SYNTONICS AS READING ENHANCEMENT TECHNIQUES AT THE LIVINGSTON DEVELOPMENTAL ACADEMY

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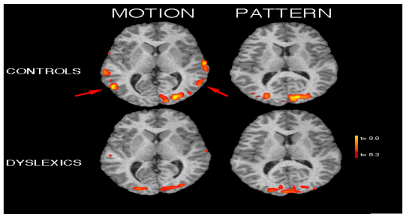
Integrated Visual Learning (IVL),
Syntonics, Visagraph,
Developmental Education, Learning Disabilities,
Reading Instruction

INTRODUCTION

Eye movement, visual attention and visual processing skills are highly correlated with reading performance. Many studies have pointed to the high incidence of visuomotor deficits among poor readers[1]. Recently, fMRI, PET and anatomical evidence of magnocellular defect[2], V5 depression[3] and metabolic depressions of the prefrontal cortex and caudate nucleus[4] among the reading disabled implicates visual perceptual/attentional/cognitive dysfunctions in those with attention and reading problems. The following fMRI scan[5] shows the metabolic depression found in areas associated with magnocellular motion detection in poor readers.



Oculomotor function (particularly saccadic and binocular fusion skills) is dependent primarily upon peripheral or magnocellular input. Peripheral field awareness thus becomes a critical factor in reading via its importance to oculomotor accuracy. Techniques to enhance functional visual field awareness may prove useful in improving oculomotor accuracy, visual perceptual/attentional/cognitive skills and reading performance.

Syntonics is believed to be useful in the expansion of visual field awareness[6]. **Integrated Visual Learning** is a method to expand visual attention and multi-tasking performance in motor, perceptual, integrative and cognitive tasks[7]. This study is designed to

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[1] Garzia RP, Sesma M. Vision and reading 1: neuroanatomy and electrophysiology. J Optom. Vis Develop, Spring 1993:24(1):4-51.
[2] Breitmeyer BG. The role of sustained (P) and transient (T) channels in reading and reading disability. In: Wright SF, Groner R. (Eds.). Facets of dyslexia and its remediation. Amsterdam: Elsevier Science Publishing, 1993:13-31.
[3]Eden G. NIMH Laboratory of Brain and Cognition. Nature Vol386, p610. April 10, 1997.
[4]Casey BJ, Castellanos FX, Giedd JN, Marsh WL, Hamburger SD, Schubert AB, Vauss YC, Vaituzis AC, Dickstein DP, Sarfatti SE, Rapoport JL. Implication of right frontostriatal circuitry in response inhibition and attention-deficit/hyperactivity disorder. J Am Acad Child Adolesc Psychiatry 1997 Mar;36(3):374-83.
[5]Eden G NIMH Laboratory of Brain and Cognition Nature Vol 386. April 10, 1997.
[6]Spitler HR The syntonic principle. College of Syntonic Optometry. 1941

investigate the impact of syntonics and Integrated Visual Learning techniques on visual field awareness, oculomotor function and reading efficiency.

SYNTONICS

Syntonics is the therapeutic application of selected wavelengths of light upon the visual system. The substantial retinal connections to the reticular, limbic and endocrine systems via the retinothalamic tracts have been hypothesized to be of importance in the regulation of attention, emotions, endocrine function and growth and body structure[8]. In general these effects are hypothesized to be mediated via the autonomic and endocrine systems. Resonance between the molecular structure of certain neuropeptides and light frequencies of the therapeutic light are the presumed mechanism of action. On a cellular level information is transmitted across the cell wall via the steric properties of embedded mucoproteins. The steric configurations of these messengers are impacted by electromagnetic field changes that can be altered by the presence of ionic molecules or by various light wavelengths depending on the resonance and steric properties of the messenger molecules. All elements of the periodic table have resonance frequencies that match particular wavelengths of light. The spectral specificity of matter leads to the interesting hypothesis that matter is "frozen" light. Various authors have postulated that light will increasingly be used medicinally. The resonance relationship between light and matter points to intriguing possibilities.

Syntonic principles posit that short wavelength (blue) light is stimulatory to parasympathetic and long wavelength (red) light to sympathetic systems. Establishing balance between sympathetic and parasympathetic stimulation through the use of various wavelengths is an important tenant in syntonic therapy.
Optometric findings guide the syntonist as to a patient's autonomic balance. Filters are prescribed in an effort to create balance between sympathetic and parasympathetic systems. Excessive sympathetic stimulation as is common from stress has a constrictive impact on fields of awareness. A prime indication for syntonic application is a constricted kinetic visual field. Appropriate syntonic therapy brings about an expansion of kinetic visual fields.

