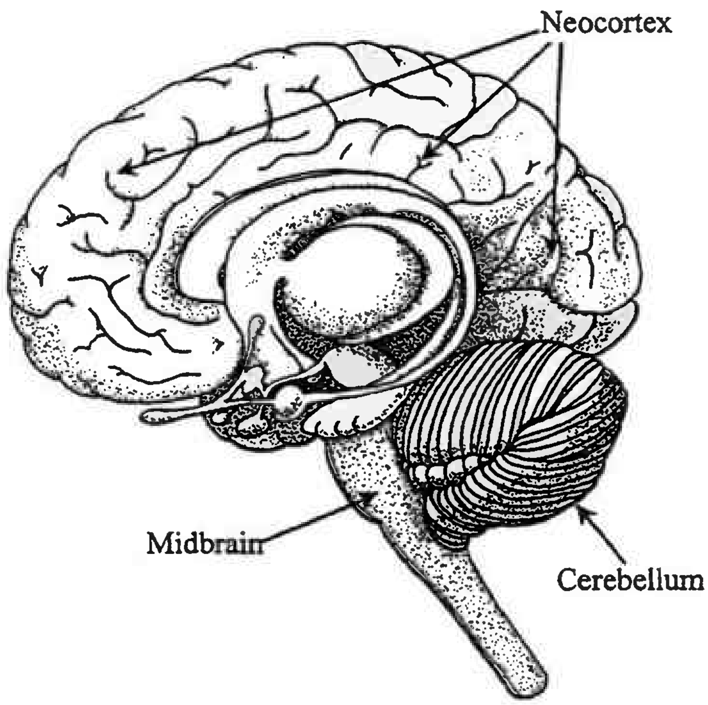
The Learning Enhancement Advanced Program.

LEAP

For the Assessment & Correction of Specific Learning Difficulties with Kinesiology and Acupressure.



Developed by Melbourne Applied Physiology
Charles T. Krebs, PhD & Susan McCrossin, B.App.Sc.
(Psychophys & Psych)
237 Rathdowne Street, Carlton,
Victoria 3053 Australia
Tel. (61- 3- 9662- 3411
FAX (61- 3- 9662- 3611)

Special Note:

The techniques and procedures described in this manual are presented solely for informational purposes. The authors or Melbourne Applied Physiology are not dispensing medical or psychological advice or diagnoses either directly or indirectly. We make no recommendations regarding the physiological effects of this information, nor are we suggesting that the material presented relates to any ailment of any reader. Those who use the enclosed procedures do so entirely upon their own volition and responsibility.

Published by:
Melbourne Applied Physiology Pty Ltd
237 Rathdowne Street
Carlton, Victoria
Australia 3053
Tel. (613 9662 3411)
Fax (613 9662 3611)

LEAP

The Learning Enhancement Advanced Program

For the Assessment and Correction of Specific Learning Difficulties.

Dr. Charles T. Krebs, Melbourne Applied Physiology, 237 Rathdowne Street, Carlton Victoria Australia 3053.
Tel: 613 9662 3411, Fax: 613 9662 3611

HISTORY

Difficulties with learning academic tasks such as reading, spelling and mathematics have been recognised for over a century, with Kussmaul in 1877 ascribed as the first person to specifically describe an inability to read, that persisted in the presence of intact sight and speech, as word blindness.[1] The word *dyslexia* was coined by Berlin in 1887.[2] Within a decade a Glasgow eye surgeon James Hinschelwood (1895) and a Seaford General Practitioner Pringle Morgan (1896) observed students who were incapable of learning to read and hypothesised that this was based on a failure of development of the relevant brain areas which were believed to be absent or abnormal. This model was based on the assumption that developmental dyslexia (congenital dyslexia) was similar in form to acquired dyslexia, which is dyslexia due to brain damage after a person has already learned to read. Deficits in other types of learning, such as mathematics, would also result from some other underlying brain damage or abnormality.[3]

Work in the early part of the twentieth century, particularly by Samuel T. Orton in the 1920s and 1930s suggested that learning difficulties such as dyslexia were not based on anatomical absence or abnormality, but rather it was delay in the development of various areas that caused these dysfunctions. This belief was largely ignored until the 1960s when it was revived by a growing interest in neuropsychology. However, more recent developments in neuropsychology and neurophysiology support the hypothesis that dysfunctions within the brain, both anatomical and developmental, may be causal in many learning problems.[4]

It was not until 1963, in an address given by Samuel Kirk, who argued for better descriptions of children's school problems that the term "learning disabilities" originated. Since that time there's been a proliferation of labels that attempt to dissociate the learning disabled from the retarded and brain damaged.

Definitions

Learning disabilities in the context of the present study includes both dyslexia and Attention Deficit Disorder (ADD) with or without hyperactivity. Historically, dyslexia has been widely defined in terms of deficits in the areas of reading, spelling and language. However, more recent conceptualisations have included a definition that also encompasses a wide range of problems, including clumsiness and difficulty with rote learning.[5] Fawcett and Nicolson have also challenged the prevailing hypothesis that dyslexia is merely a language based problem, suggesting that it might be a more generalised deficit in the acquisition of skills.[6] The term dyslexia is not defined in the DSM IV (1994) although it is still commonly used in literature discussing various learning difficulties. The term Learning Disorders (DSM IV) currently encompasses various types of learning difficulties including dyslexia and Attention Deficit Disorder (ADD). Learning Disorders are defined in the DSM IV as being essentially a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals at a comparable level of development. The performance of these individuals on standardised tests for reading, mathematics, or written expression is substantially below, more than 2 standard deviations (SDs), same age peers even though their IQ scores are average or above average.[7]

Incidence

Frequently, children diagnosed as learning disabled are also inattentive and deficient in linguistic skills, most often in reading.[8] Rutter and Yule examined a large population of children from a number of different studies and found 3.5% of Isle of Wight 10-year-olds, 4.5% of 14-year-olds and over 6% of London 10-year-olds showed reading difficulties.[9] Gaddes looked at the proportion of children with learning disorders in various studies in both North America and Europe and found that the need for special training for learning disorders ranged between 10-15% of the school age population.[10] However, estimates of the prevalence of learning disorders for broad age ranges is problematic because a learning disability is an emergent problem that is often not evident until later years in schooling. Using the criteria of defining learning disorders as being two years behind on standardised tests, less than 1% of 6-year-olds are disabled, 2% of 7-year-olds and so on until at age 19, 25% would be classified as learning disabled. So these children fall progressively behind as they mature and the complexity of work increases.[11] In an address given by the Australian Federal Schools Minister, Dr David Kemp, in October 1996, Kemp stated that a study of 28,000 students in four surveys in Australia found 30% of year 9 students lacked basic literacy skills. This high incidence of learning disorders in school children indicates a need for effective treatment.

Causes

Currently the possible causes of learning disorders are believed to be primarily the result of five major factors; 1) structural damage, 2) brain dysfunction, 3) abnormal cerebral lateralisation, 4) maturational lag and 5) environment deprivation. While none of these theories is unequivocally supported by current data, all of these factors may contribute to learning disabilities.[12]

Brain damage would appear to account for a small percentage of children with learning disorders as many of the neurological symptoms associated with brain damage in adults are not typically observed in these children. In addition, EEG and CT studies have not shown structural damage and abnormal EEGs correlated with known brain damage are not consistently observed in children with learning disorders.[13] Rather than direct brain damage, there is evidence that abnormal physiological or biochemical processes may be responsible for malfunction in some part of the cerebral cortex. Electrophysiological recording studies have associated specific high frequency EEG and AEP (averaged evoked potentials) abnormalities with various types of learning disorders.[14] Recent studies with SSVEP (Steady state visual evoked potential) have shown that children diagnosed with Attention Deficit Disorder demonstrate similar abnormal SSVEP patterns when compared to normals while performing the same cognitive task (Marie, personal communication).[15] The brain dysfunction hypothesis suggests that the dysfunction may be a consequence of defective arousal mechanisms resulting in some form of inadequate cerebral activation.[16]

This is supported by studies of children with learning disorders that show they have difficulty on continuous performance tests requiring attention and low distractibility; had slower reaction times to stimuli, and increased errors due to impulsivity on tests of visual searching.[17] Douglas proposed that the deficits on these tasks resulted from inadequate cerebral activation. Learning disorders of some types at least, do improve with drugs like amphetamines that cause cerebral activation via increasing subcortical arousal. In fact this is the basis of treating hyperactive children with Ritalin.[18]

An alternative model of learning disorders is based on recent neurophysiological findings that suggest it is the timing and synchronisation of neural activity in separate brain areas that creates high order cognitive functions. Any loss or malfunction of the timing mechanism may cause disintegration of neural activity and hence dysfunction in cognitive tasks.[19]

This model supports the approach in the Learning Enhancement Advanced Program (LEAP) that Krebs and McCrossin developed in the late 1980s and early 1990s.[20] In the LEAP Model, learning disorders that is based on the disruption or loss of timing and synchronisation between the neural activity in the diverse brain regions, both cortical and subcortical, that must be synchronised in order for successful integration to produce normal cognitive activity. Learning disorders would arise in this model from a lack of integration of functions that occur simultaneously in separate brain regions.

If the brain does integrate separate processes into meaningful combinations we call 'thought' or cognitive ability, then the main risk is mis-timing or loss of synchronisation between these processes. To quote Damasio "any malfunction of the timing mechanism would be likely to create spurious integration or *dis*integration".[21]

For synchronous firing of neurons in many separate brain areas to create cognitive functions would require maintenance of focused activity at these different sites long enough for meaningful integration of disparate information and decisions to be made.

History of LEAP: The Evolution of a New Kinesiological Paradigm.

During the late 1980s, I was doing a lot of clinical work with children with severe learning problems, who were being referred by a child psychologist as a gesture of last resort. She described them as her "basket cases" because no amount of remedial work seemed to make the slightest difference to their academic performance. Using the kinesiological tools I had available at the time, I was able to get fantastic, reproducible results in about 30 per cent of these cases. Following treatment, three in 10 of the children improved their reading ability and comprehension, spelling and were better at maths. Moreover, these improvements were on-going.

In another 30 per cent of cases, even though I did the same procedures, nothing seemed to work. And in the remaining 40 per cent of clients, there would be significant changes while I was working with them but they did not last; as soon as they stopped the treatment and their self-help exercises, the children would resort to being just as dysfunctional as they had been before. As a scientist, I wanted to know why this was happening. Why were the results so variable? Why was it working for some and not for others?

To find out, I went back to first principles and began an exhaustive search of all the material I could find on the neurology of brain function related to learning, to establish exactly what processes were involved. The critical point turned out to be the subconscious, where so much of our actual mental processing takes place. So I looked carefully at the subconscious features of the brain that were not being addressed in the treatment models I was using. This meant the limbic system and its various nuclei and the paleocortex, the ancient part of the brain.

Kinesiology as it was then practiced, allowed me to access these structures only in a very general way. I could detect that there were stresses related to specific learning processes but did not understand how to go beyond this first step to tap into the hierarchical processing of the brain to determine which specific brain functions might have gone off-line. What had become clear to me is that the brain processed in a modular fashion, with single functions antecedent to many other functions. If one of these antecedent functions was compromised, all the processes dependent on this function would also show deficits. I had to find a way to get into these processing modules.

Just as these problems were arising for me, synchronicity stepped in with the solution. In 1989 I travelled to America to learn the new techniques of brain physiology formatting that Richard Utt had been developing them at his International Institute of Applied Physiology. Utt had added to the existing model of kinesiology by focusing on the physiology of the brain itself and he showed that the readout of brain function seldom revealed itself in single active acupoints. The biofeedback from the brain would often show up as a patterns of acupoint activity[22].

With Utt's brain physiology formatting at last I had the map of the primary neurological processing modules and a basic format to access with them. Now I had a way in and from there on it was a matter of asking the right questions of the right structures. Now, for instance, I could ask the brain if there was any stress in the posterior hypothalamic nuclei? If a stress was present as indicated by muscle response, I could then proceed to determine if there was stress in the part of the posterior hypothalamic function that controlled dilation of the pupils in relation to the fight or flight response.

Once the stress had been identified then the factors causing that stress could be pinpointed. Knowing what those stresses were, I could then apply kinesiological and acupressure techniques to resolve them. As soon as the stress, or stresses that have caused the block or shutdown of functions are resolved, these processes so vital to learning come back on line.

I began to get much better results and consequently, many more patients. I was getting so busy that I needed a partner, and Susan McCrossin joined me. As we began to work together we discovered that the more we refined application of the new formatting techniques, the more effective we were proving to be. But still we were running into children we couldn't help. We needed to do more research, more trialing of technique and application.

More children, by now about 80 per cent of the referred cases, started showing positive changes yet perplexingly, there still remained a recalcitrant group that eluded our methods. What was it that we did not yet understand? To find out, we sent these children for assessment by a neurologist who specialised in epilepsy and learning problems. Using Magnetic Resonance Imaging and other assessment techniques, it was revealed that in all but one of the cases the underlying cause was organic brain damage[23]. Their problem was more than a glitch in the software. The hardware itself had been damaged.

The Learning Enhancement Advanced Program: LEAP.

We were establishing a whole new paradigm and as the parents and some of our fellow practitioners saw what we were able to achieve, they began to ask us to teach our methods. We began teaching on a one-to-one basis and as we did so started to realise just how complex the system had become. We needed to write it down and to give it a name. It became “LEAP”, which stands for the Learning Enhancement Advanced Program. This program taught not only the brain formatting techniques, but where and how to apply them, and why they worked. An in-depth understanding of neurology was essential and, as you can imagine, the teaching began to consume hundreds of hours of our time.

