

Following the signs of decision making



★ There are more than 1,300 bat species, and their behaviour is extremely variable, now researchers are using miniature sensors to investigate how they make decisions on food foraging. **Dr Yossi Yovel** tells us about the GPS-BAT project's work in monitoring the behaviour of individual wild bats within a colony

The underlying basis of animals' decision-making is a topic of great interest in biology, influenced by both their own neural mechanisms and the environments they inhabit, yet gathering data on their behaviour in the natural environment is a challenging task. Based at Tel Aviv University, Dr Yossi Yovel and his colleagues are working to bridge the gap between neuroscience and ecology. "We're trying to develop methods that allow us to run experiments on animal behaviour in the field that are highly controlled – almost as controlled as in the lab," he outlines. In particular, Dr Yovel is deeply interested in echo-locating bats, which perceive their environment through sound. "Bats are great models – they're wild and extremely variable. It's a huge group with more than 1,300 species, and a lot of behavioural variability. Some bats migrate, some navigate far, some near, they eat different things, some are social, some aren't," he continues.

GPS-BAT project

This variability is an important advantage in terms of studying animal decision-making, a topic which lies at the core of the GPS-BAT project. As the project's Principal Investigator, Dr Yovel is developing miniature sensors that can be mounted on the bats, including a GPS sensor and a microphone to track and record them. "This allows us to detect, for example, when a bat is attacking prey, when it is interacting with another bat, and other types of behaviour as well," he explains. Dr Yovel's team is monitoring an entire colony, gathering data on how bats make decisions on foraging for food, such as

individuals and gather behavioural data on a very fine scale, from which new insights can be drawn about how decisions are made. The focus of attention in the project is bats, yet Dr Yovel says the monitoring system could potentially be applied on other animals in future. "We are already applying it on rats in a different project, and several people have spoken to me about applying it on different animals. The main advantages of the system are its size – it's tiny (<2 grams) – and the fact that it includes a lot of complementary sensors. You can record things like acceleration, audio, and heart rate," he says. Dr Yovel and his colleagues have gathered

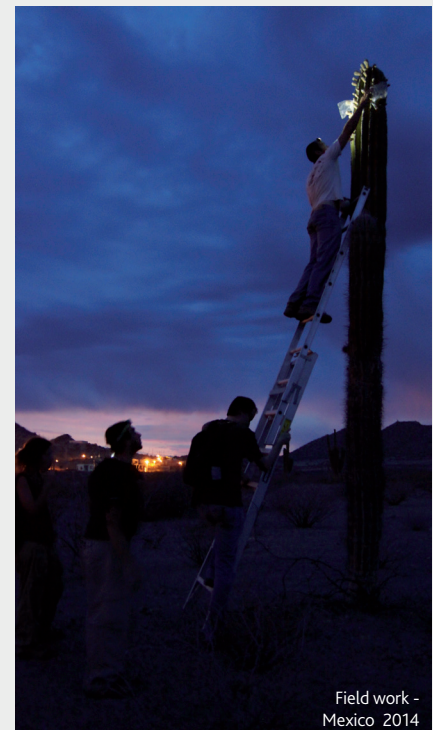
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whether they rely on their own experience and memory, or whether they are influenced by the decisions of other bats. "Imagine that we find that a bat returns, year after year, in the same season, to the same mango tree. This tree had ripe fruits a year ago – it's now the same season again, and the bat immediately goes there. That would be indicative of spatio-temporal long-term memory," says Dr Yovel.

a lot of in-depth information about a single colony, in future he plans to look at networks of colonies, monitoring the movement of bats between them. "Do bats move to a new colony to get new information about the environment? We would also like to start manipulating the availability of food by developing automatic feeding sites," he outlines.

Now, the question is what would the neighbouring bat in the colony do? Would it go to the same tree as the first bat or to another tree it knows? The researchers hypothesise that bats possibly glean information from their neighbours, maybe by smelling them, exchanging verbal communication, or some other mechanism. "Now you have this more complex scheme of decision-making, where you glean information about the availability of mango from your neighbour, but then make a decision based on a combination of social and personal information. Those are the kinds of insights that we're hoping to gain," outlines Dr Yovel. There are also differences in behaviour between individual bats. "For example some individuals are very exploratory, and will always look for new places, while others are exploitative, and tend to return to places where they have been before. This is another level of decision-making, where the personality of the bat influences their decision," continues Dr Yovel.

The goal in research is to track specific



Field work - Mexico 2014

GPS-BAT

Foraging Decision Making in the Real World – revealed from a bat's point of view by on-board miniature sensors

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