Flies, humans perceive motion in same way, study finds

January 24 2014, by Becky Bach

Close-up of the head of Calliphora vomitoria. Credit: Wikipedia.

(Medical Xpress)—Anyone who has tried to swat a fly knows they can quickly spot – and evade – the approaching swatter. New research from a team of Stanford scientists might explain why: Flies and humans share a computational strategy to perceive motion.

"What's really exciting to me is that no one would have expected this deep similarity between two animals that are so evolutionarily different," said Stanford's Thomas Clandinin, an associate professor of neurobiology and one of the authors of the study, which was published this month in the journal *Nature Neuroscience*.

The last common ancestor of flies and humans lived more than 500

million years ago when the planet looked quite different. Nonetheless, repeated patterns in the natural environment led ancestors of both organisms to evolve similar strategies to sense movement.

It is likely this model evolved twice – once in a human ancestor and once for a fly ancestor – because flies and humans are so far apart on the evolutionary tree, according to neurobiologist Damon Clark, a lead author of the paper. Despite the fact that the brains of humans and flies are quite different, they analyze motion in similar ways. Clark, now a professor at Yale, was a Stanford postdoctoral researcher in Clandinin's group at Stanford when he worked on the project.

Scientists know quite a bit about how the eye detects light. However, they don't completely understand how the brain translates a series of chemical signals into an image. The research team examined motion perception in flies and humans to learn more about the visual system and the brain's problem-solving strategies.

"The big question is really 'How does the brain evolve,'" said Anthony Norcia, an author of the paper and a Stanford professor (research) of psychology.

The study suggests there may be an optimal way to view natural moving objects which share fundamental properties, Clark said. By statistically modeling these properties, theoretical neuroscientist James Fitzgerald, also a lead author of the paper, was able to develop a framework to test these theories, team members said. Fitzgerald was previously a graduate student at Stanford and is now a postdoctoral fellow at Harvard University.

Both humans and flies discern three types of information about a moving object: its speed, direction of motion and brightness. Previous models were flawed because they discarded information about brightness,

Norcia said.

The team tested its theories in both humans and flies. In Norcia's lab, volunteers watched videos while researchers monitored their scalp electroencephalogram (EEG) signals. They also answered questions about their perception of motion based on the videos.

But to test flies, researchers couldn't just ask them which way an image was moving. Instead, Clark said, they capitalized on a known fly trait: Flies turn in the direction of motion. Clark tethered flies to sticks, posed them on tiny spherical treadmills, and then screened videos while monitoring their movements.

The project was possible thanks to the kind of interdisciplinary teamwork that is common at Stanford, Norcia said. It started when Clark gave an informal presentation in the Department of Psychology, piquing the interest of Norcia and the study's third lead author, former Stanford postdoctoral researcher Justin Ales, who is now a lecturer at the University of St. Andrews in Scotland.

Fitzgerald said he chose to study motion in flies because it could be possible to pinpoint the neural networks involved. "The ultimate hope is by finding an example of how flies solve this particular problem, it could give us some insight into how the brain solves problems more generally," Fitzgerald said.

More information: "Flies and humans share a motion estimation strategy that exploits natural scene statistics." Damon A Clark, James E Fitzgerald, Justin M Ales, Daryl M Gohl, Marion A Silies, Anthony M Norcia, Thomas R Clandinin. *Nature Neuroscience* (2014) DOI: 10.1038/nn.3600. Received 12 August 2013 Accepted 14 November 2013 Published online 05 January 2014

Provided by Stanford University