

NeuroVision Associates

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Eye Tracking and Eye Teaming

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Eye Tracking and Eye Teaming: The Hidden Skills Behind Reading, Sports, and Everyday Life

How fixations, saccades, and pursuits work, and how new eye-tracking technology lets us see what the naked eye misses

Most families come into our office believing that if a child can read the bottom line of the eye chart, their vision is fine. But 20/20 only tells us how clearly someone sees a still letter, from across the room, for a few seconds. It tells us nothing about how well the eyes move, how accurately they land where they are aimed, or whether the two eyes are working as a team.

Those skills, eye tracking and eye teaming, are what allow a child to read a paragraph without losing their place, an athlete to follow a puck at full speed, and an adult recovering from a concussion to walk through a busy grocery store without feeling overwhelmed. When they break down, the result is often mislabeled as a learning, attention, or behavior problem. In this article I want to explain what these skills are in plain language, and then share how electronic eye tracking is changing the way we measure them.

The Three Building Blocks of Eye Movement

Every time you look at the world, your brain is directing a carefully choreographed set of eye movements. Three of them matter most for daily life.

Fixations: Holding Steady
A fixation is the ability to keep the eyes still and locked on a target. It sounds simple, but it is an active skill. When you read, your eyes are actually stopped on a word for most of the time; that is when the brain takes in information. A person with unstable fixation may have eyes that drift, wobble, or jump away from the target. On the page, that can look like skipping words, rereading lines, or needing a finger to keep their place.

Saccades: The Quick Jump
A saccade is a fast, precise jump of the eyes from one point to another. Reading is really a series of saccades and fixations: jump, stop, take in the word, jump again. Saccades also come into play when a student copies from the board to their paper, or a driver glances from the road to the mirror and back. When saccades are inaccurate, the eyes overshoot or undershoot their target and must make extra corrective jumps. That wastes time and energy, slows reading, and makes the reader tire quickly.

Pursuits: Smooth Following
A pursuit is the ability to follow a moving object smoothly, like watching a baseball come off the bat or following a car as it passes. This is the skill a doctor checks when they ask you to "follow my finger." Healthy pursuits look like a smooth glide. Poor pursuits look choppy, with the eyes falling behind and then catching up in little jumps. In sports, that can mean misjudging the ball; in the classroom, it often shows up as clumsiness or difficulty with moving tasks.

Eye Teaming: Two Eyes, One Picture

All of the movements above have to happen with both eyes at once, perfectly coordinated. That is eye teaming, or binocular vision. When you look at something up close, your eyes turn inward together (convergence); when you look far away, they turn back outward (divergence). The brain then fuses the two slightly different images into one clear, three-dimensional picture.

If the eyes do not team well, the brain has to work overtime to keep the picture single. People often experience this as headaches, eye strain, words that seem to float or swim on the page, intermittent double vision, or simply avoiding reading altogether. Eye teaming problems are common after concussion and other brain injuries, and they are frequently missed in children who are labeled as "not trying hard enough."

Skill	*What It Is*	*Where You Use It*
Fixation	Holding the eyes steady on one target	Keeping your place on a line of print; watching the pitcher's release
Saccades	Quick, accurate jumps from one point to another	Reading word to word; copying from the board; checking mirrors while driving
Pursuits	Smoothly following a moving object	Tracking a ball in flight; following a car or a bird across the sky
Eye Teaming	Both eyes aiming at the same point together	Seeing single and in depth; comfortable, sustained reading

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Signs Worth Paying Attention To

Families are often the first to notice that something is off. Common signs of eye tracking or teaming difficulty include:

- Losing place while reading, skipping words or lines, or using a finger to keep track
- Reading slowly, or understanding less the longer they read
- Headaches, eye rubbing, or fatigue after near work or screen time
- Covering or closing one eye, tilting the head, or turning the head instead of the eyes
- Trouble copying from the board, or messy, poorly spaced handwriting
- Clumsiness, or difficulty catching and hitting balls
- After a concussion: dizziness or discomfort in busy visual environments, such as stores, traffic, or scrolling screens

Why "Follow My Finger" Isn't Enough

For decades, eye movements have been judged by watching them. A skilled examiner can learn a great deal this way, and observation will always be part of a thorough evaluation. But the human eye has limits. Saccades happen in a fraction of a second, and the small errors that make reading exhausting are often too quick and too subtle to see. Observation also gives us an impression rather than a number, which makes it hard to compare one visit to the next.



