

Archer fish can see like mammals (w/ Video)

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Banded archerfish, *Toxotes jaculatrix*. Image: by R.Wampers, via Wikipedia

(PhysOrg.com) -- The ability to see objects oriented differently to the background, which is known as orientation-based saliency, has long been thought to be confined to mammals, but a new study has found that archer fish have this ability, despite having no visual cortex in their brains.

Orientation saliency means objects aligned differently to the background appear to “pop out” from it. In humans this ability is controlled by neural pathways in the [visual cortex](#), and helps in identifying important objects in the visual field.

Archer fish (*Toxotes jaculatrix*) catch insects moving on tree branches or flying above by accurately spitting a jet of water at them to knock them into the water. They also accurately determine the falling insect’s trajectory to determine exactly where it will hit the water. Their abilities

are so impressive that researchers from the Ben Gurion University of the Negev in Israel wondered if they exhibited orientation saliency as well.

The researchers, led by computer scientist Ohad Ben-Shahar, trained five archer fish to shoot at images of insects on an LCD screen above their tanks. They then replaced the images of insects with a series of images of two bars representing prey objects set against a patterned background representing the habitat. The bars were shown either both oriented in the same direction as the background pattern, both perpendicular to the pattern, or with one bar in each direction.

The researchers observed which bar the fish detected and shot at each time and found they shot most often at bars oriented perpendicular to the background pattern, suggesting these objects were most obviously visible to them. They then tested humans with the same stimuli, and found that they too were most likely to pick out the bars aligned perpendicular to the background. These results suggest the archer fish have orientation-based saliency as humans do.

The fact that archer fish have no visual cortex means the neural mechanism may be similar to that in mammals, but located elsewhere in the [brain](#), or there may be a completely different mechanism. So far, the neural pathways are unknown in the archer fish.

The study also raises the question of whether orientation salience evolved differently in fish and [mammals](#), or evolved only once in an ancient common ancestor, and has been conserved for millions of years because of its usefulness. The ability may also be much more widespread than previously thought.

The paper was published in the *Proceedings of the National Academy of Sciences (PNAS)*.

More information: Orientation saliency without visual cortex and target selection in archer fish, Alik Mokeichev et al., *PNAS*, Published online before print September 13, 2010, [doi:10.1073/pnas.1005446107](https://doi.org/10.1073/pnas.1005446107)

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