Rock 'N Roll Meets Higher Math

"Wake up, Polansky. And get out of my classroom until you can stay awake!"

Sixteen year-old Larry Polansky, local rock and roll hero, woke up, but he never went back to his Algebra class

Steve Unruhe

Today this same bearded composer and guitarist has helped take the first step in the creation of artificial intelligence for music—the Hierarchical Music Specification Language. He and his colleagues at the Center for Contemporary Music at Mills College call this computer operating system a "mobile laboratory for musical experiments." Their long-term goal: artificial intelligence programs to create music.

"Generating sounds is easy," according to Polansky. "Ninety percent of what you hear on TV is done by computer." But for computers to be more than a fancy electronic instrument, to actually compose, is a challenge of a much higher magnitude. Polansky has been working with David Rosenbloom and Phil Burk since 1980 simply developing the HMIL operating system. That is the better part of a decade just to "build the laboratory," let alone conduct serious experiments.

Polansky never returned to his Algebra class, but he did turn back to math. In college he talked his way into an abstract set theory course. He liked it and decided "you have to know math to understand anything." Polansky worked his way backward from topology to calculus, where his professor pronounced him the "smartest dumb math student he'd ever seen."

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"I could prove anything. But I didn't know any algebra or trig, so I could never solve the equations. I barely passed the winter semester. During winter break my prof handed me an algebra textbook and told me to go home and read it. I don't recommend learning Algebra on your own, but I didn't have much choice."

Polansky uses math as a tool to "understand" music. A student of such contemporary composers as John Cage and James Tenney, he has been exploring the edges of perception as the basis for musical coherence. Perhaps his major contribution has been to bring the concise rigor of modern math into the domain of music theory. In particular, the HMIL makes available to non-mathematicians tools for new, sweeping but controlled variations of musical forms.

Polansky's musical operating system features a graphics editor named CREATE that enables a user to manipulate "raw musical data." Anything from a simple melody to a complex harmonic profile can be inverted, transposed, reversed, even randomized. Design of the editor with its graphics interface requires extensive use of linear approximations of real-valued functions and simple, straightforward function analysis. CREATE allows a musician to see shapes that are assigned musical parameters and then edited like a compositional word processor.

For his own experiments Polansky drives his beat-up Citation over to the UC Berkeley bookstore to buy statistics textbooks. "I finally decided to quit generating everything from scratch. To construct and test functions I need a core of commonly used equations with predictable outcomes. That's statistics."

It is certainly statistics, but how is it music? Polansky takes a stab at explaining: "In essence, we have created a model metrizable space based on musical transformations. For instance, we can analyze two melodies and profile their upness or downness as distance functions between ordered sets." Polansky is able to analyze the compositions of, say, Mozart and find a range of transformations to describe his "style." The computer can then generate further compositions that would "sound like Mozart."

"Getting the computer to compose like Mozart is actually much easier than creating original music. We at least have a sense of what Mozart sounds like. In a way it is similar to a chess program—you know if it works, although it can always be improved. But when the computer composes its own piece, who decides if it is 'music'?"

One culture's music is another culture's noise. Polansky and colleagues are using mathematical models to build a "non-biased" standard to judge whether a composition is music. Western music has traditionally used such compositional techniques as inversion and transposition. Polansky augments these rather rigid variations with experimental techniques based on such contrasting styles as classical central Javanese music (the will spend the better part of 1988 in Java doing direct research) and ancient Hebrew "harpers" used to sing the Old Testament. These styles allow great variation in harmony, melody and rhythm, yet retain clearly recognizable identities.

I asked my programming class to answer the question "Is it music?" as they listened to B'Ar's Sam, a composition for voice and interactive computer. They did not dance to the beat. Indeed, they could not even find the beat. But they were intrigued by the idea.

You can purchase your own HMIL musical laboratory for $150 (Macintosh or Amiga only) from frog Peak Music, P.O. Box 9911, Oakland, CA 94613.

Steve Unruhe
Northern High School
1011 Mineris
Durham, NC 27701