

Chapter 9

Binocular Vision

Most would agree that the ability to read would require the eyes to work together in tandem, like a team, to gather information from the text presented as printed objects on a page. This is frequently referred to as binocular vision and/or convergence.

A binocular vision problem occurs when the six muscles that each eye uses to control eye movement are not functioning correctly. Each eye also has three different cranial nerves whose duty is to control the muscles in the eye. When the eyes are looking straight ahead, the eyes are in the resting position, when looking at a distance. Normally, the eyes turn in slightly when looking at something close up. Eyes that are not aligned together when doing this have to make heavy corrections to keep from seeing double. This requires extra energy from the brain – and loss of that energy for some people causes fatigue and visual instability.

I could only identify four American states, Alaska, Arkansas, Illinois and Kentucky, that require tests to determine whether children's eyes work together properly. Called binocular vision assessment, it is just as controversial as both Dee's methods for reading instruction and testing students for Irlen syndrome. There are three professions in the U.S. that address vision and, notably, the three disagree on the importance of binocular vision for success in school. Ophthalmologists are medical doctors who focus primarily on the mechanics of the eye. They are doing some work with convergence, or the ability of two eyes to move and work as a team. Optometrists perform vision assessments and prescribe glasses for both distance vision and near vision. They also diagnose issues related to binocular and/or convergence insufficiencies, but appropriate treatment requires additional training. Developmental optometrists routinely test for and treat for binocular and convergence vision problems – and their methods still have limited acceptance with both ophthalmology and general optometry.

The American Optometric Association has published and regularly updates a position statement on vision issues that affect learning. It can be found online at: www.aoa.org/optometrists/education-and-training/clinical-care/vision-learning-and-dyslexia?sso=y.

Fundamentally, the vision professions do not agree on the importance of binocular vision as it relates to learning. Part of the problem is time – it takes a very long time for old ideas to die away and new ideas to take over. Another issue, though, is contradictory research results. The contradictory results frequently involve reading and the assumption that reading should improve if binocular vision improves. Researchers who think this way should reconsider. If Dee is correct and a neural network guides the act of reading, whether or not the neural network was built correctly in the first place ultimately controls whether or not an individual reads well. Suggesting that fixing the vision problem will simultaneously fix the reading problem is fundamentally flawed. True—treatment is likely to improve clarity and stability of the text (which may yield some notable improvement in reading), but it does not fix how the reader actually reads. To fix that, you have to help the student correct the reading problem through coaching.

As I sought to gather information on vision problems, I became acquainted with Helen Spencer. She is a lawyer who lives in eastern Washington State. Helen has been working very hard to gather information on binocular vision issues and to pass it on to school districts, parents, educators and politicians. She is having an impact in

the State of Washington and is continuously growing a group of people who are seeking better vision testing for students in our state.

Helen points out that at least 25 percent of the students in Washington have undiagnosed vision and visual processing needs because screening occurs only for distance acuity. Those who agree with her include a handful of school educators, medical doctors, university students and leaders, parents and others concerned that children and teens are being improperly labeled and, as a result, being denied the help they need. A few of the labels they receive: Dyslexic, Attention Deficit Disorder (ADD), Attention Deficit Hyperactivity Disorder (ADHD), lazy and unmotivated. Logically, some of these kids end up in special education programs, where they receive no vision assessment. Others simply give up on school and act out to compensate. Whatever happens to them, they quickly fall behind their classmates. Many end up dropping out of the school system or becoming involved in unhealthy activities, such as drugs to self-medicate.

It's a messy, life-changing problem – all because we, education leaders, are not leading the charge to get students properly assessed and connect them to effective interventions.

It is estimated that 80 percent of what sighted children learn comes through visual processing (Gazzaniga, Irvy and Jangun,1998). Recent studies estimate that 64 percent of children age five and younger have never had their vision screened by a healthcare professional (Cotch, M.F.) This means a child could be suffering from serious vision problems when they arrive at school – and even after, if regular vision screening isn't performed. Even more alarming: an estimated 40 to 67 percent of children identified with vision problems during school screenings do not receive the recommended follow-up care by an eyecare professional (Donahue, Johnson, and Leonard-Johnson, 2000).