We taught eight individuals how to apply the program and although it was certainly time-consuming we benefited because those invested hours taught us how we needed to do the training. The demand from other kinesiologists increased and we had to create an integrated teaching program and manual. Several years on, with a 250-page manual in hand, we were asked to teach the program at the biggest kinesiological centre in the world, The Advanced Kinesiological Institute in Freiburg, Germany. This centre conducts 450 workshops a year in kinesiology training.

The complexity of the program we were teaching reflected the complexity of the human brain. Before any corrections could be made, the specific nature and types of learning problems had to be assessed and this protocol required 80 or so steps. Learning problems are unique mosaics of dysfunction, as distinct and individual as fingerprints. The techniques to unravel these patterns are just as varied.

Currently we have taught and teach LEAP in Europe and the United States as well as throughout Australia. Each year more kinesiologists are learning this powerful program and then helping to change people's lives. Together with our new students we find ourselves travelling into a frontier that is, in effect, rolling ahead of us. As the knowledge of neurology explodes with new information every week, we are constantly modifying our techniques and our teaching programs. Step-by-step we can go further and deeper, and be more effective. Fewer of our clients are falling outside the scope of our ability.

Kinesiology: Its Role in Assessing Specific Learning Difficulties.

When we perform a mental function, say adding 2+2, the conscious mind asks the subconscious mind to do its bidding, but exactly how it is done or exactly what part of the brain is actually used to perform the functions required to do the task is totally out of our consciousness. When I say to you "What is 4+4?, several outcomes are possible. The first, is that you will almost instantly reply "8" with hardly a seconds delay. But if I then say "Exactly what part of your brain, which area of your cortex, did you use to do this computation?", you would have absolutely no idea! Nobody does, for the bulk of mental processing occurs outside of our consciousness, *with conscious input only providing direction for the subconscious that actually performs the functions.*

By analogy, your conscious brain receives the message in English words "What's 4+4?" It then says to the subconscious "Hey subconscious, what's 4+4?" and then just waits around for the answer. If you have uninterrupted "access" to the specific cortical and subcortical areas that processes symbolic 4 + symbolic 4, it immediately gives a symbolic 8. The subconscious then can tell your conscious brain "Pssst, the answer is 8" at which point you then are consciously aware of the answer and can tell me "the answer is 8!" In this first type of response, there were no "blocks" in direct access to the subconscious functions required to perform the task as directed, and the task is accomplished easily with little mental effort.

The second type of response we often get from children with poor access to Logic functions consists of (1) a desperate searching of their memory, eyes darting up and to and fro, often accompanied by fist tapping hand or forehead for an agonizing few seconds, then (2) suddenly their eyes "light up" and they reply "8"! Clearly, in these cases even though the subconscious received the request clearly, it could not simply send the request directly to the symbolic arithmetic processing centre for instant processing, and then immediate reply to the conscious mind with the correct answer. Rather, the conscious mind clearly heard and understood the question, but when it then commanded the subconscious to do the processing, direct access to the symbolic arithmetic centre was not immediately available. Instead, the direct route was "blocked" and the subconscious had to work out an "alternate route" around the "block" before the processing could proceed. Once the "alternate route" had been established, however, the subconscious could then access the correct answer.

The third outcome to this question is "I don't know", said with a shrug of the shoulders, sometimes followed by counting on the fingers to get the answer. In this case, there is no access to the symbolic arithmetic centres and the only way of solving the problem is to revert form symbolic processing to concrete processing. The child can observe concretely that 4 fingers + 4 fingers are indeed 8 fingers. The above example has been covered in some detail to illustrate two things:

1. Most of the actual processing to solve even simple problems is "subconscious".
2. The degree to which, or the ease with which, we solve mental problems is totally dependent upon the degree to which we access these subconscious processes.

In these three examples, each of the three children understood the question "What is 4+4?" In the first case, the child could then instantly access the subconscious functions to solve the problem and respond immediately with the correct answer. In the second case there was a time delay in answering the question while the subconscious "worked out" a route around the direct access which was "blocked". In the third case, the block of the subconscious functions was so complete that an alternative method, concrete processing, had to be employed to solve the problem at all. *Inability to perform certain mental tasks is, therefore, often not a question of consciously understanding the question or even how to do it, but rather, an inability to access the relevant subconscious functions to get the answers to the question that was understood!*

Since the relevant functions and processes that control our ability to perform most academic tasks are subconscious, how can we evaluate access to them, or know the type of "block" preventing access to them. Or how can we know at what level this block in processing occurs, particularly for more complex tasks that require several levels of processing? The answer is using Kinesiology. Kinesiology provides direct access to subconscious functions via the interface of muscle proprioception, which is totally subconscious, with other subconscious processing, including mental processing.[24]

Muscles are run first and primarily by subconscious brain centres (e.g. basal ganglia, thalamic nuclei, cerebellum etc) and only secondarily by the conscious brain (for in depth discussion, see Krebs, 1998). Indeed, the subconscious control of muscle function overrides conscious desire, the basis of checking a muscle circuit for homeostasis in Applied Physiology or blocking in One Brain Kinesiology via spindle cell sedation of the muscle. When a muscle is in balance, sedation by spindle cell manipulation will cause a locked muscle to unlock no matter how hard the person tries "consciously" to override the subconscious message. This is a protective device on the part of the brain to prevent ego driven stupidity (e.g. a macho "I'll lift that 100kg bag for you") from damaging our physical structure.

Not only is muscle function outside of conscious control, but it also interfaces directly with other subconscious mental processing. Stress generated in subconscious mental processing can directly effect muscle response. This is the basis of the muscle response when having a person think of something negative or stressful; as soon as the mental "stress" is accessed, an indicator muscle will unlock. If you have them just think of an issue e.g. think of your mother, the indicator muscle may unlock even if they are unaware of any overt conscious stress on that issue.

Kinesiology is therefore an excellent tool to investigate subconscious brain function as it can provide a direct readout of stresses impinging upon subconscious mental functions. Throughout LEAP, the link between stress in subconscious processing and muscle response is used extensively to evaluate the extent of access to specific mental functions and the nature of the "block" that prevents full access to these functions. Kinesiology, therefore, provides an effective means of assessing the nature and degrees of subconscious dysfunction resulting is Specific Learning Difficulties (SLDs).[25]

Kinesiology: Its Role in Correcting Specific Learning Difficulties.

If any specific subconscious function is "blocked" for any reason the mental processes dependent upon that function are compromised, and often can not be performed at all.

Learning problems result then, either from "blocked" access to one or more subconscious functions, or from a "block" preventing integration of the functions accessed. In more severe learning difficulties there may be both "blocks" to specific functions and "blocked" routes of integration, which makes it doubly difficult for people to overcome learning problems of this nature.

Kinesiology not only provides a means of identifying where these "blocks" in function occur, as noted above, but more importantly, provide a means of identifying the "nature" of the disturbance causing the "block" in function. Muscle monitoring provides an interface between neurological function and the more subtle energies of the energetic, emotional and mental bodies.[26] Disturbances at any of these levels can cause a change in muscle response during monitoring. The vibrational frequency of the underlying cause of the dysfunction resulting in the "indicator change" can then be "matched" against various "frequency domains" of Acupoints and finger modes enabling the source of the disturbance to be specifically identified.[27]

Once the stress causing a "block" in function has been located, then by simply touching specific acupoints or holding specific finger modes and remonitoring the muscle, the Indicator Point or Finger Mode causing an "indicator change" identifies the exact nature of the cause of the "block". For instance, if holding "emotion mode" changes the indicator muscle response, then the underlying cause of the "block" is an emotional disturbance that alters the underlying physiological function.

Once the cause of the "block" has been identified, only then can effective therapeutic techniques be applied to "defuse" or "remove" the block. Once the "block" has been entered on the biocomputer, any effective technique can successfully "remove" the block, allowing that function to once more be accessible for mental processing.

What is critical for successful long-term correction, however, is locating the exact subconscious function that is blocked. For some subconscious functions, simply touching specific acupoints or holding finger modes will detect these "blocks". Many others, particularly those "deep" within the subcortical areas of the Limbic System and other brain nuclei, can not be accessed by these simple methods. To access these very specific subconscious functions requires monitoring specific patterns and combinations of Specific Indicator Points and Finger Modes, termed "formatting" in Applied Physiology.

The Role of Applied Physiology Formatting in Correcting Specific Learning Difficulties:

While Kinesiology is a powerful tool for assessing Specific Learning Difficulties (SLDs), you can only correct the issues/functions that you have precisely entered on the biocomputer. Like a computer, the biocomputer will only address the actual issues/functions specifically entered into active processing (like the RAM processing on a computer), not all the other information held in memory (like the ROM of the hard drive), even if it is related to the data entered. Whenever an issue or function is entered on the biocomputer, it can be considered an electromagnetic/energetic "file" similar to the electronic "files" of a computer. And, like a computer, it is only the data contained within the specific "file" that has been "called up" that can be worked on or revised/altered by new input. Content in other related files is not available and cannot take part in the processing of the data on the biocomputer, unless specifically called up.

Richard Utt, in developing AP, realised the need for addressing specific physiological functions and the limitation of conventional muscle-testing. In AP he developed a system called **formatting** to provide the specificity required to address specific physiological functions directly. AP formatting uses the frequency resonance "match" between specific acupoints of the Acupuncture Meridian System, called Specific Indicator Points, and/or Finger Modes (Digital Determinators) and specific physiological functions or anatomical structures. If there is a frequency match denoted by an indicator muscle change when these acupoints are circuit-located (touched) or the finger mode held, this indicates stress in these specific physiological functions/anatomical structures.

The specific formatting for many of the brain functions used in LEAP were taken from AP's Brain Physiology research, and we wish to thank Richard Utt for developing this tremendously useful and powerful formatting. We have added a number of other specific indicator points and modes for working with brain integration and over the years developed the procedures required to effectively format for the correction of the various types of brain dysfunction generating SLDs. Using the LEAP formatting, it is possible to format for the specific brain dysfunctions resulting in SLD's, which permits these specific functions to then be entered on the biocomputer for correction. With this specific LEAP formatting it is possible to correct most types of SLDs, unless they have a predominantly organic basis

LEAP Protocol for Correcting Specific Learning Difficulties.

After the assessment is complete, LEAP provides a coherent protocol for correction of most SLDs. This protocol was established over several years based on the hierarchical processing in the brain. Perhaps to conserve space and yet provide for a variety of functions, the brain functions are *not* organised in a hierarchical fashion with a linear flow of neural impulses, but rather the neural flow is parallel and multiplex, including transfer of information that does not even flow along nerves. In this multiplex, parallel processing many of the central basal subconscious brain functions are used in many different types of processing, as a central processing unit capable of multi-tasking. Thus, this central processing unit of subconscious brain functions when not being used in one type of function they may be used in another, or may even carry out several types of functions in parallel.

Only the lead functions that request specific types of processing to be performed are conscious. The actual processing is performed by the subconscious limbic and subcortical centres in the brain. When the functions of reading or spelling, or any learning task, can not be performed properly, it is usually not in the cortical lead functions that the problems lie, as the person most likely understood the command to read or spell and via their cortical lead function asked the brain the perform this function. Rather, the problem is usually "blocks" in or to their subconscious processing centres that are required to perform the requested task. Since most learning problems result from a lack of access to specific subconscious functions, clearing the blocks to these functions could rectify the learning problems. However, there is a specific order in which the basal subconscious functions must be "cleared" to produce consistent results, and these are related to the heirarchy of sensory information processing in the brain. The LEAP protocol follows this hierarchy, and therefore provides consistent results in the treatment of SLDs.

It must be emphasised here that the LEAP protocol is not a correction procedure, but rather, a protocol that provides access to the specific functions that need correction. Imbalances in the basal subconscious functions involved in all learning never show an indicator muscle change in the "clear" because they are such specific functions and so many layers down in the processing that they do not generate greater than 51% stress in the whole system. In order to access these deep subconscious basal functions requires specific formatting. The formatting used in LEAP has been taken from the Applied Physiology Brain Physiology develop by Richard Utt, founder of Applied Physiology, or developed by the founders of LEAP based on the brain physiology concepts.[28] Using formatting for specific brain functions each major type of subconscious process can be assessed individually for "stress" that may block its function. Once the stress on that specific function has been entered on the bio-computer via Pause Lock, then any effective kinesiological technique can resolve the stress. Once the stress on the function has been removed, the function comes "back on-line" so to speak and is now available for processing.

The LEAP protocol systematically corrects each basal function in an order that we have found to be most effective and efficient. Because of the multi-tasking nature of processing in the subconscious basal functions, when a single basal functions goes "off line" so to speak, several functions may be compromised. If these antecedent functions are not cleared first, other functions relying on these antecedent process are compromised. Therefore, the order in which the brain functions are corrected is significant and the protocol must be followed for best results.

All environmental factors that affect the ability of the brain to maintain integrated function must be corrected first, or these factors such as rampant Candida, can take brain integration apart as fast as you put it together. Then the integrative processing centres and integrative pathways like the Corpus Callosum must be "opened up" before individual brain functions are addressed. It is of little value to open access to a brain function that still can not be integrated with other brain functions because of blocked integrative centres or pathways.

Now the individual brain functions need to be assessed for "stress" and any stress affecting their function must be resolved so they can be brought fully on-line. This includes all the major brain functions involved in visual and auditory processing as these are the primary inputs to the areas of the brain involved in learning and memory. Assignment of exercises to reinforce integrated brain function is then essential to maintain the new integrated state just established. Only then are any remaining eye function imbalances addressed because often the above brain integration (BI) procedures will have corrected much, if not all, of the problems observed in the assessment procedure.

Now you are ready to balance stress on functions like short-term memory and visuo-spatial processing that may remain even after the BI procedures above are complete. Again these must be done after the BI procedures because often many problems in these functions are corrected by the BI procedure alone, and no further work is required. The time spent correcting these functions, if they would correct at all before BI, would have been wasted.

