

Speech Title: Component-based Research Framework for Emergent Behavior using Langton's Ant

Abstract: The virtual ant is a system defined by C. Langton on the two-dimensional square lattice. The ant is seen as a cellular automaton with von Neumann's neighborhood. The ant moves according to the rules: (1) At a white square, turn 90° right, flip the color of the square, move forward one unit, (2) At a black square, turn 90° left, flip the color of the square, move forward one unit. **Simplicity:** During the first few hundred moves it creates very simple patterns which are often symmetric. **Chaos:** After a few hundred moves, a big, irregular pattern of black and white squares appears. The ant traces a pseudo-random path until around 10,000 steps. **Emergent order:** Finally, the ant starts building a recurrent "highway" pattern of 104 steps that repeat indefinitely. All finite initial configurations tested eventually converge to the same repetitive pattern, suggesting that the "highway" is an attractor of Langton's ant, but no one has been able to prove that this is true for all such initial configurations. It is only known that the ant's trajectory is always unbounded regardless of the initial configuration – this is known as the Cohen-Kung theorem.

