



Perception Dynamics Institute  
P.O. Box 231305  
Encinitas, CA  
USA 92023-1305

Email: [tlawton@pathtoreading.com](mailto:tlawton@pathtoreading.com)  
Telephone: (310) 903-6009  
[www.PATHtoReading.com](http://www.PATHtoReading.com)

## **How *PATH to Reading* Improves Reading Fluency, Attention, and Memory**

Research has found that improving the brain's neural timing is essential to measure improvements in reading that are sustained over time. Unless the brain's timing is tuned up to enable the 'where' pathway (dorsal stream of magnocellular neurons) to signal the 'what' pathway (ventral stream of both parvocellular and magnocellular neurons), cognitive processes such as reading, paying attention, and remembering are impaired. Path To Reading remediates the timing deficits of dyslexia and improves timing deficits for all readers, especially those children in the early developmental stages of reading.

Research has found that if *PATH to Reading* is used for 10-20 minutes twice a week immediately before guided reading or homework, these students exponentially improve in literacy as well as drastically increase their ability to pay attention and retain new information.

The first program in *PATH to Reading*, the *Motion* program, improves a basic type of neural processing that is necessary to become a proficient reader. Before one can even learn to recognize letters and words, the brain must learn how to “see” those letters and words clearly. Neural pathways must be capable of detecting and localizing the rapidly changing incoming patterns (this requires motion sensitive cells) and performing detailed discrimination on those localized patterns (this requires pattern sensitive cells). For this to happen smoothly, the motion-sensitive cells must signal the pattern-sensitive cells so they know what incoming information to discriminate, like signaling the beginning and end of a word. Children with reading problems, such as those with dyslexia, attention deficits, or autism, have sluggish motion cells that do not properly signal the pattern-sensitive cells. Therefore these readers cannot isolate and identify letters and words from the sea of incoming visual features. In this case, hesitant, poor reading results.

Fortunately, neurobiological research has discovered that it is possible to “tune” the motion cells to improve reading skills. This tuning, called Motion–Discrimination Training, trains the brain to see direction of motion as faint patterns move left or right on varied backgrounds. This improves the sensitivity and speed of the motion cells in the dorsal cortical visual stream, and permits these cells to signal the pattern-sensitive cells in the ventral cortical to stream properly. Hence the pattern cells can isolate and process letters and words, thereby unlocking the ability to read. .

Motion-discrimination, or *Motion*, training is the basis for *PATH* therapy. This therapy is patented in the U.S. and worldwide, and has been used successfully for thousands of children in controlled-validation studies in more than 25 different public elementary schools over the past several years. *PATH to Reading* is used most effectively before regular directed reading. With only 15 minutes of *PATH* training 2-3 times a week for 3-6 months, our team found that most reading skills improve permanently, with reading speed improving from 2 - 10 fold and attention and memory retention

improving from 1 to 3 grade levels in dyslexics, and others with learning and attention deficit challenges.

While the *Motion* program is designed to tune early levels in the dorsal visual pathway, the *MotionMemory* program extends the range of cognitive deficits that can be treated rapidly. *MotionMemory* requires signaling the direction for two separate patterns, one after the other, by pushing one of four arrow keys. This task flexes the anterior portions of the dorsal stream in the frontal areas of the brain, as well as the dorsal-lateral prefrontal cortex, a center for working memory and attention.

Recent MEG, fMRI, and PET studies indicate for individuals whose cognitive processing is slowed by disorders such as dyslexia, convergence insufficiency, attention deficit disorders, autism, schizophrenia, old age, or Traumatic Brain Injury (TBI) have superficial processing inadequate for reading. *MotionMemory* is the only tool designed to address these timing deficits by requiring the use of working memory and multitasking elements in addition to the attention, sequential processing, and motion discrimination required by the *Motion* program. For example, TBI patients who have used both *Motion* and *MotionMemory* in the *PATH* therapy program have improved up to 10 fold in cognitive processing skills, including speed of processing, multitasking, focusing attention, memory retention, and sequential processing. This improvement in the brain's processing speed, reading speed, attention, memory, and comprehension is also permanent!

***PATH to Reading*** is an essential tool, available for both Macintosh and Windows computers, for children and adults who have reading or cognitive issues, especially speed of processing, attention, or reading comprehension problems. *PATH to Reading* permanently improves the brain's visual neural timing, opening up the attention gateway, and improving working memory. The longer *PATH to Reading* is used, the more reading and cognitive skills improve. Controlled validation studies prove that *Path to Reading* is a singular, 21<sup>st</sup> century approach without comparable programs that improves reading fluency by tuning the brain's neural timing at both early and late levels in the dorsal cortical pathways.

*For more information read:*

Lawton, T. (2019) Increasing visual timing by movement discrimination exercises improves reading fluency, attention span, and memory retention in dyslexics, *Neurology and Neurosurgery*, 2: 1-8, Doi:10.15761/NNS.1000118.

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Lawton, T., & Shelley-Tremblay, J. (2017). Training on movement figure-ground discrimination remediates low-level visual timing deficits in the dorsal stream, improving high-level cognitive functioning, including attention, reading fluency, and memory. *Frontiers Human Neuroscience*, <https://www.frontiersin.org/articles/10.3389/fnhum.2017.00236/full>.

Lawton, T. (2016). Improving Dorsal Stream Function in Dyslexics by Training Figure/Ground Motion Discrimination Improves Attention, Reading Fluency, and Working Memory. *Frontiers Human Neuroscience*, 397, doi:10.3389/fnhum.2016.00397.

Lawton, T. (2011) "Improving Magnocellular Function in the Dorsal Stream Remediate Reading Deficits", *Optometry & Vision Development*, 42:3, 142-154.