An article by Maureen K. Powers, Ph.D. titled *What the Experts Say about Undetected Vision Problems in School-Age Children* brings out some important points of information. Her report states:

- **According to the College of Optometrists in Vision Development (COVD/developmental optometrists):** most school vision screenings only detect approximately 5 percent of actual vision issues. The COVD estimates that 17 visual skills are required for success in the classroom. The standard vision screening and eye exams only test for a couple of these visual skills. This results in many children with undetected visual difficulties being placed in special education for poor school performance.
- **According to the Mayo Clinic:** Convergence Insufficiency (CI) typically isn't detected in routine eye exams or school-based vision screenings. A child with the condition may be evaluated as having learning disabilities – not vision problems – because of his or her reading troubles. Treatments are usually effective for convergence insufficiency.
- **According to the American Public Health Association:** 25 percent of students in grades kindergarten through 6 have visual problems serious enough to impede learning.
- **According to the Vision Council of America:** an “estimated 80 percent of children with a learning disability have an undiagnosed vision problem.”
- **According to the National Institutes of Health** in a 2008 report, convergence insufficiency (CI) has an adverse effect on students' behavior. In a study of over 200 children with CI, about half saw improvements in school work as well as behavior after just 12 weeks of treatment. An earlier NIH report

(2009) found that children with ADHD or related learning problems might benefit from comprehensive vision tests to assess for CI.

- **According to the National Eye Institute:** a series of studies found that (1) children between the ages of 9 and 18 years who have CI can reliably be detected using a 15-item symptom list; (2) signs and symptoms of CI can be alleviated with visual skill training; (3) parents report that academic achievement-related behaviors improve significantly when CI is alleviated.
- **According to a Canadian research group:** in a controlled study in 2012, the reading speeds of students ages 6 to 16 years with required Individual Education Plans (IEP) were directly linked to reading difficulties correlated with vergence ability (“vergence” is defined as the turning motion of the eyeballs toward or away from each other). Significant differences in other binocular-vision related scores were also found, indicating that there are associations between reading speed and vergence ability. They concluded: “It appears sensible that students being considered for reading specific IEP status should have a ...binocular vision evaluation [prior to assignment to special education status]. (Quaid & Trefford, 2012)

In June of 1999, the National Parent-Teacher Association (PTA) became the first organization to recognize a hidden disability affecting learning and school performance. At the 103rd annual National PTA convention the delegates adopted a resolution to improve children’s vision care. The organization moved to inform people of vision-related problems and wanted schools to include testing for vision related skills that children need in order to be successful in the classroom. In 2006, the PTA recognized the importance of vision for children in schools a second time, and encouraged comprehensive eye and vision examinations by an optometrist or ophthalmologist as important for all children entering school and regularly throughout their school-aged years.

I have a lot of respect for the PTA and the role they play helping parents, teachers and children. Unfortunately, only distance acuity is being used in most states to test vision problems and, as a result, millions of students are in need of intervention. Many of these students, an estimated 85 percent of special education students, could be healed if they had the opportunity to receive the right treatment and were provided with the right kind of reading instruction to correct their reading problems.

When Carolynn and I returned from Tonga in 2008, we reopened the free neighborhood tutoring center and once again made Dee’s methods available to our community. This time, I helped Carolynn operate and manage the center. Soon after we started up again, we received an invitation from a developmental optometrist—Dr. Ben Winters. He wanted to talk to us about our tutoring methods and his work to help children and teens improve their binocular vision. He asked if he could send students to our reading program that had already been to him for vision therapy to correct issues with binocularity because the students were several grade levels behind in reading ability. We agreed, as we had openings, and told him we would also make referrals to him when we found students with binocular vision issues.

