

Fruit bats can transform echoes into images

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Bats are creatures of the night and are accustomed to complete darkness. They harness their hypersensitive hearing to feed, to fend off prey and to mate.

But that's not the entire story. A new Tel Aviv University study finds that [fruit bats](#) actually integrate vision and echolocation to flourish in the dead of night. The new research was led by Prof. Yossi Yovel and conducted by Dr. Sasha Danilovich, both of TAU's George S. Wise Faculty of Life Sciences, and was published on June 26 in *Science Advances*.

The study focuses on several aspects of fruit bats' integrated vision-echolocation abilities. Bats translate an echo into a visual image and then use their vision to find their way out of a maze and determine the shapes of objects.

"Contrary to [popular belief](#), bats do indeed see, and many of them do use their eyes as much as they use echolocation," Dr. Danilovich says. "But how they integrate vision and echolocation is poorly understood. Our new findings shed light on how fruit bats really operate in darkness."

"How animals—including humans—integrate information from different sensory modalities is a major question that still puzzles scientists," Prof. Yovel explains. "Imagine, for example, that you see a car coming from the right, but you hear another one coming from the left. How will your [brain process](#) and integrate this information?"

"Bats are useful models for studying this and other related phenomena because of their dual reliance on two remote sensory systems: vision and echolocation."

Over several months, the scientists trained the bats hoping to test the extent of their echolocation and vision skills. "These experiments take months, because the bats have to first understand what it is we want of them," says Dr. Danilovich.

In one experiment, the researchers trained the model bats to land on one of two objects in complete darkness for a reward. They also trained them to distinguish between a smooth [object](#) and an object perforated with holes.

The team first conducted the experiments under the cloak of darkness and then turned on the lights, eliminating [echolocation](#).

"We found that their brains actually transformed echoes into [visual images](#)," Dr. Danilovich says. "It was amazing to see them harness their aural experience and translate it into useful visual data."

The researchers also demonstrated that fruit bats predominantly use vision to find their way out of a maze and to learn the shape of an object.

"When we afforded them the opportunity to attempt to distinguish between a triangle and a cylinder, they only used their [vision](#)," Prof. Yovel notes. "When they were tested in [total darkness](#), they were unable to perform the task."

"We have shown that bats are able to translate the acoustic echoes of some objects into visual

representations," Prof. Yovel concludes. "We next hope to harness this new echo-to-image paradigm to examine whether [bats](#) can build a 3-D representation of the world based on echoes alone."

More information: S. Danilovich et al, Integrating vision and echolocation for navigation and perception in bats, *Science Advances* (2019). DOI: [10.1126/sciadv.aaw6503](https://doi.org/10.1126/sciadv.aaw6503)

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