. Allowing for post effects like flanger, phasor, reverb, or delay. Notes can be played with such precision, that ideas like the Risset Glissando, which sounds like a never ending scale in the same octave, can have unsettling affects on our emotions and even physical well being. An unending Risset Glissando is able to induce an overall feeling of optimism when the scale is rising and a feeling of loathe and dread when falling, a very powerful psycho acoustic effect.

Besides conjuring definite feelings, another sound design idea invented by composer Steve Reich uses multiple layers of sounds and melodies, not meant to be in synchronization. As tracks are played simultaneously, new melodies are created. Sounds that didn't exist on any specific track prior to the layered sound, emerge and dominate the melody of the piece.

While subtle in definition, psycho acoustics are capable of creating either ambiguous or very specific feelings by the listener, depending on the synthetic technique used. Coupled with the limitless production of wave synthesis, we may be at the beginning cusp of brand new audio experiences. Technology is able to harness our imagination and much more than we're capable of conceiving.

Boulanger, Richard. *The Csound Book: Perspectives in Software Synthesis, Sound Design, Signal Processing, and Programming*. Boston: The MIT Press, 2000. Print.

Chowning, John. "The Synthesis of Complex Audio Spectra by Means of Frequency Modulation". Journal of the Audio Engineering Society, 1973. <http://people.ece.cornell.edu/land/courses/ece4760/Math/GCC644/FM_synth/Chowning.pdf>