This is precisely why researchers should be cautious about using sentence or passage reading to determine whether interventions to address binocular vision issues are effective. Dr. Winters recognized the issue – he could fix the binocular vision problem, but his methods could not fix the underlying reading problem.

The result of our collaboration with Dr. Winters has been powerful. Together, we feel as though we are helping students in every respect remove the “invisible barriers” that have prevented their success in school. It has to be

one of the greatest feelings I have personally experienced. When you hand a student a certificate graduating them from a reading program, knowing their reading and vision problems are both solved, it is very satisfying.

“Every parent wants their child to be successful in school,” notes Dr. Winters. “But, as many as three to five children in every classroom have vision problems that keep them from attaining their highest level of success. Four out of five classroom hours each day involve near-vision work that is less than an arm’s length from the child’s eyes. Many children and adults cannot handle such intense, prolonged near vision work.”

When observing a young child learn to read, Dr. Winters suggests parents watch for these issues:

Reading Checklist

- Skips words while reading
- Overlooks or misreads short sentences
- Takes hours to do a few minutes of homework
- Rubs eyes, has red eyes or gets headaches
- Poor concentration when reading
- Cannot comprehend material that has been read. Must reread to obtain meaning
- Falls asleep or gets tired when reading
- Slow or hesitant reading even when rereading material
- Attention span shortens when doing intense close up work
- Must use finger/marker to hold place when reading

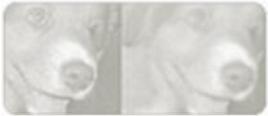
All of these issues indicate a reading problem. The question is, what is the source? Is the problem caused by the way a child reads (a flawed neural network guiding the process), or is the problem caused by an underlying problem with vision or visual processing? If the reading problem is fully corrected through a vision intervention (glasses or vision therapy), I would suggest the sole problem was vision. If the reading problem does not resolve, then it is possible an underlying reading problem also exists. For this reason, I am an advocate of seeing that children and teens receive both vision intervention and an effective reading intervention.

I would also add these issues to the Reading Checklist:

- Double images during reading
- Print that moves during reading
- Avoidance of reading because it is uncomfortable
- Difficulty learning to read

- School performance that is lower than a child's ability

The Bernstein Centers in White Plains, New York and Darien, Connecticut were created to provide state-of-the-art diagnosis and treatment of binocular vision problems. Dr's. Ira and Paul Bernstein are Developmental Optometrists. Charts 1 and 2 that follow are published with their permission and speak to specific symptoms they have identified and short descriptions of each.

| <i>CHART 1</i> | | |
|---|---|--|
| <i>Partial Symptoms</i> | <i>Short Description</i> | <i>Page Links / Learn More</i> |
| <p><i>Moves head excessively when reading, reads slowly, uses finger to keep place, short attention span (more) go to:</i> http://www.bernsteincenterforvisualperformance.com/eye-movement-problems-oculomotor-dysfunction-or-omd</p> | <p>Eye Movement Problems - <i>Inability to smoothly and accurately move the eyes from one target to another.</i></p> |  <p>Eye_Movement</p> |
| <p><i>Holds things very close, blurred vision, headaches, reads only for a short time, slow copying skills (more) go to:</i> http://www.bernsteincenterforvisualperformance.com/eye-focusing-problems-accommodative-dysfunction</p> | <p>Eye Focusing Problems - <i>Inability to easily refocus eyes, or maintain clear focus, particularly up close.</i></p> |  <p>Eye_Focusing</p> |
| <p><i>Blurred Vision, Double Vision, Eyestrain or Eye Ache, Decreased reading comprehension (more) go to:</i> http://www.bernsteincenterforvisualperformance.com/eye-teaming-problems-binocularity-convergence</p> | <p>Eye Teaming Problems - <i>Inability of both eyes to work together to process visual images properly.</i></p> |  <p>Eye Teaming</p> |
| <p><i>Trouble telling left from right, letter and word reversals, motor planning deficits (more) go to:</i> http://www.bernsteincenterforvisualperformance.com/perceptual-problems</p> | <p>Perceptual Problems - <i>Mimic symptoms of ADD / ADHD - but are binocular vision problems...</i></p> | <p>*</p> |
| <p><i>Difficult for parents to detect, infant may cry when one eye is covered, or favor one side (more) go to:</i> http://www.bernsteincenterforvisualperformance.com/lazy-eye-amblyopia</p> | <p>Amblyopia, Lazy Eye - <i>Vision - Neuro interface rejects the image from the lazy eye.</i></p> |  <p>Amblyopia</p> |
| <p><i>Eye turns in, out, up, or down. Appearance problem and a vision problem. Mild forms hard to detect (more) go to:</i> http://www.bernsteincenterforvisualperformance.com/strabismus-cross-eye-wall-eye</p> | <p>Strabismus - Cross Eye, Wall Eye, Wandering Eye - <i>eye alignment problem - mild to severe.</i></p> |  <p>Strabismus</p> |

