Robotic food helps scientists understand predators

August 30 2013

The robots which will be used in the experiment are the Merlin Miabot Pro robots, such as these. Credit: Merlin Systems Corp. Ltd.

Dr Christos Ioannou at the University of Bristol has been awarded a five year research fellowship by NERC for the study of predator-prey relationships, using robotic prey to lure predatory fish.

Dr Ioannou hopes to learn how living predators react depending on the behaviour of their prey where, for the first time, the prey's behaviour can be manipulated.

"Predators and their prey are locked in a dynamic interplay of evolved behaviour; predators try to maximise their intake, while unsuccessful prey do not live to see another day. This often culminates in dramatic behavioural displays, as cheetahs chase gazelles across the savannah, gannets dive bomb sardine shoals, and bats hunt moths through echolocation," explains Dr Ioannou.

Studying these displays has always been difficult, both ethically and scientifically. Ethically as, without subjecting living animals to being chased, researchers are unable to study prey behaviour. Scientifically as, without being able to manipulate the responses and movement of prey, researchers' understanding of whether the behaviour evolved in response to the predation or not was limited.

But Dr Ioannou and his colleagues, from Bristol, Princeton University, Newcastle University and the Indian Institute of Science, have developed interactive robots that can act as real life prey. These robots will give the scientists a unique opportunity to study how predatory fish, in this case European Perch, adapt to counteract the strategies of prey to avoid being eaten.

"At the moment it's very difficult in the UK to do experiments where you expose animals to a predatory stimulus because they react so strongly. Our system allows us to manipulate prey behaviour and study real predators without having to expose real prey. It's less stress for the animals," says Dr Ioannou.

European Perch have been chosen as they are known to cope well in laboratory conditions, and also because of their status outside Europe as an invasive species. The team hope that understanding how they react to their environment will help scientists to predict where and how the species might have an impact on the environment.

The small robots, which are available to buy commercially, will sit underneath a purpose-built tank filled with the perch. Inside the tank small items of food will be magnetically attached to the robots, allowing the scientists to manipulate where and how the food moves.

While the scientists are unable to manipulate the predator's behaviour, the movement of the prey will be entirely determined by a computer

programme that will monitor the predatory fish's movements in real time and feed it into the prey, allowing them to respond. This will enable the scientists to study how different prey behaviour, from fleeing to forming groups, affects the predator's response. The ability of the software to make these robots respond has previously been tested by making them play football.

Dr Ioannou is also interested in studying how group behaviour of animals, like flocks of starlings and swarms of insects, acts as protection from predators. The evolution of this behaviour, in particular the co-ordination within these groups continues to fascinate scientists and the public alike. This new experiment will allow this type of behaviour to be studied in unprecedented detail.

"We're trying to create a realistic and dynamic, but controlled, version of the real world to see what drives evolution of different types of behaviour," explains Professor Iain Couzin from Princeton University, who is helping to develop the robotics.

Professor Couzin believes that this research could help inform future robotics applications.

"We're using robotics to understand biology, but ultimately understanding the biology better could help inform new types of robotics," he explains.

"There are many scenarios where we need to look for cryptic or unpredictable resources in the landscape, such as in search and rescue missions or sensing dangerous environments. By trying to understand how real animals respond, and evolve to respond, to unpredictable environments this research will give us a huge insight to helping develop inspired robotics."

Provided by University of Bristol