

School of Computer Science

Ph.D. Final Defense

by

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SEXUAL SELECTION, RESOURCE DISTRIBUTION, AND GENETIC DRIFT IN SIMULATED ECOLOGICAL SPECIATION

ABSTRACT

True interdisciplinary research is difficult to classify as belonging to one field or another. Many interesting research areas lie on the boundaries of current research communities. By working on common interests, biological and computational scientists can synergistically develop new forms of computation and models of biological phenomena.

Speciation is one of the most fundamental processes in evolutionary biology, yet it is largely unexplored in artificial life, evolutionary computation, and evolutionary robotics. Traditionally, speciation was mainly viewed as allopatric. More recently, another mechanism of speciation has been studied that does not require geographic isolation. This raises a number of interesting questions, some of which we address. Will differences in resources lead to divergence and speciation? What is the role of female preferences? Would they potentially strengthen or weaken divergence?

Four hypotheses were formed and evaluated using a simulated environment inspired by life on the Galapagos Islands. In particular, wet and dry season dynamics were modelled to produce the intense selection pressure found on the islands. Both large and small populations of seeds and hence large and small populations of birds were considered.

Our results provide direct evidence for the proposed hypotheses. The most interesting case is when assortative mating is combined with uniform random seeds in which we found pseudo-speciation. With larger population sizes we found similar results with a reduced genetic drift component.

By focusing on one phenotypic trait, we found that our simulated bird populations evolved specialized beaks for the food resources available and that sexual selection based on assortative mating was necessary for speciation. This research suggests to researchers in artificial life, evolutionary computation, and evolutionary robotics some of the mechanisms that may be utilized to foster artificial speciation.

Date: Tuesday, June 28, 2011

Time: 10:00 A.M.

Place: Devon Energy Hall (DEH) Conference room 151

Committee Members: Dr. Dean Hougen, Chair
 Dr. John Antonio (CS)
 Dr. Sridhar Radhakrishnan (CS)
 Dr. Tom Ray (Zoology)
 Dr. Ingo Schlupp (Zoology, Outside Member)

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