Only now are you ready to begin the correction of academic functions like reading and spelling that were seen as the "problem" initially. The correction of many reading, writing and maths problems must first start with the complete defusion of any stress on the alphabet and numbers. Stress on individual letters or numbers can compromise or even severely disrupt academic functions requiring their use!

Once all academic functions are on-line, then the negative attitudes to their use must be defused or the person may not use the functions they can now access. Just because I can now learn to spell perfectly or read with no stress and good comprehension does not mean I **will** do so. When asked to perform a task, my first response comes from my deep limbic emotional centres with regard to how I have experienced this task in my past. If I have always "failed" at, or found this task very "stressful", my subconscious will automatically recall my past failures or stress doing this task. The associated feelings of being stupid and embarrassed, or just being physically or emotionally stressed out, may then prevent me from even giving it a go, regardless of the fact that I can now do the task successfully without stress.

The brain does not know how it is now, only how it has been, and reacts to the request to perform the task on our past experience. Run by these past emotions, including fear of failure, and physical stress responses (eg watery eyes), the brain will often not even attempt to use functions now available to it. Therefore, unless the negative emotions associated with performing these tasks is defused, the person may never use the functions now available to them. Remember if you **think** you can't, you can't!

THE LEAP MODEL OF LEARNING: A NEW PARADIGM.

The Process Of Learning

From a review of the major brain structures and the workings of memory in the neurological literature, it is clear that both memory and learning do not involve a single, global hierarchical system in the brain. Rather, learning involves an interplay between many inter-linked sub-systems or modules[29]. Also, the timing and synchronisation of information flow between these sub-systems and modules appears to be critical to the success of learning.

For example, instead of the entire left hemisphere being involved in logic, we find that there are certain cortical columns in the left hemisphere that come into play during certain types of logic processing. They become a module interconnected to many other cortical and subcortical areas on both sides of the brain.

Information is relayed to the hippocampus (centre of short term memory) and amygdala (centre of subconscious emotions). These then send the impulses back into the association areas holding long term memory for reference, and forward again to the frontal cortex to be thought about. It is at this point that we may become conscious of the answer or result. In simpler terms, a number of processing units are interconnected and involved in any one type of processing and these are further inter-linked to other areas of processing which perform other processing functions, and so on.

If in the past you've experienced tremendous problems adding even simple numbers, such a command may be perceived as a punishment and the process will become very difficult. The Amygdala, the adjudicator of reward and punishment, operating at the subconsious level, will activate avoidance behaviours. In an attempt to justify the avoidance, your conscious, rational mind will virtually tell you that you are "too stupid", or that "maths is boring, and when would you ever use it anyway?" This is the path to future failure.

On the other hand, if you've been successful in addition and get the correct answers, the amygdala perceives a potential "reward" and will not only allow you to do maths easily but may seek a more difficult task for an even bigger reward.

To be successful all brain areas are constantly interrelating through complex integrative pathways, which provide for synchronised and integrated activity. All the systems must integrate well in order for you to produce a conscious outcome: the answer. It is only when you can consciously retrieve what you have learned that you can say you have really learned it.

Brain Dominance - The Right And Left Hemispheres. Redefining The Terms

In the literature of kinesiology, a vitally important distinction is made in the use of the term "brain dominance". While in the neuropsychological literature the term refers only to the location of the speech centres (particularly Wernicke's Area), in kinesiology the term defines *the area of the brain which plays the dominant or lead role in mental processing.*

In Kinesiology terms you can be "right brain or hemisphere dominant" or "left brain or hemisphere dominant" depending on the type of mental processing you are doing at the time[30]:

When doing a predominantly logical, linear, analytical task, most people activate cortical columns of their left "Logic" hemisphere. Likewise, when most people are performing creative, or visuo-spatial tasks they would be activating cortical columns of their right "Gestalt" hemisphere.

Inductive reasoning, based on global, simultaneous processing, which we term "intuition", appears, in most people, to rely chiefly on the right hemisphere lead functions. Conversely, deductive reasoning, based on the linear, analytical processing of "facts" appears to be initiated by lead functions that take place in the left hemisphere

"Inductive" refers to the process of looking at the whole of a situation, appreciating the overall pattern and not so much the pieces that make up that pattern. This process was named after the German word "Gestalt" which means "pattern" or "form". Generally, the functioning of the right hemisphere is intuitive and non-rational.

Deductive or logical reasoning is used to analyse the relationship of the pieces that make up the whole, a process that is inherently rational and analytic.

Some tasks, like remembering someone's face, are predominantly Gestalt. Some tasks, such as solving a maths equation, inherently use Logic functions. Ideally, you should have access to whichever mode is more efficient to tackle the task at hand. More ideally still, you should be able to integrate the functions of both hemispheres because whole brain processing leads to a higher level of thinking and understanding than either of its two parts.

The brain seems to run by a program that says, "Do it the most efficient way possible". In all of its functions, the brain seeks optimum efficiency. The line of least resistance. If one particular function is not accessible, the brain will automatically go on to the next most efficient process for doing that particular task. If that second process is not available, it will go to the third, the fourth, the fifth most efficient and so on. Because each alternative process is less efficient, it is inherently more stressful. The brain will keep searching for an appropriate processing method, until eventually, the activity may become so subconsciously or consciously stressful that the person will choose to give up trying to do the task altogether.

It is very much like water running down a hill. Running water takes the most direct possible route. But if you block the water flow, the water will find the next most direct route. If you block that, it will move towards the next most direct line.

Each new block gives the water a longer journey to the bottom, and too many blocks means the water might be absorbed before it gets down the hill. This is exactly how the mind operates. If you ask your brain to do a task but there is a block, then it will then take the next best route, or the next, or the next to accomplish the task requested.

We all recognise this situation. Whenever we have difficulty doing something, we become aware of the mental stress that is required to do it. This mental stress will often cause us to avoid doing that task.

Where does that most difficult task you have to do today go on you list of daily activities? At the top? No. At the bottom and somehow, you never quite get to it, at least not today.

Models Of Learning Based On Gestalt And Logic.

As I have alluded, for the past 20 years or so the Right Brain-Left Brain model of learning has popularised the notion of "right brain" designating the right cerebral cortex and "left brain" referring to the left cerebral cortex[31].

While Gestalt functions do appear to predominate in the right hemisphere and Logic functions appear to dominate in the left hemisphere, I argue that this model oversimplifies to an enormous degree the complexity of the many cortical subsystems - many of which are located in *both* cerebral hemispheres. Further, the prevailing theory totally ignores the subcortical processes that are, in fact, major centres of our mental processing. It is the subconscious that *does* most of the actual processing but it is the conscious areas of the cortex that *direct* what is processed.

It is a controversial view because I believe that a specific hemisphere does not entirely dominate either Gestalt of Logic processing. Rather, what they do is provide the lead, or the conscious intent that activate a number of other cortical and subcortical areas to perform the essential processing.

The actual processing units of the cerebral cortex are called Cortical Columns. Newer research has shown that these vertical columns bisect all six layers forming distinct processing units. Cortical Columns are not circular columns in the architectural sense, rather long three-dimensional slabs up to 0.5 mm wide and variable in length.[32] (see Fig. 1) Each cortical column is concerned with a specific type of function, and as functions vary in complexity so the columns vary in size. And sometimes several columns may be involved in performing a single more complex function. Along the sensory cortex, each column is concerned with sensory input from a particular region of the body.[33]

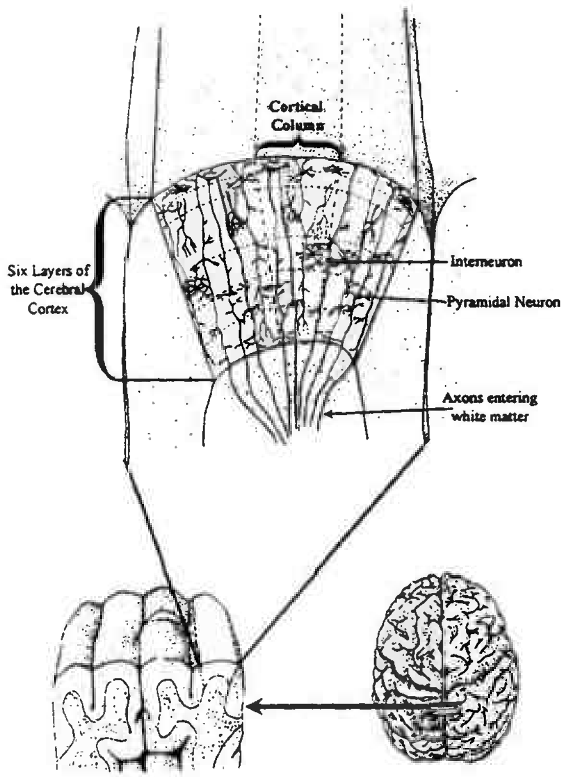


Figure 1. ***Cortical Columns.*** *Vertical slabs of cortex consisting of all six distinct cell layers, called cortical columns, are the functional units of the cerebral cortex. Some of the cells like the large pyramidal cells have dendrites that extend through almost all layers and axons that exit the grey matter to become part of the white matter tracts carrying information to other parts of the brain and body. There are also innumerable interneurons connecting the cells within each cell layer and between the layers.*

Since the cortical columns are the processing modules that relate to specific types of cortical functions, they are the centres for the Gestalt and Logic *lead* functions. The lead functions provide a point of entry into an inter-linked set of cortical and subcortical modules performing our mental function.

The cortical columns in the right hemisphere usually perform global, spatial functions and inductive reasoning - Gestalt functions, and are the seat of our intuition.

The cortical columns of the left hemisphere usually perform linear, sequential and analytical functions - Logic functions, and are seat of our rational thought. Linking these two complementary types of processing together in various combinations allows us to perform the vast number of functions of which the human brain is capable.

When you read words on a page, cortical columns that perform various Gestalt lead functions involved with the decoding of symbols will be activated by the visual stimulus of those words. This will in turn activate other cortical columns, housing Logic lead functions involved in understanding the meaning of words and their grammatical relationships.

An analogy of this process is what happens when you decide to turn on a light. This is a conscious mental decision. As soon as you flick the switch, a whole cascade of other events occur. Electrons begin to flow invisibly through wires, junction boxes, the light fixture itself and into the bulb. All of this occurs outside your conscious awareness. All you are aware of is that the light has come on. This is an electrical model, but it is very similar to what happens in the brain. In the brain, you make a conscious request to do something - whether mental or physical - and this conscious input from a particular cortical lead function creates a subconscious flow that results in the processing of that request. The end result is conscious awareness of the outcome.

The essential point of the theory is that the conscious cortical lead functions in each hemisphere merely provide the entry point. And the cortex can only provide a lead if the point of entry is intact or accessible. If the lead function or entry point has been damaged in some way then we have a situation very similar to what happens when you damage the keyboard of your computer. The computer still works, all the processing is still available, but you cannot consciously access the processing capabilities of the machine because you have no way of talking to the computer. When this happens in the brain, in a sense, you become unplugged from the processing units required to do that task.

You can look at conscious intent as the lead into the biocomputer of the subconscious mind. The subconscious units then do their best to accomplish that conscious intent. Therefore the conscious mind is not determining *how* the brain should process merely *what* it should process.

While conscious processing is free-form, subconscious processing is dictated much more by formal rules. Using a computer analogy, you, the operator, are the consciousness. But once you strike the keys to bring up a particular file, the computer follows a specific pathway, and if it is a well-written program, it will be the most efficient and direct pathway to bring the file out of memory and into your consciousness on the screen.

If however, you make the same request to retrieve that same file and you get an error message, "no matching file found", you then have to work out a new pathway into that file because the most expedient way is blocked. This may take some time and effort. Depending upon how important the retrieval of that file is to you, you may or may not choose to invest that time and effort.

Every time the route gets longer it becomes less and less efficient and takes longer to do. To the mind that translates into stress and the more stressful it gets, the more resistance there is in the brain to performing that process. If the task is associated with less efficiency and hence more stress, then the person will be less inclined to do it because it takes so much mental effort.

Ideally, the brain is set up so that all areas of Gestalt and Logic processing are accessible, and so that all the integration routes that connect them are totally clear. With this perfect set-up, all types of learning will be easy. Any blocks will make the process less efficient and more stressful.

Blocks In Mental Processing.

People who find learning joyful and easy have very few blocks in their mental processing so anything they put their conscious intent into will be successful. (They may have still have some blocks to specific functions, but not in essential academic areas). A survey of 1600 people in Britain who have achieved fame in various professions revealed that some 85% of scientists were students who really enjoyed their schooldays[34]. These people were able to fully utilise the very purpose for which their brains were designed - learning.

As a child I too loved learning but I noticed there were a lot of other children who were having difficulties with spelling and understanding the simplest arithmetic. I used to wonder why. When I talked to those children they didn't seem to be any more stupid than me. They were as creative as me but they had trouble with particular tasks that were easy for me. I couldn't understand it. Now I do.

Blocks to mental processing take two forms: organic or physical blocks, and functional blocks.

Organic or physical blocks can result from a variety of causes. One is that during the development of the brain, at between four and six weeks of gestation, the foetal brain is a neural tube that closes from the front to the back. When the tube doesn't completely close it can manifest as Spina Bifida. In the normal developmental process, the neurons that will form the grey matter on the outside of the adult brain are at this point on the inside of the foetal brain. An extraordinary process called neuronal migration then occurs[35].

In neuronal migration, the nine billion or so neurons lying in the centre of the developing brain migrate to take their place in the cerebral cortex. It is a marvel that these neurons end up lying next to the neurons that in future they will need to co-operate with. What is more amazing still is how often this process occurs correctly. On occasion, however, it goes awry and neurons end up in the wrong place, leading to future functional problems. It is the neuronal migration phase that is often interfered with by excessive alcohol intake by newly pregnant mothers which can lead to a condition of partial mental retardation called foetal-alcohol syndrome[36].

