

3-D: Our Brain's Work of Art

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Pablo Picasso said, “I paint objects as I think them, not as I see them.” We really don’t see with our eyes, but with our brain. This is especially true when it comes to depth perception.

Difficulty with depth perception may lead to difficulty scoring a goal, judging distances in traffic or watching *Avatar* in 3-D. Fortunately, we have methods for evaluating and treating these issues. A comprehensive eye exam early in life is crucial for those with albinism because an immature visual system is more mendable with treatment.

Just as artists use shading and geometric principles to create the illusion of three dimensions on a canvas, the brain constantly transforms light into the viewer’s perception of three-dimensional surroundings. In patients with albinism, this sense of depth perception is often disrupted, usually because of problems related to the optic nerve or strabismus.

Causes

The optic nerve connects our eyes to our brain, transmitting impulses independently from each eye to be blended together and perceived as our surroundings. This blending of two images into one is known as fusion, and it happens at the optic chiasm, where the optic nerve fibers partially cross before connecting at the occipital cortex. This crossing is critical for depth perception because it enables information from each eye to go to both sides of the brain’s visual cortex. In people with normal eyesight, approximately 50% of nerve fibers cross while the remaining 50% remain on the same side. In many patients with albinism, more than 50% of fibers cross. As a result, the brain receives an abnormal signal,

thus the difficulty with depth perception.

Strabismus, or the turning of an eye, is another condition that can occur with albinism. Visual confusion may result because the fovea (the center region in back of the eye responsible for detailed central vision) in each eye receives a different image than it should because of the eye turn, confusing the brain’s ability to interpret the combined images from the two eyes. In visual confusion, different objects are seen in the same place. In diplopia, or double vision, the image is seen twice.

When strabismus occurs while the visual system is immature, the brain will often develop ways to adapt. The adaptations work to reduce the issue by not using both eyes equally.

Visual suppression may occur solely in one eye or may alternate between both eyes. In the condition amblyopia or “lazy eye,” the brain ignores the deviated eye. In a third adaptation, which usually occurs when strabismus is long-standing, one can develop a sensory adaptation called anomalous retinal correspondence (ARC) in order to eliminate double vision. In ARC, the brain uses a non-central spot in the deviated eye to create its picture, resulting in inadequate binocularity and decreased depth perception.

Symptoms

Symptoms include headaches, double vision, eye fatigue, difficulty reading or concentrating and irritability. A child might cover one eye or tilt his head to eliminate the issue. Performance in school may suffer if the child tends to lose her place when reading or skips lines.

Even if these symptoms are not experienced, a thorough eye exam is needed anytime there is a suspected vision problem.

In some cases, the Visually Evoked Potential (VEP) or Visually Evoked Response (VER) test may be used to evaluate the function of the visual pathway from the retina to the visual cortex of the brain. This test records electrical potential from the nervous system in response to a visual stimulus.

Treatment

The first step toward full usage of one's binocular ability is an accurate eyeglass or contact lens prescription which often aids in the alignment of the eyes.

If strabismus is the root of the problem,

special eyeglasses with “prism lenses” can be helpful. There are also methods to force the deviated eye to be responsible for fixation and alignment: the non-deviated eye can be patched for a few hours per day or treated with atropine drops to dilate the pupil.

Many specialized practitioners can provide vision therapy. Although the initial test is usually covered by medical insurance, the vision therapy training is usually an out-of-pocket expense. Try to find a practitioner who is a Fellow of the College of Optometrists in Vision Development (COVD), a board certification for eye doctors and vision therapists who specialize in behavioral and developmental vision care, vision therapy and vision rehabilitation.