CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

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Project Number

S1217

Project Title

Clockwork Evolution

Abstract

Objectives/Goals

The purpose of this project is to create a digital model for evolution in the Java programming language. The simulation attempts to emulate the natural allowance for infinite variability in surmounting environmental obstacles.

Methods/Materials

The program's digitized creatures have a structure similar to that of simple organic organisms; each of which will contain homologous pairs of chromosomes and neural networks which produce their behavior. The chromosomes follow standard programming syntax so that many dynamic aspects of the computational model can be utilized. The combination of genetic rules and computational structures creates a system in which solutions to complex problems may be found. The creatures are contained within an environment of data that produces stimuli to which the creatures react.

Results

Within the simulation, certain social behaviors were observed such as herding and an outwards circular propagation. The simulation successfully demonstrated evolutionary theory including Hardy-Weinberg, genetic drift, founder effect, and population bottlenecks. With these basic principles confirmed, further experimentation showed that the environment could shape the organisms' behavior and structure.

Conclusions/Discussion

It was found that the simulation could produce complex behavior and structure in response to problems created by the environment. This system models organic structures and processes and exhibits adaptation of populations seen in nature. Due to the open-ended genetic algorithm that the simulation employs, the program can be used to create solutions for computational and analytical problems. As a model for the evolutionary process, this project can be used to test hypotheses that are difficult to examine with natural populations.

Summary Statement

The Clockwork Evolution Project developed a digitized model of organic systems, which demonstrated basic principles of evolution and can be expanded to test evolutionary theory.

Help Received

Louis Armin-Hoiland and Joan Williams edited our papers; Our mothers helped construct backboard; The Digital Life Lab at CalTech gave inspiration for the project idea.