INTEGRATED VISUAL LEARNING

Integrated Visual Learning (IVL) is a series of sequenced motor, attentional, perceptual and cognitive techniques designed to facilitate a shift in habitual attentive distribution. Neurological skills are built along a hierarchy matching the sequences observed in normal development. The culmination leads to competent visuomotor and visual cognitive skills.
Application of visual thinking strategies to academic tasks is the final stage of IVL therapy. IVL therapy was developed based on a model of neurological development described by the following schematic:

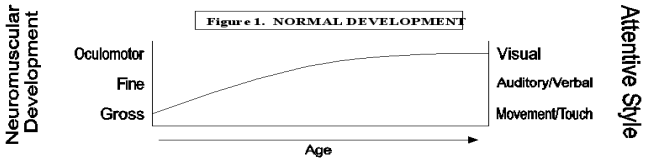

Figure 1. Etiology of normal attention/learning/behavioral habits

We believe that most academic failure results from problems of development and the resultant impact on attentional habits as is shown in the following schematic.

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[7]Ingersoll SJ Lecture: European College of Behavioral Optometry. London May 1997.
[8]Spitler HR The Syntonic Principle. College of Syntonic Optometry. 1941.

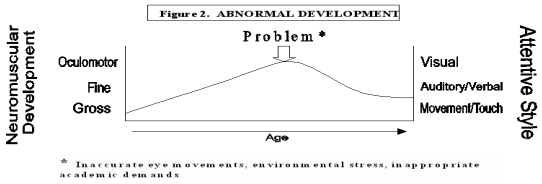


Figure 2. Etiology of abnormal development

Many learning disabilities are the result of embedded adaptive attentional distributions born of a mismatch between environmental/academic demand and neurological development. We believe that many learning disabilities can be prevented by emphasizing neurological development before academic demand. This, of course, requires a new emphasis on teacher training. Teachers need to be trained in understanding and recognizing student's learning methods and state of neurological development as opposed to emphasizing how to present data. Most underachieving students fail because they are not processing information the same way as the successful students. Children learn their learning styles. Teachers need to understand why, how and when differing learning styles emerge. The following figures illustrate a few common learning problems and their etiology. **IVL** techniques address these types of adaptive learning anomalies.

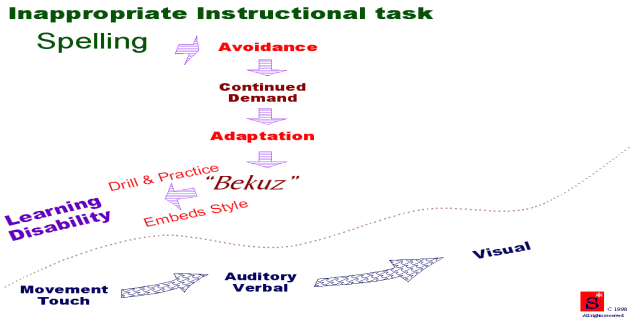


Figure 3. Etiology of Phonetic Spelling

The sequence of attentional and cognitive development must be understood and is a crucial factor in the etiology of inefficient learning habits. In the above schematic the task of spelling is inappropriately introduced to a child before visual cognitive skills have developed. Consequently, the child avoids the task initially. When the unwitting educator/parent presses the demand, the child is forced to adapt. The child learns to execute the task using the "tools" available at that point in development, in this case, an auditory approach to spelling emerges. As this approach is not particularly effective, the child is pressed to "practice" which only serves to embed the inefficient learning style. As the child falls further behind his peers (who have adopted the more efficient visual recognition approach to written language) it is typical for the curriculum to be modified to match the child's learning style. This "teaching to strength" only serves to further embed the very thing that is the problem! The following schematics illustrate some common problems, contributing causes and IVL solutions found in many underachieving students.

Problem: Can't recall math facts long term

Cause: Delays in visual cognitive development can cause some children to learn to handle math facts in a non-visual way. Typically, we see these children compute the answers to single digit math facts. Thus it is common for them to get right answers given enough time, but fail on timed tests. The following diagram shows the etiology.

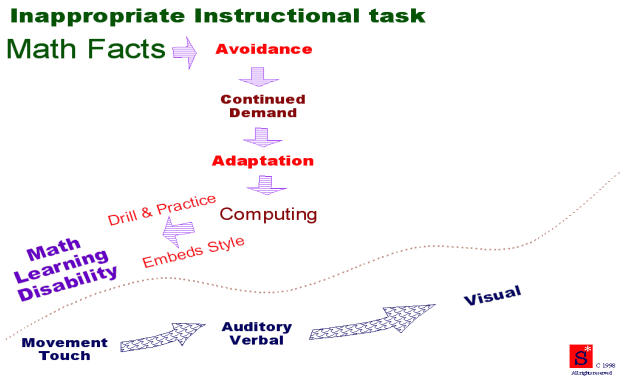


Figure 6. Etiology of math disability

Many underachieving children compute or count up the basic math facts. A much more efficient method of processing or remembering these math facts is to utilize eidetic or visual memory. Indeed, this is the method the reader of this paper likely uses. We, who are successful in this skill remember "the look" of the equations. Again, the etiology of the computation learning habit is a function of the timing of the introduction of the task relative to the child's state of visual cognitive competence.