Another major cause of organic or physical blocks is micro-bleeding in various areas of the brain, due perhaps to a difficult or too-rapid birth. This micro-bleeding is the breaking of very small blood vessels in certain areas of the brain and it can lead to oxygen starvation of the cells in this area. Hypoxia (or a lack of oxygen), can kill off brain cells, creating dysfunctional areas of brain tissue. These areas can vary from very small to reasonably large, with corresponding levels of dysfunction[37].

Two factors determine the nature and extent of brain damage resulting from hypoxic episodes: at what age and exactly where it occurred in the brain. Much of the cerebral cortex is quite plastic and one area can easily take over for another area that is damaged, but this plasticity decreases with age. Part of this plasticity of brain function before the age of eight appears to result from the active myelination and elaboration of various nerve pathways that is still occurring. After this age, the neural networks undergo pruning and sculpting to increase efficiency, but with a concomitant decrease in plasticity[38].

Secondly, there are parts of the brain, particularly old brain areas such as the hippocampus, that perform critical functions which cannot be performed by any other brain area. When these areas are damaged, dysfunction almost always results, with the degree of dysfunctional paralleling the degree of damage.

The other common cause of physical or organic blocks is a blow to the head at any time in life. Such events may also cause micro-bleeding with concomitant dysfunction. Again if this damage occurs early in childhood, generally before age eight, and particularly if it occurs in the first few years when the brain is most actively myelinating pathways and developing new circuits, the function of the damaged areas may be completely taken over by other brain areas. If, on the other hand, the damage occurs later in life, the same initial degree of damage may produce more far-reaching and long lasting effects.

Functional blocks are far more common and appear to be caused by emotional stress. For some reason, emotional stress can cause processing modules to go off-line in our biocomputer. Although the structures remain intact, they are not available for use. An extreme example of this from psychiatry are cases of hysterical paralysis, when a person may become totally paralysed, yet have absolutely no detectable organic dysfunction. Episodes of hysterical paralysis may follow emotionally traumatic events, and then just as suddenly be resolved with full return of movement[39].

From my perspective, functional blocks are the most common cause of learning problems in children and adults. By comparing the results of standard psychological tests used to assess learning disabilities, with access to specific brain functions and integrative pathways (such as the corpus callosum) which we can determine by specific kinesiology tests, we have found a very high correlation between poor access to specific brain functions and poor performance on the standardised tests. This will be discussed in greater length below.

Because it prevents the effective integration of Gestalt and Logic functions so essential in academic pursuits, "blocked" flow across the corpus callosum is found in almost every case of learning difficulties. And blocked flow across the corpus callosum is usually most strongly correlated with the poor development of Logic lead functions. In rarer cases, poor development of Gestalt lead functions may also be associated with "blocked" flow across this vital integrative pathway.

The other major factor is blocks to access of key lead functions required to perform specific tasks. Again, poor access to critical lead functions, assessed using kinesiology, correlates highly with observed learning problems. Whenever there is an area of learning dysfunction, we can measure corresponding stress in accessing the lead functions associated with this area of disability.

When the block is in an important academic area, such as reading, spelling or maths it reflects on other aspects of ourselves, such as our self-confidence and self-esteem. We perceive ourselves as dumb or just hopeless in some area of function, outcomes we will discuss in later chapters.

Essentially, all specific learning difficulties result either from lack of access to specific brain functions, or the inability to efficiently integrate those functions that we do access. Many functions, like reading and spelling, require the use of both Logic and Gestalt lead functions simultaneously and in highly integrated patterns. If you can't integrate these functions, even though you can access them, you simply cannot read or spell effectively. This lack of access to specific lead functions and/or lack of integration of these functions, I call loss of brain integration which is the underlying cause of the vast majority of learning disabilities.

Gestalt And Logic Lead Functions.

Both sides of the brain are constantly interacting and the way we learn is the result of the degree of integration in the lead functions of both cerebral hemispheres.

Each hemisphere provides the entry point to an integrated module of cortical and subcortical function, involving the relaying of sensory information to both cortical and subcortical areas and the laying down of new memories that may then be consciously recalled.

Each lead function contributes its own special capacity to all of our thought processes[40]. Certain tasks require certain lead functions. Other tasks require other functions, but all are using the same central processing units, located in our subconscious mind. We just use different combinations of the existing modules or arrange them in a new order - multi-tasking - to do different types of processing.

The human biocomputer is indeed very well designed.

To highlight my proposition I quote Levy and his explanation of the role of the right brain and left brain in reading. Instead of using his terms "right brain", "left brain", I have substituted "Gestalt lead functions" and "Logic lead functions":

"When a person reads a story, the Gestalt lead functions may play a special role in decoding the visual information; making an integrated story structure, appreciating humour and emotional content, deriving meaning from past associations and understanding metaphor.

"At the same time the Logic lead functions are playing a special role in understanding syntax, transforming written words into their phonetic representations and deriving meaning from complex relationships."[41]

Reading is a task that clearly requires Logic and Gestalt lead functions to work well together. To orchestrate this highly complex integration of a large number of both Gestalt and Logic functions, and to synchronise these functions with many subconscious cortical and subcortical modules, an awesome degree of automatic organisation and coordination is essential.

In the next chapter we examine what happens when this automatic brain integration is compromised, or various processing modules are either not accessible, or only accessed poorly.

Major Types Of Logic And Gestalt Function.

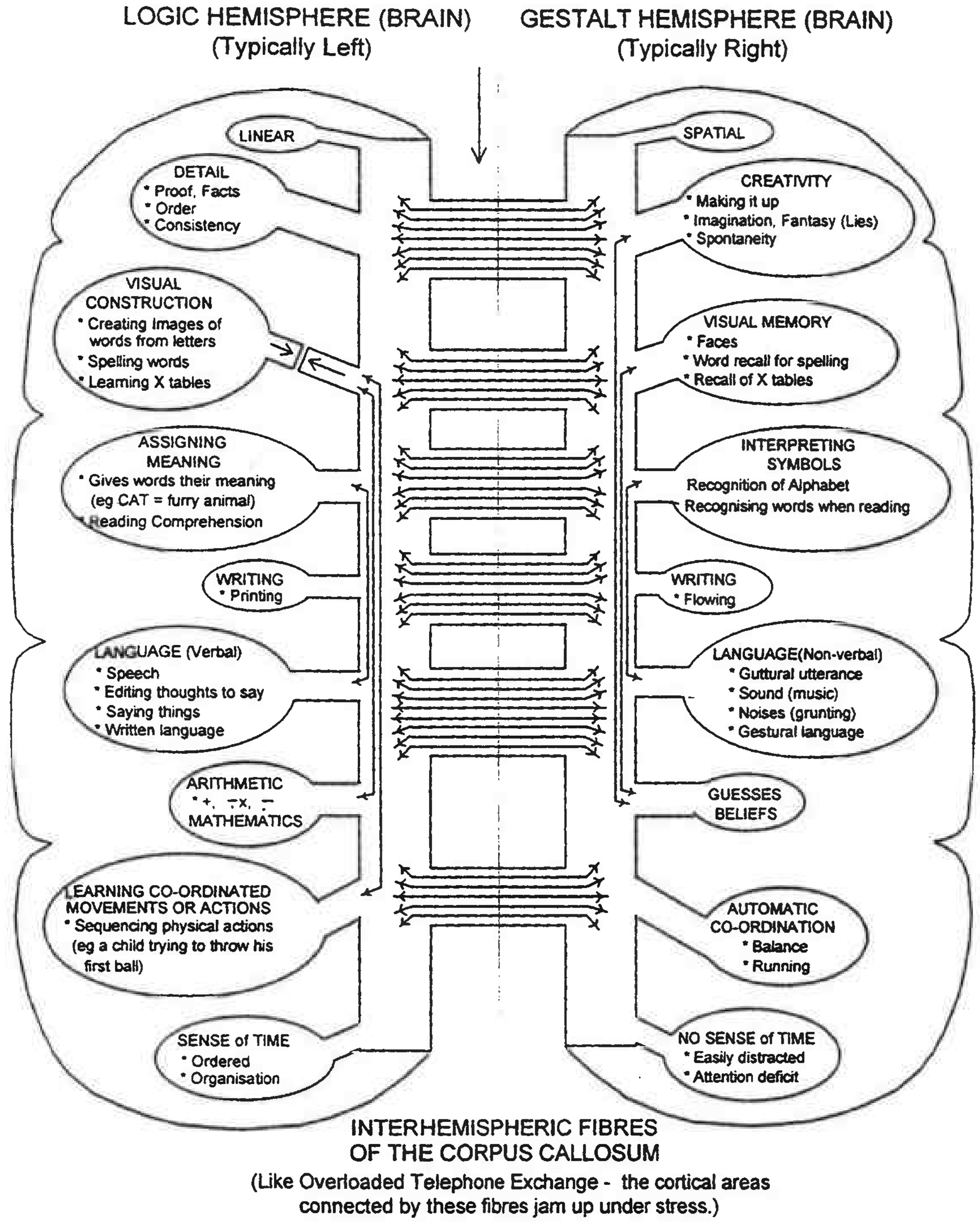
If you look at Figure 2 you will see that Logic lead functions are typically found in the left hemisphere and tend to be linear and sequential, involved with proof, facts, detail, order and consistency. In contrast, the Gestalt lead functions are typically in the right hemisphere and are simultaneous and global, involved with spatial awareness, creativity, visualisation, and beliefs.

One of the primary Logic lead functions is to construct internal visual images for instance of letters, forming words. It is therefore involved in spelling and learning new words. If we spread a set of alphabet blocks out on a table and then ask a child named John to spell his name, he will look around the table until he finds the "J" block. Then he will look until he finds the "O" block, then the "H" and the "N" and will arrange them to construct a physical, visual image of the word John.

This is exactly what happens in the visual construction process of the Logic hemisphere, except instead of moving physical blocks around, it is instead moving symbolic letters around in your mind's eye.

Once the visual image has been constructed from its pieces then, in a sense, a "picture" is taken which is transferred to the Gestalt hemisphere where visual memory is located. Visual memory is where we store eidetic information or images, which can then be recalled into active memory. While we talk of these as visual images and perceive them as pictures, visual memories are not actually static images like a snapshot, but rather reconstructions based on a record of the neural activity stored in the sensory cortices. Reactivation within the visual "convergence zone" by the act of conscious recall causes ensembles of neurons storing the pattern to reconstruct the image in our mind's eye[42].

When you go to spell a word, you activate your eidetic memory of the image that you created perhaps years ago, and that image suddenly appears in you mind's eye. To spell the word you then merely read off the letters in the order in which you see them. Likewise, if you have written a word, and are not sure if it is spelled correctly, you will often find yourself looking up into your head and then saying " Oh yes, it is e-i and not i-e" as you successfully reference the image in your mind.



* WORKS BIT BY BIT (Sequentially)	* WORKS SIMULTANEOUSLY (Intuitively)
* TIME ORIENTED (Organisational)	* NO SENSE OF TIME (Only-Now/Not Now)

Figure 2. Essential Lead Functions. *This is a diagrammatic sketch of some of the major Gestalt and Logic lead functions and the role they play in our mental processing. Note that the Logic lead functions of the left hemisphere process information lineally, sequentially, rationally and analytically. In this mode processing is objective, with reference to "facts" and based on deductive reasoning. In contrast, the Gestalt lead function process information simultaneously, globally and holistically as a Gestalt pattern or form. In this mode processing is subjective based on intuitive "knowing" and inductive reasoning.*

If we consider reading, we find that reading begins with a Gestalt lead function - the interpretation of or decoding of symbols; the recognition of the individual letters, which are grouped as words. The decoded words are then sent to Logic lead functions to have meaning assigned to them in a process called "meaning assignation".

Therefore, reading comprehension is based not only on the ability to decode symbols and to know what the word is, but more importantly the assignment of meaning to the decoded symbol.[43] Reading is after all the process of extracting meaning from written language.

When we are printing, the process is largely a Logic function because in printing you write one letter or symbol at a time in a linear sequence. If you change your writing mode to cursive script, or connected writing, then you switch to a Gestalt lead function because spatial flow is involved. Running writing is one continuous function rather than a series of individual actions requiring continuous spatial awareness.

Language, as you can see in the diagram, is located in the left hemisphere in most people's brains[3]. The language that we are defining here is speech or verbal communication. It is the ability to assign meaning to words, to edit your thoughts and to say them. It also governs written language and applies the rules of grammar or syntax.

But there is also the language of the Gestalt - a language that is largely non-verbal. It takes the form of utterances, "Uh! Uh!", and use of body movement. A two-year-old doesn't speak very well, but will make guttural sounds and point to indicate what it wants. The child is using two forms of Gestalt language: gesture and guttural utterance.

Many races are known for their Gestalt language. There is an old saying that if you tie the hands of southern Europeans they will not be able to speak because to them, much of the communication, or certainly the emphasis of what they are saying, is provided by hand gestures.

If, when speaking with such a person, you heard only the words he was speaking, you would miss a great deal of information and meaning because so much is conveyed by the way he holds his eyes, animates his facial muscles and moves his hands. Gestures enhance our communication to a great degree so much of the information we put across about ourselves is actually communicated by body language. It has been estimated that body language accounts for more than 60 per cent of total communication between people. Only about 7% is actually carried in the words[44].

The other type of Gestalt language is color, form and vocal tone, which again provides emotional emphasis to what is being communicated verbally. Research has shown that about a third of the information content in speech is from tone and inflection of the voice[45]. Damage to the right temporal cortex in the analogous area to Wernicke's Area on the left, impairs people's ability to give affect to their speech by changing vocal tone and inflection. Instead, they tend to have flat intonation and little prosody or vocal intonation to give meaning to the words and sentences they say[46].

