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Article Summary:

"Chaotic Computing" by Scott Wilkinson
(Electronic Musician, Feb. 1999, pg. 30)

A new model for computing technology is being currently developed. Although the development of this technology has little to do with music, the possible application of such new computational models holds great potential for electronic music synthesis, signal processing, and most other tools of the trade. In fact, any such advancement in computer technology will necessarily have a direct impact on electronic based music.

This new model of computing is based on a paradigm called "chaos theory," a relatively new branch of physics. Chaos theory is the study of apparently random motions and the effort to quantify these motions mathematically. To elucidate this concept, the article gives an example of a magnet swinging on a pendulum above another magnet, their similar poles facing each other. The nature of system will be that the swinging magnet will be contiuously repelled by the stationary magnet. Although the resulting pattern of swings may at first seem random, it turns out that the motions are actually "chaotic." The pattern that emerges from such chaotic motions are called strange attractors.

The application of such strange attractor systems to computing has been made by Profs. William Ditto (Georgia Inst. Tech.) and S. Sinha (Inst. of Math. Sci). The work of these two men has been to show that an array of coupled chaotic elements can perform various mathematical operations, such as addition, multiplication, and Boolean algebra. As anyone who is familiar with the mechanisms of digital technology would attest, digital computing is no more than nested versions of these same simple mathematical functions.

The reason why this new method of computing could be so revolutionary is that it more closely resembles the way in which neurons in the brain work together. The computational elements are arranged in a lattice which allows a wide range of critcal values. From my limited background in physics, I'm assuming this facet of chaos computing is similar to fuzzy logic applications where an infinited amount of resolution can be obtained even while being digitally controlled.

Of course, this new computing method will not be completely superior to modern digital computing. For many applications, modern computers are designed perfectly well. But it is in situations that model the workings of the human brain, such as musical processes, that chaos theory based computational models show such promise. Prof Ditto clarifies this idea: "[Chaos computing] might be better for those activities that digital computing doesn't do very well, such as pattern recognition or detecting the difference between two pieces of music." In a sense, this new paradigm may more closely achieve those goals set forth by artificial intelligence efforts.

The bad news for today's musician is that chaos computing is still in its infancy. Even upon its full development, the exact method of application to music and electronica is yet unknown. Many design and experimental hurdles must be overcome before chaos computing can be used in any practical situation. The possible existence of such a new method of computation, however, reminds those involved with music technology that the technology of music is continuously evolving and changning. With these changes in technology come new opportunities for composition and creation. Perhaps there is therefore something else on the horizon beyond even analog or digital.