Solution: IVL treatment starts with remediation of the oculomotor and visual cognitive deficits followed by "loading" the math facts into visual memory. This process is similar to the IVL method of teaching spelling and word recognition. Visual memory drills involving the recall of objects, pictures, geometric forms, symbols and finally letters, words, numbers and equations as stimuli are sequentially presented. The area of the brain that is metabolically active during these demands is the prefrontal cortex. Prefrontal cortex activity not only is associated with more efficiency in the recall of written symbols but also reinforces the type of brain metabolism associated with normal visually directed explorative activity, normal attentional characteristics and normal affect. Metabolic depression of the prefrontal cortex is one of the neurometabolic markers associated with ADHD, sleep disorders, obsessive-compulsive disorder and dyslexia. Hence, activity that increases prefrontal cortex metabolism is supportive to other important functions.

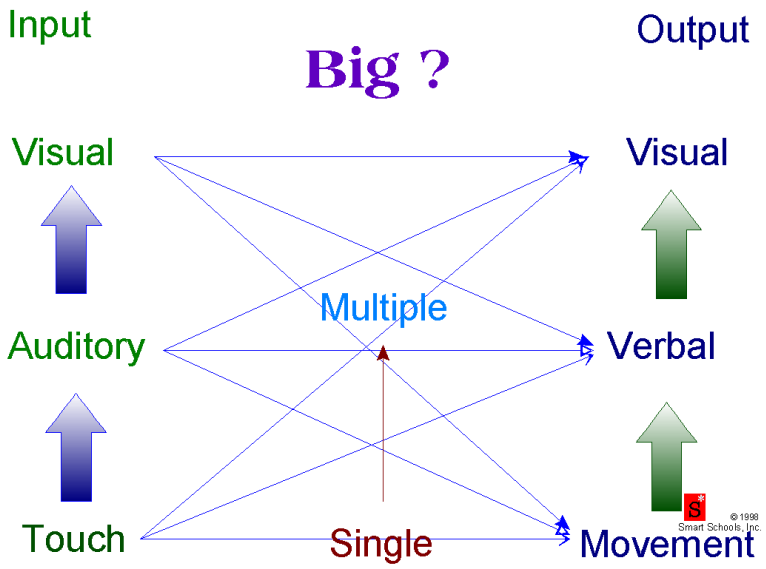
PROBLEM: Letter reversals and right/left confusion

Many children have difficulty making orientation distinctions early in their development and sometimes this difficulty persists longer than normal.

CAUSE: Delays in the normal sequence of motor/tactile development can sometimes impact a child's body awareness. Developing an internal "image" of one's own body is a crucial first step in developing laterality skills. We first learn about right/left and up/down by understanding our own body structure. The reason that right/left confusion (b/d) is more frequent than up/down (p/d) confusion is that the body is symmetrical along the vertical axis but not along the horizontal axis (the hands look almost alike but the head and toes are very dissimilar). Children who have not developed good imagery regarding their own body structure often have laterality confusion.

The second and most common cause of laterality confusion is the inability to project body laterality awareness out onto the environment as a result of eye movement and/or visual processing problems. Children with this type of problem will be able to determine which is their right or left hand but will make frequent and persistent reversals of letters and words.

SOLUTION: IVL treatment for this problem begins with drills to hone the child's awareness of body structure. Beginning drills involve single body systems and gradually moves to drills involving multiple body systems in ever-increasing complex combinations of movements. The input stimuli are sequenced from touch to sound to visual, thus paralleling the progression of neurological development of the central nervous system. The following diagram outlines the treatment strategy in terms of input stimuli and output demand. It is of critical importance to assess the type of information processing that is employed by the child (Big Question?)



Ultimately the child learns how to execute accurate eye movements which is the foundation to developing visual attention and allows visual discrimination skills to emerge. When the child is skilled at visually making accurate judgement about physical space, this becomes the dominant method of determining laterality judgements and he is able "to see" when letters are reversed.

Problem: Hyperactivity, overly tactile, excessive fidgeting

Cause: Many children who are too physically active are overly reliant on touch as their means of gathering information for their surroundings. A natural progression in development allows "visual touch" to replace tactile experience. When accurate eye movement is present visual perception matches tactile perception and vision can be substituted for touch experiences. Since visual exploration is so much more efficient, this mode of exploration becomes dominant. Children who are not consistently accurate in the execution of eye movements do not enjoy the match between vision and touch experience. This is a major cause of persistent physical explorative behavior. It is normal for touch to be the dominant mode of exploring at early stages of development before consistency in visual motor accuracy appears. Children come out of the "terrible twos" when they begin to substitute vision for touch. It is visual motor and visual perceptive accuracy that allows this important transition. The following schematic will help to illustrate the problem.

