# Origins of granular synthesis:
the *Prototype* study

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My experiments with the digital synthesis of sound grains began in 1974, while I was a student at the University of California, San Diego (UCSD). These experiments tested methods for generating large numbers of microsonic events. In the Spring of 1975, I designed the *Prototype* study as both a technical experiment and an initial attempt to compose with granular sound. Of course, experiments do not always produce dazzling results, and I never considered *Prototype* to be a musical triumph. Apart from a single performance and broadcast soon after I made it, I have not played it publicly.

Despite its aesthetic shortcomings, *Prototype* was nonetheless a significant historical step–the first attempt to combine systematic composition procedures with computer-generated granular sound synthesis. My book *Microsound* (The MIT Press, 2002) describes the technical goals of this study in some detail. I included an excerpt of *Prototype* on the compact disc packaged with the book, but several people told me that they were curious to hear the entire study. Thus for historical reasons, I decided to include *Prototype* in this DVD production.

To realize *Prototype*, I wrote a program in the Algol programming language. This program, called PLFKLANG, read a set of high-level specifications for any number of "sound clouds." The program then rendered each cloud by filling it with hundreds or thousands of grains. PLFKLANG implemented asynchronous granular synthesis with a grain waveform that could vary between a sine wave and bandlimited pulse.
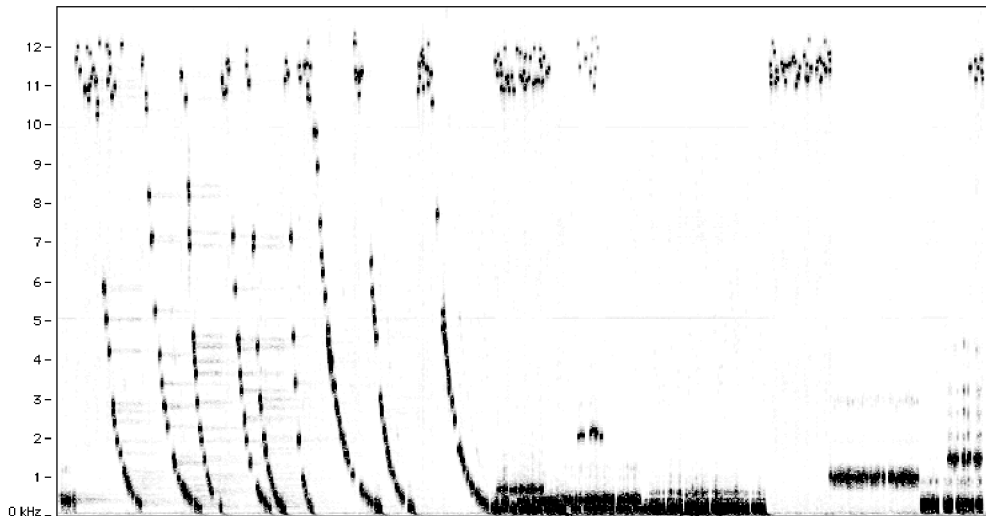
The sonogram above portrays the final six seconds of *Prototype*. (The vertical scale is frequency, and the horizontal scale is time.) The extremely fast granular glissandi shown here were a focal point of this sonic experiment.

The entire synthesis process involved 63 steps of compilation, calculation, data transfer, and digital-to-analog conversion (DAC) over a period of weeks in the Spring of 1975. The DAC at the Center for Music Experiment at UCSD handled a single channel with 12-bits of resolution at a sampling rate of 20 kHz. After assembling the sound fragments on analog tape, I took this tape to the Village Recorder–a sound studio in West Los Angeles–for the final mixdown through a Quad-Eight mixing console. There I added electronic plate reverberation (EMT plate reverberator with a 2.5 second reverberation time) and spatial panning according to the graphic score. The piece was recorded at a slightly off-speed rate so that it would play back slightly faster and with a broader bandwidth. I transcribed the 1975 analog master tape to compact disc on 1 January 2004.