In the realm of numbers, Logic governs. There are particular Logic functions involved in symbolic reasoning of which the simplest form is arithmetic: adding, subtracting, multiplying and dividing[47]. Writing "one plus two" means making use of mental symbols to represent concrete realities, like one pencil and two pencils.

If you move to higher levels of abstract conceptualisation you get mathematics: "X plus X equals Y". No number of Xs can ever equal a Y concretely, but if they are standing for abstract proportionality, they constitute a very valid statement. Abstraction and abstract functions can only be appreciated via the entry point of access to Logic lead functions.

On the other hand, Gestalt lead functions allow us to draw on the overall situation, pattern or picture, and guess what the answer might be. If you get the overall idea you often develop a belief based on your feeling or hunch about the situation which is often correct.

As you can see in Figure 2, when we move to the operations of the physical body, learning to develop a coordinated action relies initially upon Logic lead functions to organise and plan a motor sequence in conjunction with the subconscious caudate nucleus and cerebellum. It is Logic led.

You first have to learn a sequence of individual physical movements to perform a whole action smoothly. You know what it is you want to do, this conscious desire then activates Logic lead functions that initiate the frontal cortex-caudate nucleus conversation that eventually results in a successful motor program to perform a physical action.

The motor sequences to perform the desired action result from the interplay between the Logic lead functions, frontal lobe motor areas, and the head of the caudate nucleus. But once the sequence for this motor function has been transferred to subconscious parts of the brain (basal ganglia and cerebellum) they now appear to be run by Gestalt lead functions which simply activate the subconscious "Pour a glass of milk program" and this then becomes a single, integrated movement.

The Gestalt brain also controls the body's spatial awareness and this perhaps explains why people who are Gestalt-dominant in processing are often athletically gifted because they have a great sense of their body orientation in space.

Another important area of Logic is a sense of time. Logic provides us with the ability to perceive the linear sequence of time passing: one minute, 10 minutes, 60 minutes, two hours. This function resides in the same part of the brain that allows you to order your actions and to organise.

By contrast, the Gestalt hemisphere has no sense of time. Gestalt-dominant people will tend to have poor attention to detail and they can sometimes suffer Attention Deficit Disorder. Why? Because to be ordered and sequential in your functions you have to concentrate, and concentration is a matter of paying attention over time. If you have no sense of time, how can you pay attention over it? Without a linear time sense to give you a reference point for your activity, you tend to jump from one activity to another, to be easily distracted and have great difficulty in holding your attention on any particular task for any length of time.

In overview, you can see how you have a set of Logic lead functions that are in most people predominately located in the left hemisphere. Logic lead functions basically work in bits, they are sequential, linear and analytic. They are also time-oriented, which means they are ordered and organisational.

By contrast, Gestalt lead functions work simultaneously, allowing us to intuit or "know" things. There is no time in the conventional linear sense, there is only Now! or Not Now!

Another feature to take note of in Figure 2 is that the Logic and Gestalt lead functions are wired together for integrated function. This wiring takes the form of the neuropathways crossing through the corpus callosum, which is the major interchange for the communication of information between the two side of the brain.

In the examples above, of spelling (creating images on one side and storing them on the other) and reading (decoding symbols on one side and assigning meaning on the other), it becomes clear that the commissural fibres passing through the corpus callossum are the centres of integration for many cortical functions.

So although it is essential to access relevant lead functions, both Gestalt and Logic, it is equally important to have clear communication between them. But what happens when you have problems in accessing those functions or their interconnections?

Patterns Of Dysfunction.

The explanation that follows is based on models of learning from the literature and on my clinical experience. I am talking more about lack of or poor access to specific cortical lead functions essential for certain types of learning and thinking. If any of these cortical lead functions is functionally "blocked", types of thinking and behaviours dependent upon access to that function are just not available.

The LEAP model is also concerned with the integration of different functions at many levels within the brain, from the integration of Gestalt and Logic lead functions initiated by conscious intent, to the integration of the many basal subconscious functions carrying out the intended processing requested by the lead functions. This multi-level integration of the functions of many disparate areas in the brain, both conscious and subconscious, is termed "brain integration", a concept developed in more detail in the following section.

In this model problems in learning, either in general or in particular areas, appear to originate from one or more of five major sources:

- **A failure to access or poor access to specific Gestalt or Logic lead functions. Access to these functions is blocked.**
- **The pathways across the corpus callosum and other commissure fibres are blocked preventing effective integration.**
- **Access to specific subcortical processing modules is blocked.**
- **The integrative pathways connecting the subcortical pathways are blocked.**
- **The integrative pathways linking the cortical and subcortical processing modules are blocked.**

By "blocked" I mean that access to these processing centres or their integrative pathways is not available, the nature of this block is discussed below. Whatever the causes, all the blocks will result in some type of learning dysfunction. In the context of learning difficulties, I find the most common pattern is Gestalt dominance in mental processing due to blocked flow across the corpus callosum. Because our Gestalt functions are well developed from birth, if the flow of information across the corpus callosum is blocked at an early age it appears to inhibit the development of Logic functions. In its extreme expression, Gestalt dominance in mental processing is currently recognised as Attention Deficit Disorder.

Normally, there is a complementary relationship between Logic and Gestalt with one balancing the other. But what happens when, for some reason or other, you lose that balance? What happens when you can access Gestalt functions well but have only limited or poor access to Logic functions? This lack of balance results in the expression of quite consistent patterns of behaviour, which centre around avoiding those tasks you find difficult, frustrating or impossible.

For people suffering from any type of SLD, (ADD, Dyslexia etc) school is often a frustrating experience because so many essential academic functions, such as spelling and reading, require good integration. Learning becomes very stressful and the individuals who suffer SLDs it can become very frustrated and angry. They are intelligent, and they know it, but cannot do so many fundamental tasks that they are often presumed to be or presume themselves to be stupid.

I once worked with Ron, a 42-year-old American who was a classic example of poor integration. He was innately bright with good access to Logic and Gestalt but with almost no communication occurring between them. Ron had never learned to read and he only spelled phonetically.

When he was 14 and a big, athletically well-developed youth, a teacher admonished him in front of the class by saying, "Ron, you're so stupid, I don't know why you are here. You are wasting your time, my time and the school's time." Any other child might have stormed out of the school, never to return, but Ron took it as a personal challenge. He became absolutely determined to finish high school even though he couldn't read.

He managed this seemingly impossible task by getting friends to commit their class notes to tape (he had good auditory comprehension and recall), and by cleverly cross-examining teachers during tests. When it came to written exams he would look through the questions and manage to recognise some words. Then he would ask his teacher a question about the question and from the answer, would then guess what the question might be. He already knew the answer because he had studied, he just couldn't read the question. By this and many other ingenious methods, he was somehow able to graduate from high school, and in the manner of the athletically gifted, he was given a football scholarship to university.

After six months of continually failing exams and of it becoming increasingly apparent to his tutors that he was illiterate, he flunked out. At 19, he was a very angry, very frustrated young man. He bought a Harley Davidson, joined a gang and took to the road for the next 10 years. And on many Saturday nights he found himself fighting in a bar to vent his internal rage.

The only difference between Ron and many prisoners is the fact that he did not happen to kill or permanently maim someone in one of these Saturday night brawls. If he had, he would probably still be behind bars. One of the only commonalities that has been found among prisoners who commit violent crimes is that they are almost all functionally illiterate.[48]

One day, he happened across an old school friend and they got talking. The friend was pursuing personal growth and seeking spiritual answers. Ron was fascinated. He desperately wanted to know more, but found that most of the answers were written in books. He needed to be able to read. He traded in his colors, built a landscaping business that became quite successful because it relied on his innate creativity and, he married, as it happens, to a primary school teacher.

With the motivation of wanting to read esoteric books, over the next two years Ron learned how to read. He succeeded only by force of will. To read he would willfully jam the functions of his Logic and Gestalt together. At the end of about 10 minutes of reading, however, his eyes would be streaming, his stomach churning and he'd have to stop. Half an hour later he'd start reading again, forcing himself to succeed, albeit in short bursts.

After a couple of hours of treatment which opened the flow through his corpus callosum, and defused his negative attitude toward reading, Ron was able to read effortlessly for hours. He still does so to this day.

Extremely motivated individuals like Ron are very rare. He was motivated enough to overcome the stress involved in surmounting the barriers to knowledge. For most people, when the stress gets high enough they just avoid tasks.

I had another adult patient, a 32-year-old woman who could read very fluently -in fact too fast, but could remember virtually nothing of what she read. She was just word processing, not reading. She could write, but in terms of reading, was functionally illiterate. Her bright personality had been sufficient to allow her to get on in the world and she worked at many jobs including being a waitress. In order to explain the menu to her customers, at the beginning of each day she would go to the chef and have him explain each dish to her and show her which one it was on the menu. When people ordered she would have the point to the dish on the menu and in this way she could tell what they were ordering.

She was eventually offered the position of maitre d' of the restaurant. Yet because she felt she couldn't do a job that required greater literacy, she left the restaurant. Instead of being confronted with what was difficult for her, she avoided it altogether. This was not the first time she had opted out of the stress loop.

The Stress Loop.

Lack of integration of brain functions, or lack of access to specific lead functions, results in stress in doing certain tasks. Because of the stress, you avoid the task.

Particularly when you are a child in school, there are certain tasks that may be difficult such as reading, spelling or maths. You try to avoid doing them. Your teachers and parents however, recognising the importance of these subjects will often force you to attempt them.

You keep being told, "Try harder; pay attention" and "Don't be so lazy. Do your homework!" As a last resort they will try punishment but punishment only generates more stress because you genuinely can't do it or can do it only with enormous effort. More avoidance and thus, more stress.

The stress actually creates a greater loss of brain integration, and so the loop goes around and around until an individual develops such avoidance behaviours they are regarded as misbehaving or withdrawing deliberately. Children in this loop are often labelled troublemakers, daydreamers or class clowns.

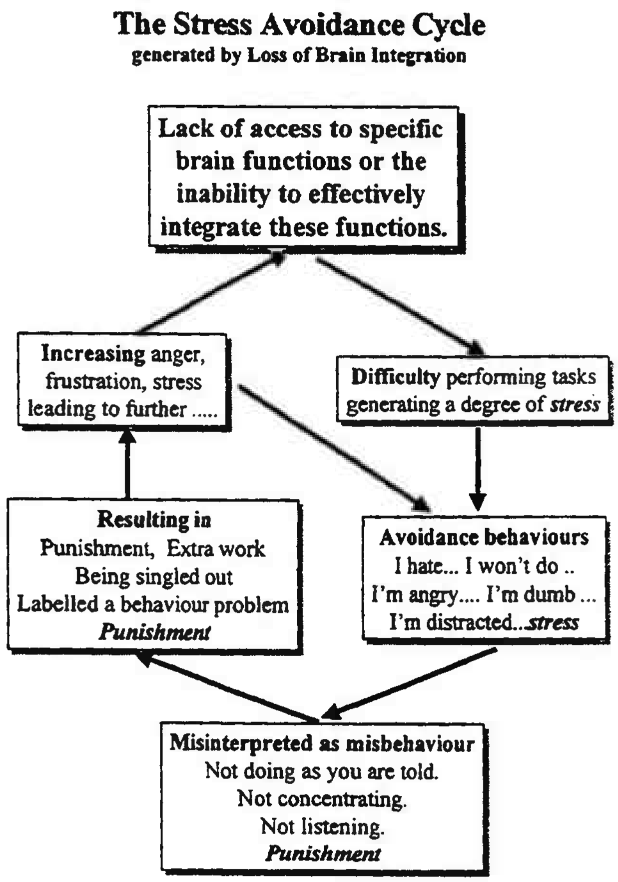


Figure 3. The Stress-Avoidance Cycle. Whenever there is lack of access to specific brain functions or the ability to integrate these functions this initiates the avoidance of tasks dependent on these brain functions. This is often misinterpreted as misbehaviour.

But people's behaviour always tells you the truth. It's just a matter of being able to understand what the behaviour is really telling you. From a conventional perspective, a child not doing what he is asked is believed to be purposely misbehaving and therefore the proper response is to encourage them to do that which they are avoiding, and if this doesn't work, to punish them.

Yet if the child could learn to spell, they would spell. Any child that can read and comprehend easily, enjoys reading as there is always something interesting to read about. They do not avoid it. What is not understood is that these children often do know *how* to spell but they just lack access to the essential functions needed *to* spell.

When young people say that they hate maths or English, what I understand them to be really saying is "I cannot do this task easily," or, "I can only do this task with a great deal of emotional and mental stress and if I can, I will avoid it." If you think about it, it is perfectly rational to avoid something that both tortures you and gives you very little in return for the effort.

Avoidance behaviour is largely misinterpreted in our society as misbehaviour, plain and simple. But if we understand what their behaviour is actually telling us we could then have compassion for them having to attempt that which is very difficult.

I find that most people with learning problems are innately very clever. In my clinic we have worked with thousands of so-called poor learners and constantly find that the highest percentage are not stupid or slow, they just lack access to functions that allow them to express their intelligence. In fact, the majority are highly intelligent as demonstrated by their ability to understand concepts and solve practical problems, they just find it difficult to perform basic academic functions like reading and spelling.

All of us have a sense of our own innate intelligence. If you have a sense that you are intelligent but cannot perform simple tasks that most of your peers can master easily, you start feeling stupid, and find yourself constantly failing. And every time you fail you become more firmly entrenched in a downward spiral of loss of self-esteem and self-confidence which, of course, constitutes more stress - more loss of integrated brain function - leading to more failure.