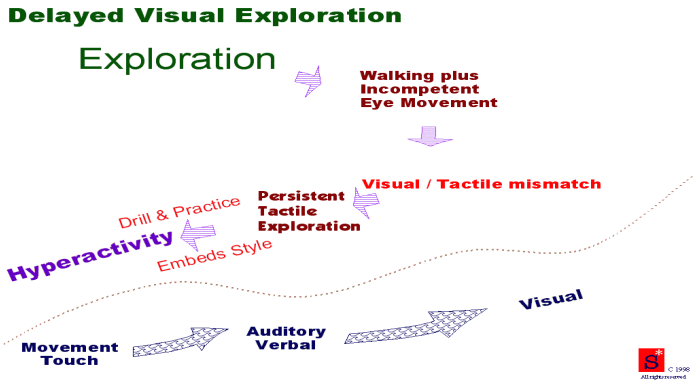
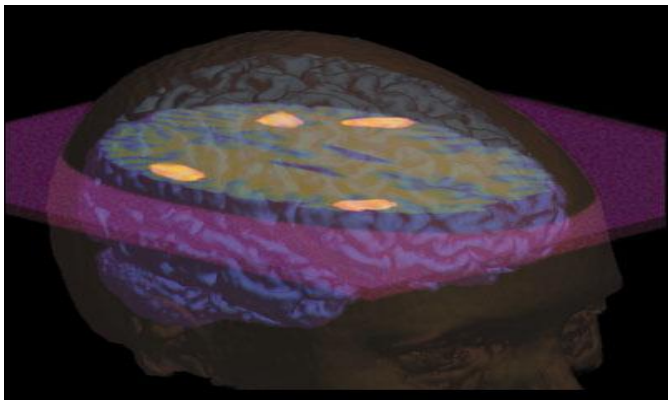


Figure 5. Etiology of hyperactivity

Overly active children are displaying explorative behavior that is not as visually driven as the norm. This is a mark of delay in the

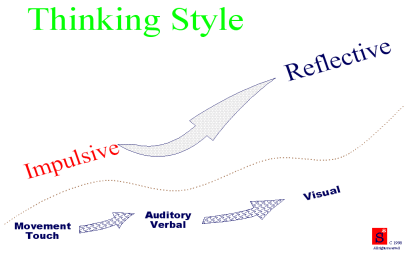
development of oculomotor competence which is a necessary precursor to visual attention. Those children who have yet to develop consistently accurate oculomotor functions tend to have variable visual perceptive experience. Unreliable visual perception stands as a blockade to visually driven exploration. This leaves tactile experience as the most consistently reliable input channel with which to explore. We believe that "hyperactive" children are children who have not yet learned to explore their environment visually. They have yet to transition beyond the tactile stage of exploration that we all relied upon earlier in our development. This line of thinking, of course, begs the question of whether pharmaceutical inhibition of physical exploration benefits or harms such children. We believe that helping children to become visually more competent motorically, attentively and cognitively is a far superior approach to the all too common pharmaceutical treatment of hyperactive behavior. Indeed, at the Livingston Developmental Academy we are virtually "drug free" having succeeded in discontinuing medical treatment in over 50 "hyperactive" children in our first year of operation (1996-97 academic year).

Recent functional magnetic resonance imagery (fmri) research has shown that individuals with hyperactivity and attention problems have metabolism differences in the areas of the brain responsible for visual thinking. Functional mri is a technology that measures changes in magnetic fields and allows images to be produced to show "where thinking is taking place". The prefrontal cortex is the spot of visual memory and is shown in the following fmri image.



Individuals with hyperactive and attention problems show less than normal activity in the visual thinking area (prefrontal cortex). We believe that by teaching these individuals to "do their touching visually" a change in behavior and brain metabolism will result.

Solution: IVL therapy is designed to establish normalcy in oculomotor function. Accurate eye movement then supports accurate visual perception and ultimately a transition to a more visually dominant exploration pattern. As visual skills improve physical activity will be replaced with visual exploration and impulsive behaviors will become more reflective.