Saccades happen in a fraction of a second.

Electronic Eye Tracking: Measuring What We Can't See

Modern electronic eye trackers use a small infrared camera to follow the pupils many times per second while the patient watches targets on a screen or reads a short passage. In a few minutes, the system records exactly where each eye was pointing, how long it stayed there, and how accurately it moved to the next target.

In our office, we use Optics Trainer, a platform built on Tobii eye-tracking hardware. It records fixations, saccades, pursuits, and reaction times with a level of precision no stopwatch or observer can match. For our patients and their families, this offers three big advantages:

- **Objective numbers.** Rather than "your child's eye movements look a little jumpy," we can show you how many extra corrective jumps occurred and how that compares to others the same age.
- **Pictures you can understand.** Many systems replay the eye movements as a trace on the screen. Seeing your child's eyes bounce across a line of text is often the moment everything makes sense.
- **Progress you can measure**. Repeating the test during treatment shows whether skills are improving. Optics Trainer also turns therapy into gaze-controlled games, which keeps children (and adults) engaged and practicing.

The Next Frontier: Tracking the Retina Itself

Most eye trackers follow the pupil. A newer approach looks deeper. C. Light Technologies, a company that grew out of vision science research at UC Berkeley, has developed a retinal eye tracker based on a tracking scanning laser ophthalmoscope. Instead of watching the front of the eye, it records a short video of the retina at the back of the eye while the patient looks at a target for about ten seconds.

Because the retina is followed directly, the device can detect extraordinarily tiny movements, on the order of one-hundredth the width of a human hair, which the company reports is about 120 times more sensitive than pupil-based tracking. No dilating drops are needed, and blinking does not spoil the test. The company's retinal eye movement monitor, Retitrack, received FDA clearance in 2023.

Its first focus has been on monitoring neurological conditions such as multiple sclerosis, with research aimed at Parkinson's disease, Alzheimer's disease, ALS, and concussion. It is still an emerging tool rather than a routine part of a vision exam, and NVANT is currently in the trial process of using it in our practice. We are excited about what it may add to how we evaluate and follow our neuro-rehabilitation patients. It reflects something we in neuro-optometry have long believed: the eyes are a window into how the brain is working, and the finer we can measure eye movements, the earlier we may be able to spot problems and track recovery.

Technology Is a Tool, Not the Answer

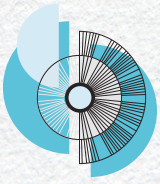
I want to be clear about one thing: no machine replaces a careful evaluation by a doctor who understands how the visual system and the brain work together. Eye-tracking data is most valuable when it is combined with a full assessment of focusing, eye teaming, visual processing, and the patient's own story. The numbers tell us what is happening; clinical judgment tells us why, and what to do about it.

The good news is that eye tracking and eye teaming problems are very treatable. Depending on the findings, care may include a program of vision therapy to retrain the eye-brain connection, therapeutic lenses that help the visual system organize space more efficiently, or both. Objective measurements help us set clear goals and show families real, measurable change along the way.

When to Schedule an Evaluation

If your child struggles with reading despite good effort, if an athlete in your family seems a step behind the ball, or if you or a loved one are still having visual symptoms after a concussion or other brain injury, a functional vision evaluation can provide answers that a standard eye chart cannot. We take eye care well beyond 20/20.

This document does not contain medical advice.



Have A Question? Let Us Know!

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