Brain integration is very fragile, in the sense that it is largely determined by your stress levels. Even the most well integrated person, given enough stress of a specific type, will lose integration and become temporarily dysfunctional. One of the major differences between people is the type of stress and the extent of stress required to cause loss of brain integration.

In a sense, we are all dyslexics, or learning disabled under certain circumstances.

People who already suffer poor access or poor integration, are already in a state of partial loss of brain integration and hence need very little extra stress to become totally dysfunctional. This may occur largely in one area of function. For example, they will look at a maths equation and won't even know where to begin. They will state: "I'm hopeless at maths", not recognising that they have merely lost integrated brain function in that particular sphere. They have not lost their intelligence.

The opposite of the downward spiral is what happens when someone has been reconnected to their integrated brain functions. They attempt a new task, and now being able to bring fully integrated brain functions to the task perform it with ease. Tasks now begin to have positive outcomes. And as success is reward and stimulates release of endorphins in the brain, you will now look forward to the next challenge. If you once again maintain integrated brain function you will be successful again: further reward. You become more an more confident of your ability to succeed and this is the essence of self-confidence.

Self confidence is a common outcome of integrated brain function. I will elaborate on this ephemeral thing called brain integration in the next section.

Brain Integration And Performance.

Now that we understand the basic structure and function of the brain and have a model of learning based upon the integration of Gestalt and Logic lead functions, it is timely to consider what brain integration is and how it affects our performance.

Because I am proposing a new concept of brain integration, I first must define exactly what I mean by this term. Brain integration is the state of having access to all relevant Gestalt and Logic lead functions, the subconscious processing centres and the pathways to integrate these processing modules. In this state you are in optimal learning mode because every function you need to perform any type of learning is accessible and you can easily integrate all relevant functions to perform these tasks.

In the state of complete brain integration there is virtually nothing the brain finds difficult to learn. Yet only a very small minority of people (probably less than two to three per cent) have managed to survive childhood with most of these functions intactSuch ease of learning and mastering tasks is actually the birthright of all human beings. It is not always what happens. To understand why, we need to look at the nature of brain integration.

Choreographing Thought

Nature designed the brain as a fully integrated functioning unit in which many separate parts (carrying out various functions) were designed to work seamlessly together. The key to this ideal functioning is to maintain a level of stress which will not interrupt this process. Once stress exceeds a certain threshold various functions may be compromised, or the integration of these functions may be lost.

But what is the inherent nature of this integration that can be so easily compromised?

Conventional neurological theory presents a view of the brain as a mass of neuronal connections, and it is believed that it was via these neurons (wires) and their connections (junction boxes) that mental processing occurs. In such a model it might be difficult to understand how the connections could break down when subject to a specific stress and then suddenly be regained when the stress is removed.

Recent neurological research, however, has suggested that this picture is a very limited view of the actual processes involved in thought and other types of higher mental processing. The new view of the brain suggests that much of the integration of functions occurs not by information flowing to a particular area that then integrates this information, but rather, that it is the *synchronisation* and timing of processing occurring in widely distributed subsystems in many different areas, at the same time, that constitutes integrated brain function.[49]

Using the analogy of a railway system, the old view was that there were a lot of stations connected directly by tracks. Trains could not leave the tracks and could only change direction at the shunting yard in the station. It was a fixed, linear system in which it was assumed that for processing to occur, information needed only to reach its destination, like a train pulling into a station.

The rails are still there in the new theory, but now the trains also communicate by radio. As well, some of the information coming into the station is carried by vehicles other than trains: cars, bicycles and trucks - all travelling at different speeds on different routes, and some are not limited to the tracks.

For example, for just one mental process to occur, it requires not only the timely arrival of information carried in a number of trains to converge on the same station at the same time, but also radio transmissions about the information being carried on other trains, running on other tracks and entering other stations, which must also arrive right on time. But still, only part of the necessary information has reached the Grand Central Processing Station. Other essential information must also arrive via other vehicular traffic. Only then can the information be integrated to perform one sometimes quite simple function. This is what it takes to add one plus one.

A further potential difficulty in this highly complex system is that the trains only remain in the station with their information for a fraction of a second. In that short time, all the other vehicular information must arrive, and the correct radiowave transmissions be received for well-integrated processing to occur.

So clearly the nature of brain integration is timing and synchronisation of neural events. Loss of timing results in a massive traffic snarl in which little information gets through. Any information that does move is often meaningless because it does not seem to be related to anything else.

In short, this is what happens when you try a mental process that you find particularly difficult. If you have difficulty understanding maths, the loss of synchronised arrival causes an information jam in the processing modules that are involved with doing maths. You just do not have the right information coming together at the right time to allow you to comprehend and solve that type of mathematical problem. It does not compute.

From a neurological point of view, it has been recognised for a long time that the brain is a mass of some one hundred billion neurons, each of which has one thousand to as many as one hundred thousand other connections. And these are just the trains and the stations! Nerve impulse conduction in any one neuron also generates electrical and electromagnetic fields (like the radiowaves in our analogy), that broadcast information to other neurons about their activity. These can be recorded electrically as EEG patterns.

More recently, it has been shown that considerable information flow in the brain is actually not carried by neuronal connections at all. Rather it is carried by volume transmission.[50] Volume transmission is the information carried by various chemicals both within and between the neurons and at different rates of speed - all those bicycles, cars, trucks and goat carts that aren't running on the railway lines.

Antonio Damasio, a leading American neurologist, proposed that thought and mental processing is the result of synchronised neural, electrical and chemical activity generating higher-order information flow within the brain. There seem to be what he describes as "convergence zones", where information from different areas comes together to create another level of mental processing, one that borders on what we might term "thought".[51]

For synchronous firing of neurons in many separate brain areas to create conscious thought would appear to be dependent upon some type of "time binding" requiring powerful and effective mechanisms of attention and working memory. This time binding of disparate inputs to the various convergence zones appears to rely upon the global attention and working memory areas of the prefrontal cortices and their connections to the various limbic structures such as the anterior cingulate, amygdalae and hippocampi.[52]

The timing and synchronisation of neural activity in these diverse brain regions, both cortical and subcortical, must be maintained to produce coherent "thought". The main risk of our thinking being dependent upon this integration of separate processes into meaningful combinations is that any mis-timing or loss of synchronisation between these processes could result in learning disorders. To quote Damasio "any malfunction of the timing mechanism would be likely to create spurious integration or disintegration".[53]

From this new perspective, therefore, brain integration is the dynamic synchronisation of the timing of neural and mental events. Any loss of synchronisation represents a loss of integration. Loss of integration in turn, results in loss of some specific mental capacity, such as the ability to do maths.

The Stress Factor

When I tell people we are going to integrate their brain functions they tend to assume the change will be permanent, like pouring concrete. It is not. Brain integration may come and go depending on a two factors: the stress in your life at that time, and the stress associated with whatever task you are doing *both* at present and in your past.

The difference between a well-integrated person (who learns easily), and a poorly integrated person experiencing learning difficulties is stress tolerance - the level of stress that triggers a loss of integrated brain function.

Following, or during times of peak stress in our lives, loss of brain integration may be global. There are times in your life when you totally lose it. You lose your ability to think straight and just can't seem to function. In this case you have lost synchronisation of most of your brain functions. The trains are off schedule, the roads are blocked and the drivers are on strike.

What is more normal however, is the loss of local integration: loss of synchronisation between functions that perform specific tasks. In these cases, only that task is compromised; the train system is running well, but some of the stations have closed.

The other factor to recognise is that there is no such thing as a *stressor* that causes loss of brain integration, rather there are stresses in people's lives and, depending on the context, they may or may not cause loss of integration. The same stressors that cause one person to lose integration may only represent a challenge to another person, a challenge to accomplish something. For example, some people who find maths easy might become dysfunctional when asked to write an English or history essay. Yet if you ask a person who easily writes English essays to pen something about literature, they'll be happily challenged. But if they are asked to work out a mathematical equation, they may fall apart. Whether an experience constitutes a stressor or a challenge is thus different for different people. Stressors are contextual within each person's life and life's experience.

This brings us to the real cause of learning difficulties: *the loss of integrated brain function, produced by a particular stressor in a particular circumstance. For some it may only be a momentary loss of integration when performing a specific task, while for others, it may be an on-going loss of integration in whole areas of function.*

We emphasise that this is an entirely new concept, not current in modern psychological or educational literature. Previously there has been no way to measure whether someone has integrated brain function or not. Hence, when people became dysfunctional it was assumed that they had become anxious and that their anxiety had inhibited their ability to think.

Kinesiology provides us with the opportunity to understand why a person becomes dysfunctional when trying to learn. Any stressor affecting mental functioning can also cause a change in muscle response. By matching the muscle response that indicates stress, against different types of stressors, the specific stressor causing loss of integration can be identified. I can tell, for example, whether the loss of integrated brain function is due to emotional anxiety or to the loss of synchronised brain function itself. I have found that the most common cause of learning difficulties *is* the loss of synchronised brain function.

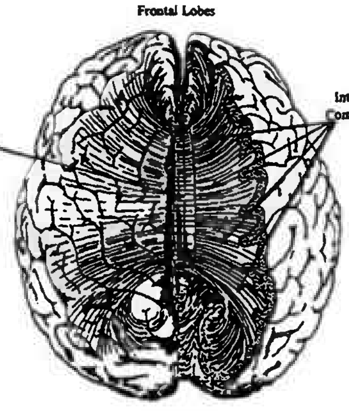
Once you lose integrated brain function, you become dysfunctional - unable to perform a desired task and this then often generates an emotional state of anxiety. If you can't understand something you often become anxious, and this generates further stress which causes further loss of integration, and further anxiety; a positive feedback loop. I claim that it is the initial loss of integration that causes anxiety, not the anxiety that causes disintegration. In my clinical practice based on several thousand cases, in greater than 90 per cent of these cases, loss of brain integration precedes the emotional state of anxiety. Loss of brain integration does indeed immediately generate anxiety, because once you have become dysfunctional there is plenty to be anxious about!

Anxiety can become a factor, but only after you have already lost integration, tried and failed. The more you fail, the more anxious you are likely to become because you are afraid of failing again. This anxiety created by the fear of failure may then cause more rapid and even greater loss of integrated function, guaranteeing that you will indeed fail again. Failure initiates a negative spiral of diminished self esteem and loss of confidence. This is the negative stress loop.

THE CORPUS CALLOSUM: THE ROUTES OF INTEGRATION.

The most common site for loss of integration is the cortical areas connected by fibres passing through the corpus callosum, the lineal structure running from the front to the back of the brain. It contains between four hundred million and six hundred million interhemispheric neurons, which connect the functional areas of the right and left hemispheres. (see Fig.4)[54]

Anatomically, the Corpus Callosum is a 1cm strip on axons connecting a cortical column in the right hemisphere with the cortical column in exactly the same position in the left hemisphere, and vice versa. We can thus regard the corpus callosum as the trunk cable connecting many telephone switchboards by which functions in one hemisphere are co-ordinated and integrated with functions in the other hemisphere. If the operators on all switchboards controlling individual cortical processing are all on duty, then the flow between the functional centres in the two hemispheres



through these switchboards can be easily co-ordinated; all the messages can be transferred to the correct areas at the right time and processing can proceed unimpeded.

Figure 4. The Corpus Callosum - expanded view. *On the right side of the diagram the cortex has been removed so that you can see that most of the interhemispheric fibres that cross the corpus callosum connect a cortical column of one hemisphere with cortical columns in exactly the same area in the opposite hemisphere.*

If 70 per cent of the operators on any one of these switchboards suddenly walked off the job, few problems will be experienced as long as there is only minimal flow through the switchboard. But as soon as the functions dependent upon that switchboard are activated, the number of messages will rapidly exceed the number of available operators, lines start getting crossed, messages are cut off or mislaid and eventually the whole switchboard jams up. Functionally, this represents a loss of synchronisation of flow across the corpus callosum and hence a loss of integrated brain function.

If only one of these cortical switchboards is compromised then only those messages that are usually processed through this switchboard will be affected. Because of this block to straightforward communication, the brain will seek an alternate way to process the information, the next best route. If it cannot integrate the Gestalt and Logic functions that are required to most easily perform this task, the brain will then process the information in the Logic or Gestalt area that is the next most accessible.

If you are already Gestalt dominant in your mental processing, then the Logic functions with which you would otherwise integrate are unavailable. Your brain takes the line of least resistance and processes this information in the Gestalt processing centres that are available. It may not be the optimum method but in your brain it constitutes the most efficient mode possible. If the processing is not possible at all, or only with great difficulty, the brain may just opt out and stop processing this type of information altogether as it is just too stressful.

When you set out to solve a problem in algebra, you look at the problem, and the symbols and spatial arrangement of those symbols are interpreted and decoded by your Gestalt processing. This should stimulate flow across the corpus callosum to activate the areas of Logic function that can appreciate abstract proportionalites. If the integrating areas (switchboards) of the right and left hemispheres connected through the corpus callosum are blocked, suddenly you will not be able to bring on line the Logic functions needed for abstract problem solving. Your conscious response may be, "My God, this is difficult. I don't see how I can do this. It's too hard." This will either result in you feeling very stressed, perhaps to the point of perspiring, or, you might just give up altogether.

Emotional stress or other stressors can cause the cortical areas linked via the corpus callosum to go "off-line", shutting down effective information transfer between the hemispheres, or the stressor may alter the timing of transmission disrupting synchronised activity. Whether it is "blocked" transmission or "de-synchronised" transmission of information through the corpus callosum, the result is the same, a loss of brain integration. From here on, I will call this loss of brain integration due to transmission problems across the corpus callosum - corpus callosum shutdown

Shutdown in one or more of the cortical areas linked via the corpus callosum may occur when a child is as young as two or three, in fact this is one of the most common ages associated with corpus callosum shutdown. The most common result of this is poor access to Logic functions. If it happened before the child reached the age of reason (about four to five), then there is little stimulation of the Logic areas and these areas never develop fully. After age five, most children have developed their Logic functions at least to some degree. In other words, they become more logical and can be reasoned with, and they can now use rationalisation and reason to effectively reduce the stresses in their lives.