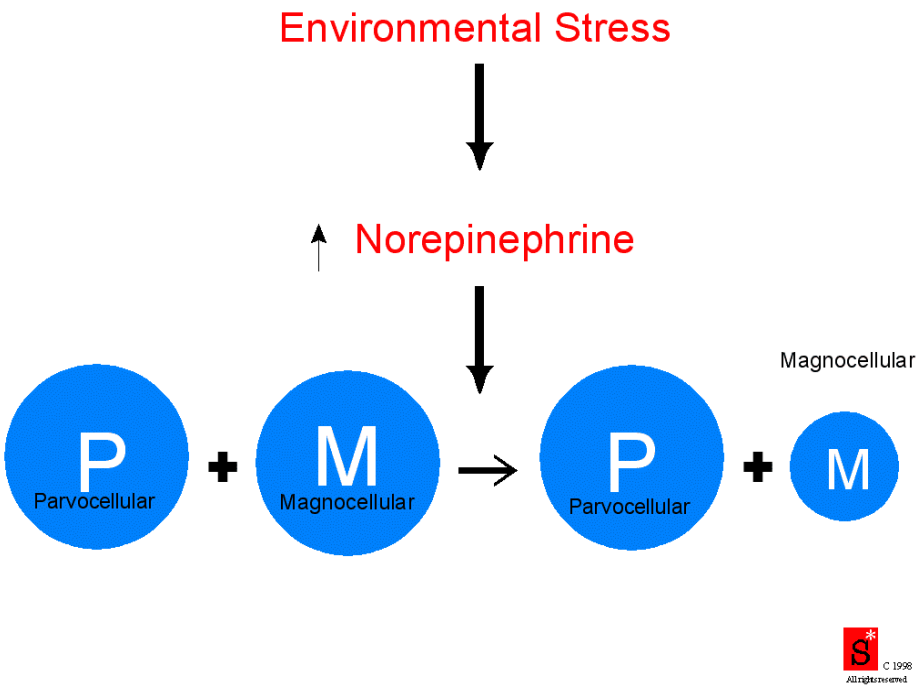


Seeing into the future, predicting potential consequences of actions helps modify impulsive behavior. Physical touch is gradually replaced by the more efficient and more behaviorally acceptable "visual touch".

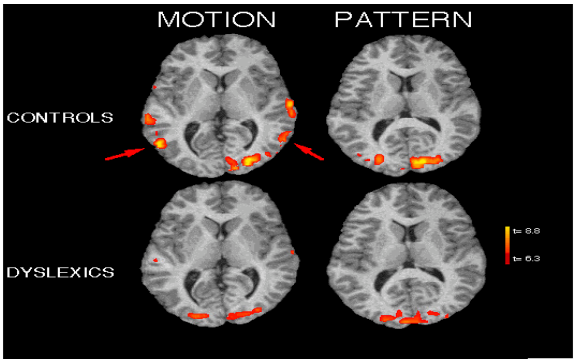
PROBLEM: Loss of place in reading

Many children seem to need to use their finger to keep their place in reading.

CAUSE: Children who lose their place when reading quite commonly have difficulty executing saccadic eye movements with accuracy. Saccadic eye movement is the type of eye movement "jump" that we make when moving word to word across a line of print. Successful saccadic accuracy depends heavily upon awareness in the peripheral visual field. Many studies have shown that most poor readers have poor awareness and delayed processing in their peripheral visual fields. This condition has been called the magnocellular defect (magnocellular refers to the type of cell that carries information to the brain from the retinal periphery). Using the finger or a straight edge does not solve the problem. These compensatory strategies do, however, make it easier to re-find the place after the eye movement mistake has occurred. Stress also plays an important role in reducing awareness in the peripheral or "magnocellular" field. The following schematics illustrate this important relationship between peripheral visual field awareness and accurate eye movements during reading.



The above schematic shows that stress tends to decrease peripheral awareness. The neurotransmitter norepinephrine increases under stressful conditions and mediates the shrinking of awareness field. Functional magnetic resonance imagery has allowed us to "see" that poor readers show less activity in the areas associated with the peripheral and motion detection areas as is shown by the following slide.



SOLUTION: IVL treatment of saccadic eye movement problems involves a two pronged approach. First, drills requiring sacaadic eye movements are practiced in isolation followed by multiple demands of increasing complexity. Second, expanding attention into the peripheral visual field is accomplished by fixing the eyes on central targets while peripheral vision controls increasingly complex coordination tasks. Expanded peripheral awareness and processing skills coupled with saccadic accuracy drills combine to produce better eye movement accuracy in reading and other tasks involving spatial judgement such as catching a ball. We carefully monitor eye movements during reading using technology called the **visagraph**. Visagraph is an apparatus that records eye movements during actual reading. We are able to measure reading rate, comprehension, eye movement patterns and efficiencies in excellent detail. This technology also allows an efficient analysis of the thinking and attention during reading. IVL intervention is based on actual observation not assumption.

IVL, Reading and Attention

IVL techniques to enhance reading skills are designed to transition the child's attentional approach during reading. Recent fMRI findings indicate a relative metabolic depression in magnocellular LGB, V5 striate cortex, pre-frontal cortex, caudate nucleus[9] and substantia nigra among disabled readers[10]. These findings imply reduced visual attention during reading. **IVL** treatment seeks to enhance visuomotor skill and visual cognitive activity during reading.

The following schematic illustrates the **IVL** strategy of reading development and treatment.

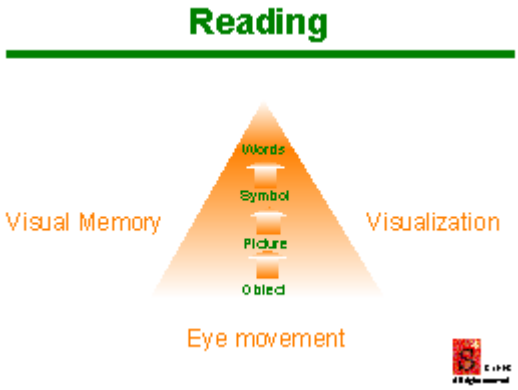


Figure 4. IVL Reading Instruction

The above schematic illustrates the essential elements of efficient reading. Phonetic decoding nor verbalization (vocal or subvocal) appear. IVL reading instruction strategies are designed to present tasks mirroring the neuro developmental hierarchy outlined earlier in this paper. Children learn oculomotor skills through the use of traditional vision therapy techniques. Visual memory and visualization skills are presented with input stimuli that follow the hierarchy shown in the above graphic (object-> picture-> symbol-> word).

