Project Summary

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I am working with Jim Crutchfield to study the levels of complexity and organization that develop in a spatially configured "soup" of epsilon machines. Initially, a grid is filled up with random epsilon machines. At every time step, each cell in the grid is replaced by the composition of two of its neighbors. If this process is iterated, stable and unstable spatial patterns of interacting autocatalytic networks emerge. Previously, Jim Crutchfield and Olof Gornerup analyzed the autocatalytic networks that develop in a non-spatially configured soup of epsilon machines, where at each time step any machine can combine with any other. However, little research has been done regarding how the development and behavior of these networks changes when they are embodied in space. The long-term goal of this research is to understand the beginnings of evolution and self-reproduction: the population of autocatalytic networks "evolves" because some networks are better at self-reproducing than others. This evolution is an emergent property of both the spatially-configured and non-spatially-configured cases. Hopefully, the study of these systems will shed light on how self-reproduction, complexity, and evolution can emerge from physical laws.