EBERHARD KARLS UNIVERSITÄT TÜBINGEN

CIN Werner Reichardt Centrum für Integrative Neurowissenschaften

Press Release

More Than Just Looking – A Role of Tiny Eye Movements Explained

Tübingen researcher learns how the brain keeps an eye on the periphery even when focusing on one object.

Tübingen, 14.02.2013

Hochschulkommunikation

Myriam Hönig
Leitung

Antje Karbe
Pressereferentin
Telefon +49 7071 29-77853
Telefax +49 7071 29-5566
antje.karbe@uni-tuebingen.de
We request you to send copies of any publications.

Have you ever wondered whether it's possible to look at two places at once? Because our eyes have a specialized central region with high visual acuity and good color vision, we must always focus on one spot at a time in order to see our environment. As a result, our eyes constantly jump back and forth as we look around.

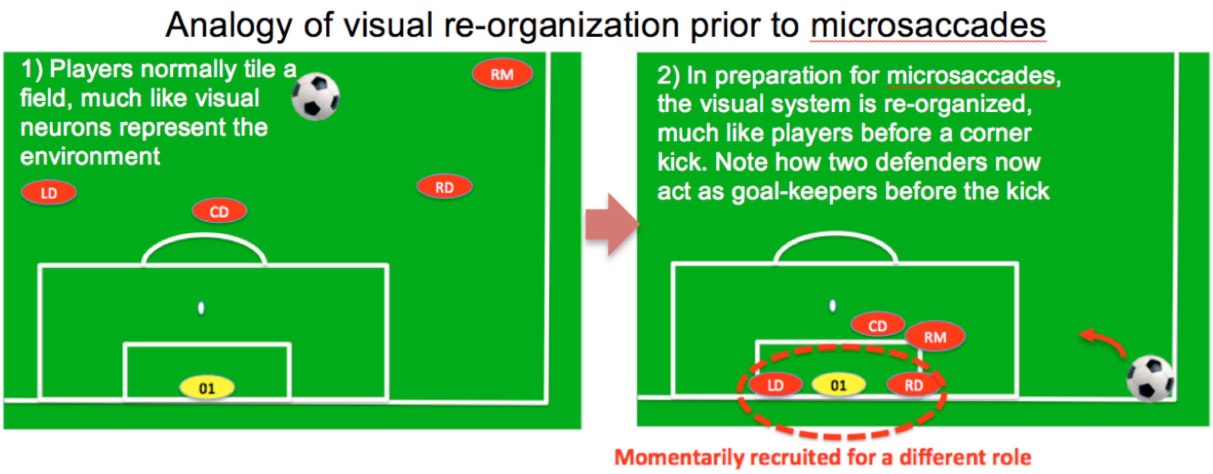
But what if – when you are looking at an object – your brain also allowed you to "look" somewhere else at the same time, out of the corner of your eye, as it were? Now, a scientist at the Werner Reichardt Centre for Integrative Neuroscience (CIN), which is funded by the German Excellence initiative at Tübingen University, has found a possible explanation for how this might happen.

Ziad Hafed, the leader of the Physiology of Active Vision Junior Research Group at CIN, wondered about the role of a type of tiny microscopic eye movement that occurs when we fix our gaze on something, called a microsaccade. "Microsaccades are sort of enigmatic," Hafed says. They are movements of the eye which occur at exactly the moment when we are trying to look at something steadily – i.e., when we are trying to prevent our eyes from moving.

It was long thought that microsaccades were nothing but random, inconsequential tics, but Hafed wondered whether the mere unconscious preparation to generate these tiny eye movements can alter visual perception and effectively allow you to "see" out of the corner of your eye. He found that before generating a microsaccade, the brain re-organizes its visual processing to alter how you perceive things. "Imagine that you are the coach of a football team," Hafed says. "You would normally ask your defenders to spread out across the field in order to provide good coverage during match play. However, in preparation for an upcoming corner kick by your opposing team, you would re-organize your defenders, assigning two of them to become temporary goalkeepers and protect the goal. What I found was evidence for a similar strategy in the visual brain before microsaccades," says Hafed. That is, in preparation for generating a tiny microscopic eye movement, the brain – the "coach" – causes a subtle re-organization of the visual system, and thus alters how you might see out of the corner of your eyes.
(see diagram).

Using a series of experiments on human participants, coupled with computational modeling of the human visual system, Hafed asked participants to fix their attention on a spot that appeared on a screen in front of them, while he carefully measured their tiny microscopic eye movements. Hafed then probed the participants' ability to look at two places at once by testing their peripheral vision. He found that in preparation to generate a tiny microsaccade, the participants demonstrated remarkable changes in their ability to process visual inputs. In the periphery, tiny microscopic eye movements effectively improved the capacity to direct visual input – from around where gaze is fixed – towards the brain. Hafed's results, which are described in the leading science journal **Neuron**, thus demonstrate an important functional role for these tiny, microscopic, and "enigmatic" movements of the eye in helping us to perceive our environment.

Hafed's results not only help us understand a previously puzzling phenomenon; there are also potentially wide-ranging applications arising from this work. In particular, this work can affect how we design computer and machine user interfaces. For example, using knowledge about the whole range of eye movements we constantly make, including microscopic ones, our future "smart user interfaces" can ensure that things likely to attract our attention are not displayed in places where they can be distracting. Conversely, if we need to locate something that should attract our attention – a warning light in a control room, for instance – this same approach will also be useful. As Hafed put it, "eye movements would essentially be a window on our minds."



The Werner Reichardt Centre for Integrative Neuroscience (CIN) is an interdisciplinary institution at the Eberhard Karls University Tübingen funded by the DFG's German Excellence Initiative program. Its aim is to deepen our understanding of how the brain generates function and how brain diseases impair them, guided by the conviction that any progress in understanding can only be achieved through an integrative approach spanning multiple levels of organization.

Original Publication:

Hafed, Z. M. (2013). Alteration of visual perception prior to microsaccades. *Neuron*, 20 Feb 2013, DOI: dx.doi.org/10.1016/j.neuron.2012.12.014

Contact:

Dr. Ziad Hafed
Universität Tübingen
Werner Reichardt Centrum für Integrative Neurowissenschaften (CIN)
Otfried-Müller-Str. 25
72076 Tübingen
Telefon: +49 7071 29-72965
ziad.m.hafed [at] cin.uni-tuebingen.de
http://www.cin.uni-tuebingen.de/research/hafed.php

Dr. Ivan Polancec
Universität Tübingen
Werner Reichardt Centrum für Integrative Neurowissenschaften (CIN)
Wissenschaftlicher Koordinator
Otfried-Müller-Straße 25
72076 Tübingen
Telefon: +49 7071 29-89105
ivan.polancec [at] cin.uni-tuebingen.de
www.cin.uni-tuebingen.de