| <i>CHART 2</i> | | |
|---|--|--|
| <i>Partial Symptoms</i> | <i>Short Description</i> | <i>Page Links / Learn More</i> |
| <i>Kids with coordination problems, athletes of all ages wishing to improve performance (more) go to: http://www.bernsteincenterforvisualperformance.com/sports-enhancement-vision-therapy</i> | <i>Sports Enhancement -</i> <i>Uses comprehensive vision exam to identify sports related vision problems</i> |  <i>Sports Enhancement</i> |
| <i>Strokes, ABI's, and TBI's cause significant binocular vision problems (more) go to: http://www.bernsteincenterforvisualperformance.com/post-tbi-abi-vision-therapy</i> | <i>Post TBI, Stroke -</i> <i>Diagnosis and treatment of vision disorders from stroke, ABI, TBI</i> |  <i>Post TBI, Stroke</i> |
| <i>Headache, unusual fatigue after computer use, Eye Strain, distance blur (more) go to: http://www.bernsteincenterforvisualperformance.com/computer-vision-syndrome</i> | <i>Computer Vision Syndrome -</i> <i>Acquired condition from heavy computer usage</i> |  |

Something important to note: a struggling reader may not even be aware that they are struggling to compel the eyes to work together properly. The work is occurring implicitly – or, below the level of conscious awareness. The reader may only know they don't like to read or it makes them feel tired. In truth, it does make them tired because the brain has to expend a great deal of energy to force the eyes to work together. They may also experience visual anomalies that might cause them to sound "crazy" if anyone ever asked them what they "saw" on the printed page. They may perceive text as moving, rising or falling or they may focus too much on the white spaces between words because they connect together and look like rivers flowing down the page. The struggle can cause inaccuracies while reading, as well as discomfort like headaches, inattention, inability to sustain tasks and problems in sports related to poor depth perception.

Binocular vision problems are not the only issues that can arise with near-vision. Here are three others. The vision professions recognize the first two and one is not:

Ocular Motility

Ocular motility refers to the ability to focus the eyes in a specific direction and follow a moving object almost effortlessly for a reasonable amount of time. Eye movements require coordination and a degree of precision. If reading requires scanning text to gain information from the print, then it stands to reason that the eyes must work together properly to gather this information with as little effort as possible. Each time a reader scans a page of text, he must – to varying degrees, depending upon the complexity of the text – move the eyes to find information that helps the brain reconstruct the author's language and intended meaning.

Optical Fusion

Optical fusion is the combining of images from the two eyes to form a single visual percept. This skill relates to the balance and coordination of the two eyes; i.e. the ability of the two eyes to work together as a team at all distances (near, intermediate, far) and in all positions of gaze (left, right, up, down, etc.). Issues with optical fusion can have a direct impact on the ability to perform physical activities (e.g., sports), because of resulting poor depth perception.