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News

Making music by numbers online

Website offers an infinite selection of computer-generated ring tones.

Philip Ball

Some of the tunes are catchy, some vaguely familiar, others like nothing on Earth. There are more than a trillion trillion trillion of them, all accessible at the click of a finger.

When you listen to one of the compositions created by WolframTones, an online music resource devised by researchers at Wolfram Research, you are almost certainly the first person ever to hear it.

The tune is composed on the spot by a computer program that draws on the patterns explored by British mathematician Stephen Wolfram. The idea of using Wolfram's work to compose music isn't unique. But the site is perhaps the first to make it so easy to produce and listen to the musical creations; you can even download them as ring tones for your phone.



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**“It is made easy
for just about
anyone to do it”**

*George Lewis
Columbia University,
New York*

In 2002, Wolfram excited intrigue and controversy when he published his book *A New Kind of Science*, a 1,000-page argument for why algorithmic processes based on cellular automata underlie the basic laws of physics.

A cellular automaton model consists of a grid of cells that can each adopt one of several states, such as a checkerboard on which each square can be empty or occupied. The model evolves according to a set of rules that describe how the state of each cell depends on that of its neighbouring cells.

Research has shown that automata can mimic natural phenomena, from snowflakes to patterns on sea shells. Wolfram has suggested that they form the basis of much more, including the fundamental physics of the subatomic world.

Natural patterns

Of particular interest are automata in which the rules lead to grid patterns that are constantly changing in a seemingly organized way, and

yet are not repetitive. A classic example of this is the Game of Life devised in the 1970s by British mathematician John Horton Conway. In this program small clusters of 'live' cells seem to behave like coherent organisms, moving around a computer screen eating up other clusters or spawning offspring.

Now Wolfram and computer scientist Peter Overmann have constructed a program that converts an automaton to a musical score, assigning different pattern elements to different notes and instruments.

Like the corresponding visual patterns, the scores (usually) have enough constancy to avoid descending into chaos, but enough unpredictability to remain interesting.

Others have used aspects of Wolfram's early work on cellular automata to do something similar. George Lewis, a professor of music at Columbia University in New York, collaborated with experimental musician Joel Ryan in the mid-1980s to create compositions this way. Brazilian composer Eduardo Reck Miranda has even drawn on the Game of Life for his scores. "What is different here is that it is made easy for just about anyone to do it, which I like very much," says Lewis.

Sounds good to me

WolframTones produces compositions that last just 30 seconds. You can select compositions from a range of conventional styles, from 'classical' to 'country' and even 'experimental'. The program searches the automaton soundscape to find patterns that match the typical features of such styles. However, Overmann admits that this is a fairly subjective process.

Music professor Paul Lansky of Princeton University, New Jersey, argues that this aping of conventional styles actually limits the musical merit of the approach. "All they're doing is modelling things on existing notions of how music goes."

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But is it really music? "People do seem to perceive what we have as music," says Overmann. "We've heard from many composers, both classical and pop, who want to use WolframTones in their work." He is currently working with a composer from the New England Conservatory, Boston, Massachusetts, to produce a full-length composition that will be played by live performers.

Wolfram is equally interested in what this approach might teach us about music perception. "It's surprising, to me at least, the extent to which different people seem to agree about which

compositions they think sound good," he says.

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