

# Visual information processing

What is it? | How is it assessed? | How is it treated? | Does it affect academic performance?



## What is visual information processing?

There are a large number of identifiable visual processing skills operating within the visual system. There are different systems to describe these functions. One approach is to divide visual information processing into the following functions: visual cognition, visual memory, pattern recognition, scanning and visual attention. These functions can be described as follows<sup>1</sup>:

*Visual cognition:* The ability to mentally manipulate visual information and integrate it with other sensory information to solve problems, formulate plans and make decisions. It includes the ability to analyze similarities and differences, to understand the relationship of stimulus elements to one another, and to reason and deduce about the nature of visual stimuli. It also includes the ability to use contextual cues to help in the development of meaning from the image.

*Visual memory:* The ability to visually process stimuli, store them in memory and retrieve them upon command. The individual must also be able to match what they see with what is stored in memory.

*Pattern recognition:* The ability to identify the salient features of an object including configural and holistic aspects such a shape, contour, and general features, such as color, details, shading, and texture. It is important for the individual to be able to recognize objects even when viewed from different or obscure angles (perceptual constancy).

*Scanning:* The ability to record all details of a scene systematically in an organized and thorough manner. The route taken is known as the scan path. The eyes obtain and process information by executing a series of broad sweeping cycles with reexamination of the most important details several times to ensure identification. These eye movements are called saccades. Saccadic eye movements are normally executed in an organized, systematic, and efficient pattern.

*Visual attention:* The ability to attend to stimuli and shift attention between stimuli.

## How are visual information processing deficits treated?

Due to a brain injury or organic causes an individual may have deficits in one or more components of visual information processing. The best illustration of vision therapy in the treatment of visual processing disorders comes in patients with brain injuries, as the presence of an injured brain makes treatment more challenging. Vision therapy or training has been shown to successfully treat visual processing deficits even in the presence of brain injuries. A number of studies taken from neurological, optometric and occupational therapeutic literature show the effect of visual processing therapy and training on visual processing deficits<sup>2</sup>.

---

<sup>1</sup> Raymond et al. **Rehabilitation of visual processing deficits following brain injury.** NeuroRehabilitation. 1996;6 229-2404.

<sup>2</sup> Ibid.

## Who is qualified to assess visual information processing disorders?

Raymond et al. recommend that the assessment of visual processing should be done by an optometrist – not an ophthalmologist<sup>3</sup>. The ophthalmologist, according to the authors, does not have the expertise to make the assessment. The study authors note that patients:

should be referred to a behavioural or neuro-optometrist. It was also noted that referrals made to an ophthalmologist may be insufficient, as they are primarily concerned with the health of the eye only, and ophthalmologists are mostly experienced with acute medical problems rather than rehabilitation issues. This assertion is supported by considering the typical components of an ophthalmologic exam, which may yield a lack of specificity, and/or provide information which is inadequately defined in terms of rehabilitation consequence. Trobe, Acosta, Kirscher and Trick identify a lack of measurement in areas of distance and near acuities, contrast sensitivity and confrontation, while Gianutsos and Matheson describe a need for greater quantification in terms of field gradations and boundaries, and binocularity conditions. A more thorough investigation is important for the rehabilitative efforts of all patients who demonstrate visual processing deficits.

Ophthalmologists are excellent surgeons and expert at treating acute disease but their expertise does not extend to the diagnosis or treatment of visual processing deficits.

## Do visual information processing deficits impact academic performance?

According to several studies, the answer is, "yes".

One example is a 2005 study by Goldstand et al. published in *The American Journal of Occupational Therapy* entitled "Vision, Visual-Information Processing, and Academic Performance Among Seventh-Grade Schoolchildren: A More Significant Relationship Than We Thought?"<sup>4</sup>

The researchers (consisting of professors of optometry and occupational therapy), set out to compare visual and visual-information processing skills between children with and without mild reading and academic problems and examine the incidence of visual deficits among them. They found that visual function significantly distinguishes between children with and without mild academic problems, as well as on visual-perception scores.

Another study published in *Optometry and Vision Science* in 2002 by Kulp et al.<sup>5</sup> found that poor visual memory (one component of visual information processing) as significantly related to below-average reading decoding, math, and overall academic achievement (as measured by the Stanford Achievement Test) in second- through fourth-grade children, while controlling for age and verbal ability.

---

<sup>3</sup> Ibid.  
<sup>4</sup> Goldstand et al. **Vision, visual-information processing, and academic performance among seventh-grade schoolchildren: a more significant relationship than we thought?** *The American Journal of Occupational Therapy*. 59: 377-389.  
<sup>5</sup> Kulp et al. **Is visual memory predictive of below -average academic achievement in second through fourth graders?** *Optometry and Vision Science*.2002; 79(7): 431-434