Charles Wuorinen

Explorer of the Mathematics of Music

CHARLES WUORINEN IS a veteran of electronic music and a master of the complex, demanding compositional style called serialism, an approach that allows precise, quantitative control of harmonic structure.

It is not surprising, therefore, that the widely recognized Wuorinen has begun running fractal geometry algorithms on a PC and applying the results to his music.

Wuorinen began experimenting with electronic music in 1957, and 13 years later he won a Pulitzer Prize for his electronic composition *Time's Encomium*. More recently, he received a five-year, $236,000 "genius award" grant from the MacArthur Foundation's fellowship program, which honors individuals for lifetime achievement.

Fractals captured Wuorinen's attention in the mid-1970s—soon after Benoit Mandelbrot advanced the idea that natural forms are better described mathematically as the sum of their parts than they are by using Euclidean geometry. For instance, a tree more closely resembles a branch, and a branch a twig, than any of them resembles a cylinder.

Wuorinen, believing that much in music also resembles a "nesting of the small inside the large and replication of similar relationships on very different scales of size," saw fractals as a way of linking music and nature.

In 1984, Wuorinen employed a minicomputer to produce *Bamboula Squared* (a Bamboula is a type of Creole dance). The composition pitted the sonorous sounds of an orchestra against cascades of electronic notes based on fractal calculations. To create the electronic sounds in *Bamboula Squared,* Wuorinen ran a short program written for him by two programmers at the University of California at San Diego, Lee G. Ray and Mark B. Dolson. The program used Mandelbrot's principles to determine the duration and pitch of every note. Essentially, it started with a few large-scale note patterns that it subdivided into successively smaller versions. Wuorinen describes the fractal-derived sounds as "natural music."

More recently, the composer has moved his fractal calculations to his PC and hopes to hone his own programming skills so that he can work independently. He used to rely on the PC only for the more mundane task of music notation. It has been his copyist on eight compositions so far, serving him much as a word processor serves a writer.

Wuorinen began running music notation software on an early Mac. He soon abandoned those programs, however. "I found them basically useless," he says, "because they were designed primarily for people who either are not well trained musically or are basically musically illiterate and whose requirements are pretty much cut-and-dried."

Then he learned of a powerful PC notation package, developed at Stanford University by composer Leland Smith. SCORE could handle the complexities of traditional notation as well as any unconventional elements that a composer might use. Wuorinen bought SCORE in 1986, as soon as Passport Designs made it commercially available, and invested in an AST Premium 286 to run it.

> *Charles Wuorinen applies principles of fractal geometry to his music, achieving motifs similar to those found in nature.*

Now, when composing works for small groups of instruments, like his recent *String Sextet,* Wuorinen types work into the PC, where he can make changes with a few keystrokes instead of rewriting the piece over and over as he did in the past. The PC eliminates tedious work that, he says, "is not properly composing but certainly takes a lot of my time and affects the rate at which I produce."

In large-scale orchestral pieces where the initial draft is difficult to enter into SCORE, he uses the program later in the process to eliminate time-consuming copying and proofreading. When all is done, the work goes to his publisher, C. F. Peters—on disk, not on paper.

Wuorinen believes PC-based notation programs will eventually become more than just time-savers. He anticipates that composers will begin linking music-generating programs with sophisticated notation software to compose music for human performers rather than for synthesizers, the route most computer-generated music now takes.

But Wuorinen still has a few caveats about PC technology. "An awful lot of the hardware and software floating about is designed to overcome the user's musical limitations," he says.

"It's one thing to use a computer to do something like prove the four-color theorem, because it's the only practical way; it's another thing to always have a calculator in your hand because you don't know in your head what two plus two is. That's sort of what a lot of this stuff musically is about. It is the use of technology to diminish skills musicians ought to have, not to eliminate tedious labor that shouldn't be necessary. I think there's a very strong distinction between those two things."

Robert Kendall, a frequent contributor to PC/Computing, *holds a master of fine arts degree in music.*