Cellular Automata

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Introduction

A cellular automaton is a collection of "colored" cells on a grid of specified shape that evolves through a number of discrete time steps according to a set of rules based on the states of neighboring cells. The rules are then applied iteratively for as many time steps as desired.

–Wolfram MathWorld
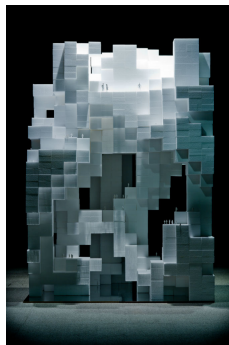
Figure: "Game Of Space" on exhibit at the Museum of Contemporary Art in Hiroshima.

Chapter 10
Cellular Automata, Life, and the Universe

Computation in Nature

Cellular Automata

The Game of Life

The Four Classes

Class 1: Quickly settle to the same uniform final pattern independent of initial configuration.

Class 2: Produce either a uniform or cyclical patterns that are sensitive to the initial configuration.

Class 3: Produce mostly random behavior with some regular structures present.

Class 4: A mixture of order and randomness: simple localized structures are produced which interact with each other in complicated ways.

Woldfam's "New Kind of Science"

Wolfram's proposed principle (in four parts):

1. The proper way to think about processes in nature is that they are *computing*.

2. Since even very simple rules can support universal computation, the ability to support universal computation is very common in nature.

3. Universal computation is an upper limit on the complexity of conputations in nature. That is, no natural system or process can produce behavior that is *noncomputable*.

4. The computations done by different processes in nature are almost always equivalent in sophistication.

Chapter 11
Computing with Particles

Block Types

This is a Block

This is important information

This is an Alert block

This is an important alert

This is an Example block

This is an example