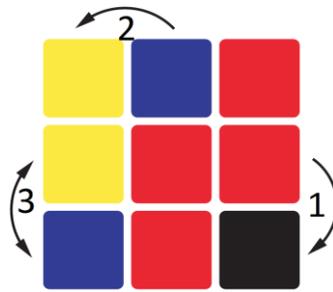




SIMULATION OF THREE-DIMENSIONAL IN SILICO ECOSYSTEMS

Background

One of the main enigmas in ecology concerns biodiversity: how do species manage to coexist? To shed some light on this matter, the behaviour of *real-life* species can be abstracted to a set of simple rules for *in silico* species to live by. After implementing these rules on a computer, the outcome of applying them repeatedly tells us how the *in silico* ecosystem behaves, and whether the species in the ecosystem manage to coexist.



As an example, a set of three rules which govern an ecosystem consisting of three species (Red, Blue, and Yellow) is displayed in Figure 1: 1) Individuals can reproduce if there is empty space (black); 2) Blue kills Yellow, Yellow kills Red and Red kills Blue; 3) Individuals can exchange their positions. Implementing these rules on a large two-dimensional grid containing up to 200^2 individuals, results in coexistence through the formation of spiral waves.

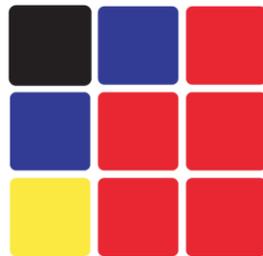


Figure 1

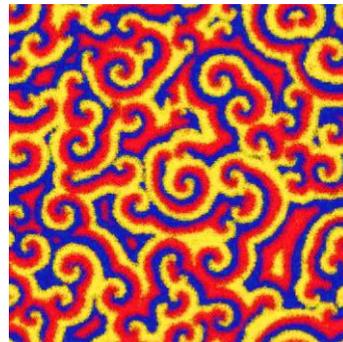


Figure 2

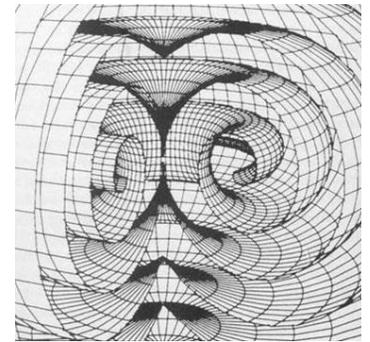


Figure 3

Scope of the thesis

Two-dimensional computer experiments involving three species and more have shown that coexistence depends critically on the formation of intricate spatial patterns, as the ones shown in Figure 2. While one may expect that the patterns produced by an *in silico* ecosystem depend on the dimension of the space which the ecosystem occupies, the behaviour of *in silico* ecosystems has not yet been studied in three dimensions, due to the fact that such experiments are computationally demanding. The aim of this thesis is to tackle this problem. We will do so by optimizing and parallelizing the algorithm used to simulate *in silico* ecosystems, while will resort to the *Stevin Supercomputer Infrastructure* of Ghent University for running massive simulations. Analysis of the resulting three dimensional patterns (Figure 3), will lead to a better understanding of coexistence in three dimensions.

SUPERVISORS

Prof. dr. Bernard De Baets
Dr. ir. Jan Baetens

TUTOR

Ir. Tim Depraetere

BACKGROUND

B&N, C&G, C&B, L&W, M

MORE INFO

tim.depraetere@ugent.be