Phonics

Phonics is a decoding system that allows the conversion of approximately 80% of the English language between written and verbal form. Once a child has established a primarily visual recognition approach to written language phonics instruction should be undertaken. However, teaching phonics to a child who has not yet developed adequate visual cognitive skills will invite poor adaptations as the following schematic illustrates.

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[9] Hynd GW, Hern KL, Novey ES, et al. Attention deficit-hyperactive disorder and asymetry of the caudate nucleus. Journal of Child Neurology 1993; 8(4):339-347.

[10] Eden G. NIMH Laboratory of Brain and Cognition Nature Vol 386. April 10, 1997.

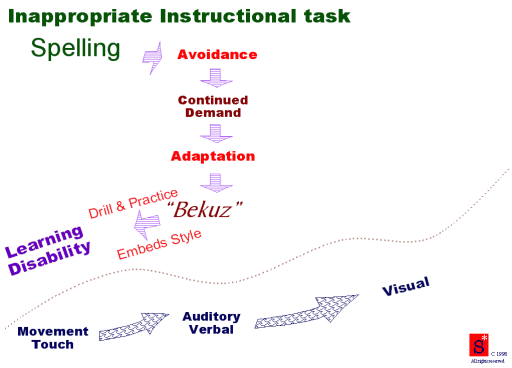

Figure 5. Etiology of phonetic spelling

Introduction of written language before visual cognitive competence has emerged will result in avoidance, adaptation and embedding of an inefficient learning strategy. In the above example an auditory driven processing style develops.

Phonics instruction, as it is commonly sequenced, is improperly ordered. It is not logical to move from abstract to concrete as typical phonics instruction does. Thus we refer to traditional phonics as upside down phonics as figure 6 shows.

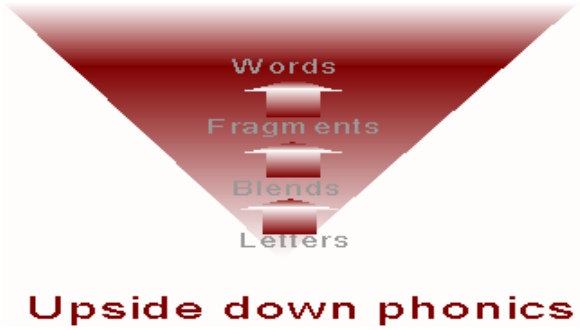

Figure 6. Traditional (upside down) Phonics

IVL Phonics

IVL theory dictates that instructional methods must respect brain development hierarchy. Thus movement from concrete to abstract concepts suggests words before letters and wholes before parts in the presentation of written language just as we learn whole words before parts of words during acquisition of spoken language development. Figure 7 illustrates this point.

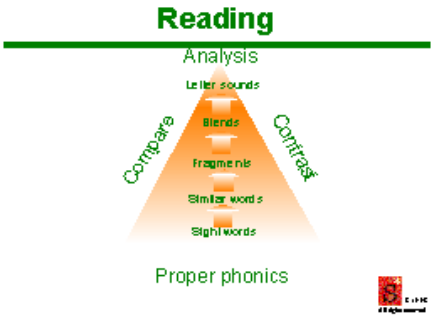

Figure 7. IVL Phonics

IVL and attentive fields (multi-tasking)

IVL procedures sequentially increase the number and complexity of task demands. In this manner the child learns to handle increasingly complex sets of sensory, motor, perceptive and cognitive loads. The name of the game is "how many things can you handle at one time– let's try one more". Too little demand does not facilitate attentive field development, too much demand collapses attentive fields as illustrated in the following schematic:

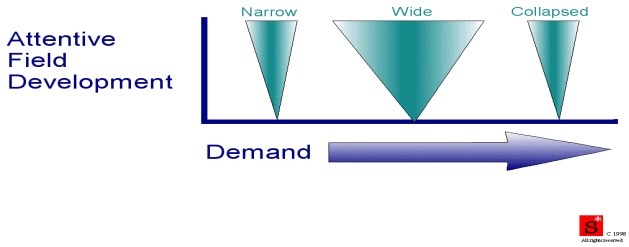

Figure 8. Attentive Field Development

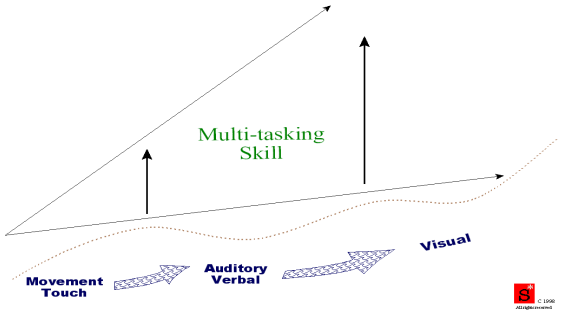

Figure 9. Multitasking vs. Neurologic development

Multiple function demands are at the heart of IVL treatment for attention problems. At the Livingston Developmental Academy, we have successfully reduced the number of students on stimulant therapy from 20% to 2%. Our treatment strategies involve carefully monitored multitasking loads. As is illustrated in figure 8 too little demand results in narrow attentive fields and too much demand causes a collapse of multitasking skill. The combination of loading tasks is sequenced to respect the neuro-developmental hierarchy illustrated at the bottom of figure 6. It is our belief that children with poor multitasking skills need to develop that type of ability as a matter of high priority. Stimulant therapy limits awareness of competing stimuli and is thus counter productive to the development of multitasking skills. **The reason that many children treated with stimulant therapy are less distracted is that they are less aware of their surround.** We believe that these children need to increase their awareness and skills to simultaneously process the inputs from their surroundings.

Purpose of the Study

Depressed metabolism associated with magnocellular input matches our clinical findings of constricted kinetic (motion detection) fields in poor readers. We believe expansion of the field of awareness is an important factor in the treatment of underachieving students. Our status as a school makes us acutely interested in reading performance. Thus we proposed to study the relationship between reading measures and field awareness and IVL and syntonics. IVL treatment is directed at increased oculomotor and visual

cognitive skills and syntonics purports to expand kinetic (motion detection) visual field awareness.

STUDY GROUPS

Students were selected upon teacher referral and parental consent for the various groups from the enrolled population grades 3 through 6 at the **Livingston Developmental Academy,** a Michigan Charter School co-founded by Chuck Stockwell and Dr. Steven J. Ingersoll. The students were referred based on academic and/or behavioral difficulties in the classroom.

Visagraph Reading Group

Students were placed in four groups: IVL & Syntonics (n=47, 20 females & 27 males), IVL only (n=8, 4 females & 4 males), syntonics only (n=9, 4 females & 5 males) and control (n=66, 29 females & 37 males). The average age of the groups were as follows:

Control	9.95 Years
IVL	11.24 Years
Syntonics	9.98 Years
IVL & Syntonics	10.3 Years

Syntonic Field Group

Students were placed in four groups: IVL & Syntonics (n=31, 10 females & 21 males), IVL only (n=15, 6 females & 9 males), syntonics only (n=15, 10 females & 5 males) and control (n=37, 11 females & 26 males). The average age in each group were as follows:

Control	9.1 Years
IVL	9.68 Years
Syntonics	10.35 Years
IVL & Syntonics	10.08 Years

DURATION

Visagraph Reading Group

The average duration in days of the Visagraph groups were as follows**:**

Control	64
IVL	67
Syntonics	68
IVL & Syntonics	67

The average number of sessions for each group were as follows:

Control	0
IVL	8
Syntonics	13
IVL & Syntonics	12

Syntonics Field Group

The duration of the syntonics groups were from the final week in February, 1998 to the first week in May, 1998 (approximately 70 days).

The average number of sessions for each group were as follows:

Control	0
IVL	11.8
Syntonics	14
IVL & Syntonics	15.14

METHODS

Visagraph Reading Group

Reading performance was measured using **Visagraph** (Taylor Associates) technology. Visagraph is a system which records eye movement during reading by using infrared sensors mounted in goggles worn by test subjects while reading. Recordings measure a variety of reading eye movement characteristics that are described below. Reading rate and comprehension measures were also recorded using this technology.

Syntonic Field Group

Kinetic visual fields were measured using the field tester instrument recommended by the **College of Syntonic Optometry**. First detection and detail fields were measured by advancing a 2mm white test target from the periphery in 8 meridians until first detection and until detail of the target (black ring around white target) responses were obtained. Fields of awareness were measured in square millimeters and in the sum of degrees in eight meridians. The size of the optic nerve scotoma was also plotted.

Examination Procedure

Optometric interns Emmanuelle Grizard and Thierry Tillement performed initial Kinetic visual fields and visagraph reading measurements, respectively. Post examinations were performed by outside IVL staff from another facility and were not familiar with the students academic standing or study group affiliation.
The French interns performed statistical analysis.

RESULTS

Visagraph Reading Group

The results of Visagraph recordings are summarized in the following table[11]:

	Control	IVL	Syntonics	IVL & Syntonics
Fixations/100 words				
initial	155.17	119.88	168.11	239.11

[11] Tillement T Effets d'une methode d'entrainement visuel americaine sur les capacites de lecture d'enfants de 7 a 13 ans. Maitrise de Science et Technique d'Optique Physiologique, d'Optique de Contact et d'Optometrie a l'Universite de Paris-Sud(XI) Centre Scientifique d'Orsay. Annee Universitaire 1997-1998.

