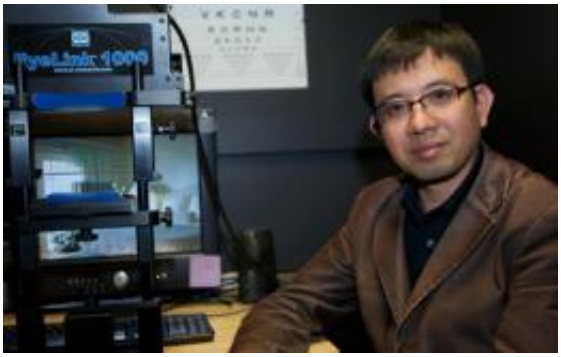
Medical Xpress

# Scientists keep their eyes on peripheral vision

January 20 2012, By Robert Perkins



USC Dornsife's Bosco S. Tjan (above) and USC graduate student Anirvan S. Nandy theorized in a new paper that peripheral vision is hindered by the visual experience formed in the brain during eye movements. Credit: Dietmar Quistorf.

(Medical Xpress) -- Two USC scientists are bringing peripheral vision into focus, showing that the way the brain sharpens its attention while the eyes are in motion leads to false assumptions about how objects should look.

The eye's photoreceptors — the cells that detect light — are clustered at the center of the field of vision, leaving the periphery like a low-resolution camera. USC Dornsife neuroscientist Bosco S. Tjan and USC graduate student Anirvan S. Nandy theorized that peripheral vision is hindered by the visual experience formed in the brain during eye movements.

Their paper was published online on Jan. 8 in *Nature Neuroscience*.

According to the researchers, a single neural signal directs the eyes to look at an object of interest in the periphery and causes the brain to start paying attention to that object. Unless they are tracking an object — such as a police officer's penlight during a sobriety test — human eyes do not tend to move in fluid motions. Instead, they jump from one point of focus to another in a jerky fashion called "saccadic" eye movement.

Those movements bring an object into the center of the field of vision. The brain actually starts paying attention to that object — "turning on" its ability to learn about it — shortly before the eyes move and lock on to it.

The researchers said this makes the version of the visual world that the brain learns from the periphery appear smeared.

"Parts of the brain that process peripheral vision assume these smears were typical of the physical world and make corresponding perceptual errors that cannot be explained by merely seeing the world in low resolution," said Tjan, associate professor of psychology.

Vision is based, in part, on assumptions made by the brain. For example, if you look at a coffee mug, your brain sees one side of it and assumes that the rest is completely round — when in fact the back side that you do not see could be almost any shape at all, to a certain point.

"For the brain to see things, generally speaking, it has to make assumptions about the world," Tjan said.
(Mis)guided by the peripheral vision's smeared version of the world, the brain would have a hard time recognizing objects in the periphery and be more prone to error. Tjan and Nandy's theory explained a wealth of empirical data on peripheral vision gathered in the last few decades.

Tjan said he hopes their work will help inform therapy for patients

suffering from diseases like macular degeneration, in which damage to the retina costs patients sight at the center of the field of vision.

Macular degeneration is, for the moment, irreversible. Patients with macular degeneration are retaught how to see by focusing their attention outside the center of their field of vision — a difficult task, given the poor quality of the image with which they are left.

“At least for now, the best we can hope for is to train a patent to use [his or her] periphery. But to do that, we need to know why the periphery is so much worse,” Tjan said.

The research was supported by the National Eye Institute of the National Institutes of Health.

Provided by USC College