Once access to Logic has been blocked such children can be literally locked into their Gestalt functions. They will then attempt to handle the vast majority of their mental processing by Gestalt means. These are the people who are run by their emotions, with little understanding of cause and effect in their life. Yet these people are also often highly creative even though they may have difficulty expressing this creativity in their lives.

The Role Of Subconscious Processing Centres In Brain Integration

While access to integrative pathways is important in the maintenance of brain integration, of equal importance is access to, and the full function of, the subconscious centres involved in mental processing.

As we have stated earlier, the vast majority of brain activity takes place in the subconscious. The desire to perform a mental task is a conscious decision but the ability to perform the mental task relies on an integrated set of subconscious functions involving visual and auditory processing. Even though the auditory processing may not be overtly verbal, we talk to ourselves in our head all the time. And whether you are externally verbalising a thought or only thinking it, you would find many of the same neural pathways are activated.[55]

Thus we rely upon the subconscious visual and auditory functions to do most of our mental processing, particularly when it comes to academic pursuits. Most of the words we see in our inner speech, before speaking or writing, exist as auditory or visual images in our consciousness. If they did not become images, however fleetingly, they would not be any thing we could know. The same is true of symbols, which if they were not imaginable, we could not know them to manipulate them consciously such as in doing mental arithmetic. Again, in the words of Damasio, "thought is made largely of images".[56]

The simple act of reading one word involves a complex cascade of neural processing. It begins with the control of pupil dilation and contraction to provide exactly the right intensity of illumination on the retina. This initiates a vast flow of visual impulses through optic radiations to the back of the brain where they are assembled into a rough image. Then, through a series of steps the rough image is developed into a full-blown conscious perception of the word via references to images in our memory. All neural events up until the moment of conscious perception of the word took place outside of consciousness.

If any of the subconscious processes preceding conscious perception were not easily accessed and well synchronised, then we may have difficulty forming an accurate conscious image. You may for example have difficulty reading a word on a sign if you have suddenly come from deep shade into bright sunlight because your pupils have not yet constricted properly. They are letting in too much light, and that decreases the sharpness of your vision.

On the other hand, even when there is proper illumination of the retina, the streams of neural impulses flowing back to the visual centres follow different pathways and move at different speeds. If these should arrive at the visual processing centres out of sync, you may still have difficulty knowing what the word is. Or, the image may be properly formed in the visual cortex, but problems with accessing referents (images in memory) within the other areas of the brain, may cause you to misinterpret the word on the page. You might read the word "through" as "thought".

This has been a specific - if simplified - example, demonstrating just how many layers of processing are involved and how many potential points of dysfunction there are in the perception of a single word. This is equally true of all other sensory perception. At this point we must acknowledge how truly amazing it is that we are able to perceive the world with such clarity.

Although mental processing is consciously initiated (I look at a book with the intention of reading) most of the actual process of reading is subconscious, right to the last level of visual perception, where it once again becomes conscious. If something should interfere with any of these subconscious processes, I will only be aware that I cannot read, not why I cannot read. This is equally true of difficulty in any other academic area.

If access to these subconscious functions is blocked then clearly our ability to perform conscious mental activity is compromised. As it is in the case of the corpus callosum, one of the primary factors found to block the subconscious functions is emotional stress. And again, emotional stress is contextual for each person and unique to their personal history.

The Loss Of Brain Integration

From a functional point of view, the primary factor controlling our ability to learn is the maintenance of integrated brain function. Since the components of both our learning and memory systems are widely distributed through out the brain, involving both subconscious cortical and subcortical functions, it is the synchronisation and timing of neural events that permits the brain to operate as an integrated unit. Loss of timing or synchronisation between two or more parts results in loss of brain integration, and the ability to "think" in certain ways. It is like an orchestra that has lost its conductor. The symphony musicians are still playing, even playing well, but just not together, and the symphony disintegrates into meaningless noise.

But what can be done about this loss of brain integration that can have such devastating effects on our learning, our sense of self-esteem, and our lives? The next section introduces the LEAP program, a Kinesiological protocol to re-integrate a disintegrated brain. The techniques used in the LEAP Program were developed in the field of kinesiology or borrowed from other fields, and are largely based upon the re-synchronisation of neural activity either via movement exercises or acupressure stimulation.

LEAP: Reintegration of Brain Function and the Correction of Specific Learning Difficulties.

For those people who have long-term on-going loss of brain integration resulting from experiences traumatic enough to permanently shut down part, or most of the communication across their corpus callosum, or who experience the massive brain confusion that we call deep level switching, more specific and direct interventions are required to resolve these more difficult causative issues.

The LEAP acupressure protocol has proved to be very effective intervention that reintegrates brain function with concomitant improvement in academic performance and learning abilities. The following case studies demonstrate the efficacy of the LEAP program.

Leap In Application.

A way of exemplifying the power and effectiveness of the LEAP program is to look at some of the cases to which we have applied it. Interestingly, Susan McCrossin, my partner, is a case in point.

Susan's story.

Generally, you can tell to a large extent how integrated a person is by knowing them for a while and by watching what and how they do things. Because Susan appeared to be such a functional human being, to the point of running her own computer software business successfully in both Australia and overseas, I assumed she was very well integrated. There was no evidence of any major learning dysfunctions.

As a first step in demonstrating the original program to her, I assessed access across her corpus callosum and to my surprise found that she had very little access across it. She had virtually only half a brain functioning and obviously, a major integration problem.

All through her schooling Susan had been a very diligent student who worked very hard. She could conceptually demonstrate to her teachers that she understood the information she was studying, yet each time she faced an exam, she would bomb out. She had a major problem in the fact that she could not adequately memorise dates, names and equations, all things that are crucial to passing written exams in many subjects.

But I knew she spelled very well. And how did she know her maths well enough run her own computer business? Like most innately bright people she had managed to compensate by figuring out clever ways of by-passing, or compensating for her dysfunctions. Susan happens to have a very long forward digit-span capability. She can remember eight random digits where the average adult can only remember six. She also has an excellent ear for sound. What she had managed to do was remember the auditory pattern of words rather than word pictures, which is the usual mode of encoding words into memory. She could phonetically make patterns out of the words and hold these sound pictures in her mind. Susan understood that there were phonic representations in words that were not phonetic. For instance, when she saw "tion", she recognised that phonically this sounds like "shun", but it phonetically is "tie-on".

When it came to learning her times tables, she just couldn't make the images of the answers, and thus had nothing to store in long-term memory. Fortunately for her, her father was a mathematician and would quiz her every day on the way to school about her times tables. She finally got so tired of not remembering the answers, she was motivated to work out a solution to her problem.

She managed to make up algorithms so that she could calculate her multiplication tables very quickly. Normally, people will simply recall the answer to the question, "What is 8 x 8?" by looking up into their visual memory and seeing the symbol picture of the answer, 64. Susan would create an algorithm which built on 8, 16, 32, 64. She did it so quickly that her teachers never realised she had any problems remembering her multiplication tables.

To memorise poems, however, she would have to work for months on a piece that other students would have down in a week. She had no idea that her methods of compensation were not normal for others. It is the only way she could do it. Her willpower had served to overcome her learning problems and she was able to get by, but only with average grades.

It was not until her 10th year of school, when she took a standardised intelligence exam, on which she scored very highly, that her teachers realised how bright she really was. The teachers then began to pressure her to perform up to her abilities and stop being so lazy. They did not realise that she was already putting an extraordinary effort in to get the mediocre results she was achieving. When it came to her final year when she had to pass a set of matriculation exams to graduate, she failed the critical test in Ancient History that had required her to reproduce dates and names.

In spite of her failure, she came out of school with such good recommendations from her teachers that she entered the Royal Melbourne Institute of Technology to do a course in Industrial Design. After a year, she had failed again. Taking her mother's good advice she learned to type and secured a secretarial job. It soon became apparent to her boss that she had more potential than being a typist so she was moved into the data processing area of the company. There, having such logic dominance to her brain function, she excelled.

When we unravelled the stress that had primarily shut down flow across her corpus callosum, we discovered that it was based on an incident that had occurred when she was 18 months old. At that time her father, a banker, had been transferred to the United States for a six-month posting. To a toddler, even the temporary loss of a parent is tantamount to desertion, an unbelievable emotional trauma to someone who cannot rationalise even the temporary departure of a significant being. To deal with the perceived pain of her loss, she made a conscious decision never to be vulnerable to such pain again. The subconscious consequence of this decision was corpus callossum shut down.

Susan was rather lucky because, unusual for a child so young, she already had good Logic development and this became extremely well developed, if at the expense of her feeling Gestalt functions. Computing was a stream that suited her functional style exactly, and operating in a male domain in her own business was no problem because she was cool-headed and unemotional. Having a learning problem is, as Susan's experience shows, not always barrier to being successful in the world. (Australia's richest man, media baron Kerry Packer is a dyslexic, who was held back in his academic function but not in his worldly achievements.)

From then on Susan became the perfect guinea pig for our program because every time we developed something new, we could apply it to her and watch what improvements took place in her performance. Over a year her progress was rapid and very gratifying. In 1993 she went back to university to begin a dual degree in psychology and neuroscience, neither of which are soft options. She was a distinction student and has gone on to complete her honours degree in neuroscience.

She reports that since being reintegrated via the LEAP protocols, she is more intuitive, which reveals that her Gestalt functions are now more open, and thus she is more in tune with her feelings. She often jokes that she had never consciously experienced a feeling until she was reintegrated. She also finds she can remember facts much more easily and this has given her the first real academic success of her life: a university degree at age 42.

Sharon.

When I first saw Sharon she was 15 and presented as being very Gestalt dominant, which is by far the most common outcome of corpus callosum shutdown. In our assessment protocols, Sharon demonstrated only a 3 per cent access to Logic function. She was attractive, charming and very witty, which is the way many Gestalt dominant people compensate for their high level of Logic dysfunctions. Everyone likes a charmer and will usually help them because they are so delightful to have around. Sharon was progressing through school with her classmates but was consistently failing in maths.

In year 10, she could not add up numbers greater than 10. She did not know how to carry a digit and couldn't add, subtract, or do fractions. At 15 she could not abstract arithmetical concepts that a primary school student could manage easily, yet was so personable and popular that she had been promoted through the grades with her peers.

Over a series of appointments that added up to about 10 hours, we did the whole LEAP protocol, reintegrating her visual and auditory functions, and bringing on-line various memory processes. Once the stress on numbers and letters that also caused disintegration had been cleared, we started addressing her presenting problem, which was her difficulty with maths.

I showed her the process of adding and carrying numbers, a technique she had probably been shown hundreds of times before. She suddenly said: "Oh, that's how you do it!" With her new access to Logic available, she could instantly grasp the concepts. I gave her harder problems, and she easily generalised what I was teaching her, and could now deal with elementary arithmetic.

Our job is not to tutor students, so having opened up her functions, we sent her to a maths tutor for remedial work. In the five weeks of her summer holidays she was able to come up to the maths levels of her classmates. She went from basic numeracy all the way to algebra. Her tutor told us that in 25 years of tutoring students she had never before seen anyone make such rapid progress. Sharon's reading and comprehension also improved, as did her spelling. Her self-esteem rose alongside her performance.

Jane.

An eight year old girl, Jane was also Gestalt dominant to an extreme degree. Indeed, she was so fey that you felt that she was hardly there; her body was present but she seemed to be off in her own fantasy world. She was incredibly creative but could never produce any work because she could not access the Logic functions required to organise herself. Jane could do no schoolwork; all she could do was retreat into the realm of creative imaginings.

I took her through the brain integration procedures and after I had seen her a few times, she bought us a present. It was a beautiful tie-dyed wall hanging, which displayed an incredible appreciation of form and color. She had made it herself. Her mother told us how, for the first time in her life, Jane had completed a task: she had decided to do something and had actually managed to organise all the necessary materials, and actually complete the project.

Jane was so proud of herself that she was beaming. She had finally found a way to express who she was. Like a lot of the outcomes I see in my work, the internal changes to functioning expressed themselves in a positive change in self-perception.

Steven.

Sometimes subtle factors can be a major block to a person's function. Often they will be so subtle that they almost don't seem real. Stress that is triggered by either reading or hearing numbers or the letters of the alphabet can sometimes resonate with so much emotional loading that they can cause a total loss of brain integration. Steven was nine when he came to us for spelling problems. To him the alphabet was little more comprehensible than alphabet soup.

I took him through the alphabet to see what letters caused him stress and found the letter K was enormously loaded for him. I did an emotional stress correction and took him through the age recession procedure to find out why, when he saw the letter K, he would lose it. A major emotional stress was revealed at age five. His mother confirmed our findings saying, "Oh, I remember. When Steven was five, K was first letter that he learned and he scratched it into the side of his grandmother's cedar wardrobe."

You can bet that grandma didn't congratulate Steven on mastering one letter in the alphabet. She justifiably hit the roof, and the whole emotional context of the event had been locked into that letter for Steven ever since. And since there are Ks in many words and scattered through even elementary reading material, was it any wonder that this boy had been having all sorts of problems with reading and spelling tasks?

David.

I had another young lad who at 12 exemplified what happens when a similar stress becomes attached to a number. David could read, comprehend and spell well, but his maths was erratic. His father said: "I just don't understand it. Sometimes he can do it well, other times he just can't do it at all."