gain	-7.02	-8.88	20.22	-35.91
% gain	-4.52	-7.40	12.03	-15.02
Regressions/100 words				
initial	31.83	18.00	35.22	58.04
gain	-5.62	-3.75	7.78	-15.13
% gain	-17.66	-20.83	24.92	-26.06
Span of Recognition (words)				
initial	0.71	0.92	0.62	0.53
gain	0.20	0.06	-0.08	0.06
% gain	2.74	6.56	-12.30	12.19
Duration of Fixation (seconds)				
initial	0.28	0.28	0.33	0.34
gain	0.00	-0.01	0.00	-0.00
% gain	1.96	-4.91	1.35	-1.27
Reading Rate (words/minute)				
initial	158.85	200.34	114.44	102.09
gain	0.23	15.00	-16.00	14.17
% gain	0.14	7.49	-13.98	13.88
Grade Equivalent				
initial	4.83	7.86	2.57	2.65
gain	0.30	0.96	-0.87	0.57
% gain	6.24	12.24	-33.77	21.33
Comprehension (% correct)				
initial	78.03	76.25	88.89	74.89
gain	1.97	13.75	-11.11	8.30

Syntonic Field Group[12]

	Control	IVL	Syntonics	IVL & Syntonics
Detection Field (mm2)				
{d	102.46	216.70	1545.16	1923.99
d^	2.77	14.45	49.84	62.06
{d2	138725.10	90029.38	220342.72	354792.20
Detection Field (degrees)				
{d	14.97	15.53	76.28	101.73
d^	0.40	1.04	5.09	3.28

[12] Grizard E Etude de l'effet de la stimulation par syntonic (lumiere coloree) sur le champ visuel. Maitrise de Science et Technique d'Optique Physiologique, d'Optique de Contact et d'Optometrie a l'Universite de Paris-Sud(XI) Centre Scientifique d'Orsay. Annee Universitaire 1997-1998.

{d2	601.50	297.05	653.15	963.69
Detail Field (mm2)				
{d	211.88	585.15	1751.79	2344.08
d^	5.73	39.01	116.77	75.62
{d2	178435.00	46517.08	266293.93	464218.82
Detail Field (degrees)				
{d	10.29	55.59	134.51	209.81
d^	0.28	3.70	8.97	6.77
{d2	547.50	1069.94	1315.55	2572.02
% Detail/Detection (mm2)				
{d	177.01	395.01	382.95	463.20
d^	4.78	26.30	25.53	14.94
{d2	20752.4	38850.28	18508.27	24892.69
% Detail/Detection (degrees)				
{d	-51.00	128.80	370.28	461.33
d^	-1.00	8.59	24.68	14.94
{d2	14885.00	6346.47	14241.20	16266.25

{d= Sum of measurement differences
d^=Sum of measurement differences/ number of subjects
{d2=Sum of measurement differences squared

DISCUSSION

We can conclude within 95% accuracy that syntonic application expanded both detection and detail field awareness in syntonic and IVL & syntonic test groups. Also with the same degree of confidence both of these test groups showed an improvement in the percentage of detail to detection fields. Strong gains in fields of awareness were shown in the groups who had syntonics only and both syntonic and IVL procedures. **. Syntonics only (5.09 degrees, 8.97 degrees) and the combination of syntonics and IVL (3.28 degrees, 6.77 degrees) produced substantial statistically valid expansions in detection and detail fields compared to the control group. The percentage of field involved in detail awareness also expanded in both test groups.** The IVL only test group did not produce statistically valid expansion of visual field awareness. The syntonics only group showed a decline in all reading measures. **However, the combination of IVL and syntonics procedures produced the largest gains in reading measures (13.88% in rate, 8.3% in comprehension) in this study.**

CONCLUSION

This preliminary study indicates that with just a few sessions of IVL therapy, visual skills related to reading and actual reading performance can be improved. This confirms previous studies using pre and post treatment measures of IVL intervention of the improvement of reading skills. The study also confirms that syntonics, when used alone and in combination with IVL, expands visual field awareness an important component in reading. Interestingly, however, syntonics in isolation, while expanding field awareness, actually reduces performance in other reading related visual skills. One possible interpretation of this finding is that the expansion of fields of awareness without building skills in handling the increased complexity can lead to confusion. **This study supports the use and further study of the combination of IVL and syntonics as a method to enhance field of awareness and reading skills.** *We believe that these results may mean that the expansion of visual field awareness in and of itself may be detrimental to reading progress, unless that expansion is combined with strategies to teach the subject how to use that expanded awareness in the complex task of reading.* This study represents only a short-term intervention of less than ten weeks and an average of less than 15 sessions. The conclusions can only be considered preliminary. Further study of the effects of syntonics intervention with and without IVL therapy need to be conducted and are in progress at the Livingston Developmental Academy. These studies will measure results with longer durations, more sessions and various combinations and sequences of treatment strategies. Of particular importance is determination of treatment efficacy in a school based setting. **The large gains made by the IVL and syntonics combined group may indicate a dramatic new avenue to be used as a special education intervention.** The rapidly growing numbers of children now being identified as learning disabled and/or attentionally disturbed, requires that public education find more successful educational interventions**.**