Computer simulation explains why zebras have stripes

18 December 2013, by Bob Yirka

A photo showing two Zebras in Mikumi National Park. Credit: Sajjad Sherally Fazel / Wikipedia. (Creative Commons Attribution-Share Alike 3.0 Unported)

(Phys.org) —Two researchers, one from the University of Queensland, the other the University of London have published a paper together in the journal *Zoology* in which they claim to have solved the riddle of why zebras have stripes. In their paper, Martin How and Johannes Zankerb describe how they built a computer simulation that demonstrated that the stripes on zebras serve to confuse both pests and predators.

Evolutionary biologists have long been intrigued by the black and white striped coat sported by zebras, but have been at a loss to explain why it evolved. Because the stripes are so vivid and stand out from the environment in which the zebra live, it would seem having them would cause the animals to be targeted more by predators, rather than less. One of the more plausible arguments to explain the stripes has been that they "dazzle" predators causing them to have difficulty focusing. This idea has never been proved, however—How and Zankerb set out to do just that.

Suspecting that the stripes might be causing optical illusions in those who view them, the researchers created a simulation based on motion detection algorithms and used it to analyze various parts of the zebra body. In so doing, they discovered that the motion signals generated by the striped patterns on the zebra's body tend to result in misleading optical information.

The stripes, the researchers say, cause conflicting messages in the brains of both predators (big cats) and biting insects. They suggest the conflicting sensory information is a combination of two well documented optical illusions: the wagon-wheel effect and the barber-pole illusion. In the first, to people (and presumably lions, etc.) a spinning wagon wheel appears at certain speeds to spin in the opposite direction. In the second, a rotating barber pole appears to be rising as it turns. The net effect, the researcher say, is that when a zebra moves, it's difficult to tell which part of it is which. The illusion is even more profound, they note, when looking at more than one zebra at a time.

The findings by the pair of researchers are likely to lead to similar research on other striped animals and might even instigate some studies by military groups looking to better camouflage their ships, tanks, etc.

More information: Motion camouflage induced by zebra stripes, *Zoology*, Available online 4 December 2013. dx.doi.org/10.1016/j.zool.2013.10.004

Abstract
The functional significance of the zebra coat stripe pattern is one of the oldest questions in evolutionary biology, having troubled scientists ever since Charles Darwin and Alfred Russel Wallace first disagreed on the subject. While different theories have been put forward to address this

question, the idea that the stripes act to confuse or 'dazzle' observers remains one of the most plausible. However, the specific mechanisms by which this may operate has not been investigated in detail. In this paper, we investigate how motion of the zebra's high contrast stripes creates visual effects that may act as a form of motion camouflage. We simulated a biologically motivated motion detection algorithm to analyse motion signals generated by different areas on a zebra's body during displacements of their retinal images. Our simulations demonstrate that the motion signals that these coat patterns generate could be a highly misleading source of information. We suggest that the observer's visual system is flooded with erroneous motion signals that correspond to two well-known visual illusions: (i) the wagon-wheel effect (perceived motion inversion due to spatiotemporal aliasing); and (ii) the barber-pole illusion (misperceived direction of motion due to the aperture problem), and predict that these two illusory effects act together to confuse biting insects approaching from the air, or possibly mammalian predators during the hunt, particularly when two or more zebras are observed moving together as a herd.

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