

Cal Poly Pomona, Mathematics Ed Colloquium

A Four-Parameter Family of Two-Dimensional Cellular Automata: Results, Conjectures, Open Questions, and Mathematics Education

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***Larger than Life* (LtL) is a four-parameter family of two-dimensional cellular automata that generalizes John Conway's celebrated *Game of Life* to large neighborhoods and general birth and survival thresholds. LtL was originally imagined by David Griffeath and motivated in part by two mathematical prototypes for continuous time models of population growth: the *Lotka-Volterra* model, which is the simplest model of predator-prey interactions and the *logistic map*, which is a simple population growth model. LtL is the simplest spatial version of nonlinear population dynamics in which both space and time are discrete. LtL rules are challenging to study since most of them are neither symmetric nor monotone nor do they have other regularity properties. It has been said that many of the rules are "so exotic that, at least for now, empirical study seems the only avenue to understanding." We have made much progress along these lines and as clock speeds on personal computers increase, so too does our ability to design and run experiments for the study of LtL.**

In this talk, I give a tour, via computer simulations that update in real time, of the rich dynamics and complex self-organization that emerge from LtL's phase boundaries. The focus is on my favorite subset of exotic rules and the viable structures they support. The most interesting such structures are called *bugs* and generalize Life's famous *spaceships*. Part of the fascination with LtL's bugs comes from the fact that they are fairly common, they scale in a reasonably coherent manner, and their geometry is distinct. A mix of rigorous results, conjectures, and open questions will be presented. I end the talk with a connection between cellular automata and mathematics education. This will be an accessible talk and students are encouraged to attend.

This talk takes place Tuesday, January 23, 2007 from 12:05-12:50 in Building 8, Room 156.