

Deciphering communication: learning from robots

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(PhysOrg.com) -- An experiment led by Laurent Keller at the University of Lausanne (UNIL) and by Steffen Wischmann and Dario Floreano at EPFL shows that communication systems can evolve differently within the same species and even the same environment. Performed using robots, this research can enable a better understanding of communication within the animal kingdom.

A joint research project conducted at UNIL and EPFL enabled the scientists to follow the evolution of communication in 100 groups of 20 robots over the course of 1000 generations. The robots were equipped with a camera that detected the environment, and also with wheels and a ring enabling them to emit luminous signals of different colors. Positioned in arenas, they had to locate a source of virtual food that was only visible when they came upon it. Their behavior was guided by a “neural network”, which was also controlled by genes that could evolve through mutation and selection in the course of successive generations.

An initial experiment showed that the robots rapidly acquire a communication system that enables them to transmit information about the location of the food to their peers. In fact, two really distinct [communication systems](#) evolved, according to the given populations. The simplest mechanism, using a single color to indicate the location of the food, proved more effective than the system using two colors – one pointing towards the food and the other towards the remaining part of the arena.

It also became evident that a population that has evolved towards a relatively effective type of communication doesn't subsequently change it, as it would then be necessary to simultaneously modify the way the information is transmitted, and also the way of responding. In other words, a communication system, just like a language, cannot change rapidly through generations. In addition, this research underlines the importance of random factors in evolutionary processes. The experiment performed in twenty homogenous groups (with robots of the same type) actually shows that half of them choose the simpler – one color – strategy, whereas the other half opt for the two color system.

Competition requests more complex talking

Finally, a second experiment demonstrated that, even with robots,

nothing is perfect. Within a competition context, when groups of robots were confronted with robots of other populations, it was the more complex (two-color) strategy that won the day, in spite of the proven effectiveness of the single-color strategy.

Supported by the Swiss National Science Foundation, this research has been published in the magazine PNAS (Proceedings of the National Academy of Sciences of the United States). It shows that communication strategies can evolve in different ways through generations within an identical environment.

“We know that in the animal kingdom communication systems are very complex”, concludes Laurent Keller, “and this diversity evolved over a very long period of time. Our experiment shows how it occurs, and reveals that environmental factors are not the only ones involved, as one might believe. The robots shed new light on these evolutionary processes.”

Provided by Ecole Polytechnique Federale de Lausanne

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