Robots show the evolution of altruism

May 23 2011

Scientists in Switzerland have pieced together the puzzle on the evolution of unselfish behaviour. They simulated genetic evolution over hundreds of generations by using simple robots, providing evidence of kin selection. Presented in the journal *PLoS Biology*, the study was backed in part by the EU projects ECAGENTS and SWARMANOID with a combined funding of EUR 6.8 million.

Altruistic gene expression is not foreign to nature; one generation gets it from the one that came before. A case in point is worker ants. These ants are sterile and make the altruistic sacrifice by not transmitting their genes in order to guarantee the survival of the queen's genetic makeup. Kin selection is when an individual makes a sacrifice so as to ensure the survival of a relative's genetic code.

The biologist W.D. Hamilton proposed in the mid 1960s a set of conditions under which altruistic behaviour could evolve. Today's researchers call this 'rule' kin selection. In a nutshell, when an individual shares food with family, they decrease their chances of survival but increase the likelihood that their family members will pass on their genes. Under this rule, the genetic proximity of organisms influences whether one individual shares food with another.

To date, the challenge for researchers to test the evolution of altruism has been great, mainly due to the lack of experiments and the fact that too many variables were involved.

Dario Floreano, a professor of robotics at the Ecole Polytechnique Federale de Lausanne (EPFL) in Switzerland, and one of the authors of the study, used simulated gene and genome functions on robots that evolve quickly, giving researchers the support they need to calculate the costs and benefits associated with the trait.

'This study mirrors Hamilton's rule remarkably well to explain when an altruistic gene is passed on from one generation to the next, and when it is not,' explains Laurent Keller from the Department of Ecology and Evolution, Biophore, University of Lausanne.

In past tests, Professors Floreano and Keller demonstrated that foraging robots able to do complex-free tasks evolve over multiple generations. In this latest study, they used a foraging robot that could handle more complex tasks including deciding whether it wants to share an object or not.

The team says the results are already proving useful in swarm robotics. 'We have been able to take this experiment and extract an algorithm that we can use to evolve cooperation in any type of robot,' Professor Floreano says. 'We are using this altruism algorithm to improve the

control system of our flying robots and we see that it allows them to effectively collaborate and fly in swarm formation more successfully.'

More information: Waibel, M., et al. (2011) A quantitative test of Hamilton's rule for the evolution of altruism. *PLoS Biology*. DOI: 10.1371/journal.pbio.1000615

Provided by CORDIS