I gave him a series of maths tests to establish just where it was that he was having problems. First I tried addition. He added and carried quite well at a simple level, so I gave him bigger numbers: 3211 plus 179. He added them easily. Then I tried him on subtraction. Take 64 from 94. He sat and stared at the numbers for almost a minute. Nothing happened. I then changed the problem to 94 minus 74. Instantly he said "20!". I tried again: 94 minus 54. Instantly he gave us 40. I tried 94 minus 64 again. He sat and stared blankly.

It turned out that any time there was a six in the digits presented, he would lose his brain integration and become totally dysfunctional. I could well imagine why he was driving his maths teachers nuts.

David's story demonstrates how a particular stimulus can bring an emotion back on-line and cause complete loss of brain integration. In his case the stress wasn't so much maths as the number six. David had an unresolved emotional issue that related to the number six. On his sixth birthday he had been given a bicycle with a big number six attached to it. He could not master learning to ride it. It may have been his frustration that had become so firmly linked to the number. It was this memory of frustration that I defused. After defusion of the stress on the number six, David could then easily do all the maths procedures he already knew, whether they contained the number six or not.

David's story illustrates an important point about brain integration, which is that it is totally contextual. David had brain integration and the ability to perform in maths - provided the context did not contain the number six. Once six was present, integration would be instantly lost. However, as soon as the six was removed, his brain would reintegrate. This was because David was basically functional, with full brain integration, except in the context of the stressor six.

Adding and subtracting are functions of simple arithmetic. It is not until you start doing fractions that you enter the realm of mathematics. Fractions require the abstract application of arithmetic principles. The symbol 1/2 is an abstract representation of half of anything. When children are being introduced to the concept of fractions, they will often be shown a big circle with a line down the middle and told that this represents a whole which is composed of two halves. Two halves therefore make a whole. For students who can abstract, the statement is perfectly logical and self-evident. For those who are totally Gestalt and cannot abstract, all they will be able to see is a flat circle with a line down the middle. Concretely, that is all there is.

I often meet children with learning problems who demonstrate few difficulties with basic arithmetic but who have insurmountable problems understanding fractions.

By the time they have consistently failed in maths for five, eight or 10 years, the subject has become so stressful for them that all you have to say is "think of mathematics" and they will instantly lose total brain integration. Thus, they have become dysfunctional before they even look at a maths problem and there is no possibility of them successfully solving these problems. All the tutoring in the world is going to be relatively ineffective because of their inability to maintain integration when they attempt maths. Once you lose integration in a specific context you will invariably be dysfunctional in that area.

Aden.

A variation on this theme was embodied by a 13-year-old boy, Aden, who was extremely bright. He was about to sit an exam that might win him entry to one of the best high schools in the state, but was having great difficulties in maths. He too would wax and wane. He could often complete a very complex maths problem successfully and then, in the next instant, be unable to add or subtract. It was obvious that he would not be able to maintain brain integration through the exam.

As I went through the steps of assessment, I found that most of his functions were truly on-line. But one function was dropping out: access to the hippocampal commissure, the structure that links both visual and auditory short-term memories, through which we access long-term memory. This meant Aden would literally become disconnected from what he did know.

He knew how to perform a lot of higher maths functions but because of the drop out of the hippocampal commissure, he couldn't express it. As in the case of trying to recall the name for a face you have remembered, the harder you try to remember the name you know you know, but cannot verbalise, the more the more profound the breakdown in communication across the hippocampal commissure becomes and the more the vital information recedes into the distance. As soon as you relax or change topics, the information may suddenly pop into your mind, as integration across this vital structure is once again re-established.

When integration dropped out Aden became incapable of doing even simple arithmetic. He must have been a great source of frustration to his maths teachers, who probably wondered whether they were dealing with a clever but lazy student, or an occasionally brilliant dunce.

His treatment took me some time because I needed to re-establish access to his hippocampal commissure in many different contexts. I would clear the blocks to particular functions and he would go to school and test them in the context of the class environment. He would report back in what contexts he now experienced no difficulty, and which contexts were still proving to be problematic for him. I would then work on another specific learning context and when he sat the exam, six months later, he held brain integration and achieved one of the highest marks. Without integration, it was highly unlikely that he would have been able to perform at this level, if at all.

These outcomes are very gratifying. However, while we do have about a 95 per cent success rate (excluding known cases of organic brain damage) we need to understand that learning is a voluntary activity. Even if you have good brain integration you may chose not to use it for a variety of personal and emotional reasons. There are some children who unfortunately live in extremely dysfunctional family situations. Emotional and physical survival is their paramount concern, and academic learning is a secondary consideration. Even when these children have been treated and have full brain integration, they may not improve in their academic performance.

Unfortunately, too, teenage boys can be some of our least satisfying clients because in many cases they are brought to us under protest. Also if you have not been able to learn to spell since you were six and you are now 16, you have 10 years of spelling and thousands of words to catch up on. And they have other interests such as girls and football that can distract them from wanting to learn to spell. Learning to spell therefore often comes at the bottom of "must-do" items. Even if these teenagers currently choose not to take advantage of their new state of integrated brain function, reintegration does give them one big advantage: they now genuinely have the ability to develop a function if they want to use it in the future. Before integration they had little chance of ever spelling well.

For example, during a follow-up visit after completing the brain integration program with a 15-year-old named John, his mother told me: "He doesn't spell any better than when he started." I then asked John: "How many spelling words did you learn last week?" His reply was, "None." How many had he learned the week before that? None. And the week before that? Again, none. I then checked John's ability to learn to spell words, which he easily demonstrated. I then asked him to spell some words he had learned as part of the program months before, again there was no problem.

I told his mother that John had demonstrated his ability to learn to spell any word quite easily and to remember it, but that he was just choosing not to do so at this time and for his own reasons. What John did recognise was that he had gained an enormous benefit from the program. The integration was showing up elsewhere: He was now making seven out of 10 baskets in basketball while before the treatment he had been making only two to three.

An encouraging counterpoint to John was the case of a 16-year-old boy who passionately loved reading and who was desperate to be able to spell well. He came to me for integration and in the two weeks following the correction of his spelling functions he mastered 150 words that had always given him problems. At his next appointment, he bought in a list of the 50 most difficult words and asked to be tested on them. He got all but one right. Six months on, he had no spelling problems of any note and continued to be highly motivated to succeed in an area where he had previously experienced only failure.

Brain Integration Under The Microscope.

As part of her neuroscience degree, Susan McCrossin undertook a study with five learning disabled adults using a very sophisticated form of an electroencephalogram (EEG) brain scanning device. These subjects ranged in age from 18 to 45 and each recognised that they had learning difficulties in certain contexts. Primarily they reported reading comprehension and short-term memory problems.

EEG allows scientists to look at the patterns of electrical activity generated by the cortex when it is performing an activity. But the results of previous studies with traditional forms of EEG, using only three reference points, were notoriously variable, with little consistent correlation between the type of mental task and the areas of the cortex showing activity. Thus, patterns of EEG activity as a means of understanding cortical processing have been highly controversial because the brain is always involved in lots of simultaneous activities. How were the researchers to distinguish if activity was due to the stimulus they were initiating, or some other brain activity, such as random thoughts?

Susan's study concentrated on a new EEG method known as Steady-State Visually Evoked Potential (SSVEP).[57] In this test, the subjects had a small red light flickering into the corner of their eyes, and because vision is a dominant sensory process, the flash rate entrained all brain patterns into a single brain wave. As long as the subject is not thinking of anything else but is just passively observing a visual stimulus, the brainwaves become a single pattern of 13 cycles per second.

In the SSVEP technique 64 electrodes are placed on the scalp, covering all processing areas of the cortex (see Fig. 5). In this way, specific areas of cortical activity can be identified, particularly against the constant stimulus of the flashing light. When the data from the electrodes is fed into a powerful computer, detailed maps of cortical activity can be constructed. While being SSVEP scanned, if you ask the person to consciously do a particular mental task, they will automatically activate specific brain areas related to the performance of that task. In the area that is active, the SSVEP signal is reduced and the degree of reduction is proportional to the degree of activation of that area.[58] This allowed us to draw an activation map of the brain.

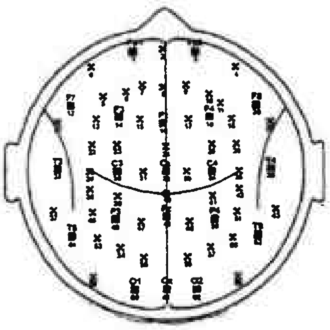


Figure 5. The 64 Electrode Pattern. *Location of recording sites with International 10-20 positions indicated*

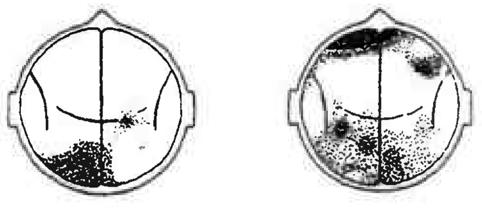
The SSVEP machine had been used in a previous study comparing children with Attention Deficit Disorder (ADD) to normal subjects on two different mental tasks. One of these was an attentional task requiring the subject to pay attention and anticipate events. The other was a decision-making task. The SSVEP patterns of these two groups showed significant differences:

When normal subjects were doing a purely visual task: observing a computer monitor displaying numbers, their brain showed activity predominantly in the occipital lobes in the back of the brain, where visual image formation takes place. When they were then asked to anticipate, or pay attention to a particular signal, their cortical activity switched to the frontal lobes, the area of the brain involved in attentional tasks. In ADD children, the brain activity did not change. Activity remaining predominantly in the occipital lobes.[59]

When Susan scanned her adult volunteers before they underwent brain integration, it was found that, like ADD children performing an attentional task, all of the activity was registered in the occipital region. Following application of the LEAP protocol, the activity patterns of all five adult subjects changed to the pattern observed in normal subjects (see Fig. 6). Now, when they were asked to pay attention, or make decisions, their cortical activity immediately switched to the frontal lobes, indicating a shift from passive looking to active mental participation in the task.[60]

Thus, it appears that children with ADD or adults with learning problems often just watch their world and react to whatever happens with little anticipation of what might occur because they cannot activate the brain areas involved in "paying attention" which is required for anticipating outcomes. Likewise, since prefrontal activity is also required for "planned" decision-making, and there is little prefrontal activity when people with ADD and learning problems make decisions, it would appear that these decisions must depend more on "reaction" to stimuli than on planned actions based on considered decisions.

Along with these changes in cortical activity, there was concomitant improvement in the adult subjects' digit span and reading comprehension. Before integration, the reading comprehension of the group had varied from 33 per cent to zero. One of the subjects could remember nothing of what she read because the stress she experienced in knowing she would be tested caused total loss of brain integration.



Before LEAP Treatment

After LEAP Treatment

Figure 6. SSVEP Maps of typical subjects Before and After LEAP treatment. *Degree of stippling indicates degree of activity. Before treatment subjects with learning difficulties showed the most activity in the occipital lobes when performing attentional and decision-making tasks. After treatment the cortical activity now switched to the frontal lobes on the same attentional and decision making tasks, the same areas active when normal subjects perform these tasks.*

After the treatment, all had 100 per cent reading comprehension. On the digit span test, all subjects changed from being marginal or borderline in their function to being above-average. Changes in both these mental functions is supported by the significant changes in cortical activity observed in the SSVEP results.[61]

In a year long study for her honors thesis in neuroscience, Susan performed a control study of children with learning difficulties, predominantly in reading, reading comprehension, spelling problems and demonstrable short-term memory deficits. She randomly selected 10 children for treatment and 10 other children to act as controls. All children were to be pre and post tested on a range of standard psychometric tests for intellectual performance.

Measures of intelligence are highly controversial because intelligence is a hypothetical construct and therefore, impossible to define in terms of "an essence of intelligence".[62] Never-the-less, a number of different standardised intelligence tests, such as the Wechsler

Intelligence Scale for Children (WISC) and Stanford Binet Intelligence Test, have been developed to measure various aspects of cognitive function. Regardless of whether these psychometric tests measure "intelligence" or not, they do provide reliable assessment of performance on certain types of tasks. The use of intelligence tests in Susan's study was not to measure intelligence but rather, to provide a standard assessment of performance in a variety of cognitively demanding tasks.

Intelligence has been defined as being composed of two distinct aspects: "fluid" and "crystalline" intelligence.[63] Fluid intelligence is the capacity to perform abstract reasoning which involves "native" intelligence and is thought to be unaffected by formal education. This includes the ability to solve puzzles, memorise a series of arbitrary items such as words or numbers, as well as the ability to change problem solving strategies easily and flexibly. Crystalline intelligence, on the other hand, comprises the abilities that depend upon knowledge and experience or the amount of stored factual knowledge such as vocabulary and general information.

Susan chose three standardised tests of fluid intelligence; the WISC Block Design subtest, the Kaufmann Matrices and Inspection Time. She also tested them on short-term memory and reading comprehension. The WISC digit-span subtest was used as a measure of short-term memory, retrieval and distractibility. The Neale Analysis of Reading, a standardised test to assess reading comprehension, was also applied. Tests measuring crystalline intelligence were not used as knowledge of facts is accumulated over a number of years and would not be expected to change substantially over the short time frame of the study.

All children were initially assessed on the five psychometric tests and then were retested six to eight weeks later. In the intervening period the treatment group had the complete LEAP protocol performed on them. The control group received no treatment but were retested at the end of the study.

The results were remarkable. Empirical observation and scientific validation of these tests show that fluid intelligence generally does not improve over time.[64] From this data it has been assumed that the person will in the future perform as they have in the past (or, allowing for growth, will hold their relative position amongst their peers), and therefore changes in performance in these subtests is considered unlikely. This appears to hold true for children with learning disorders even when they have received extensive remediation.

Rewardingly for Susan's thesis there were statistically significant improvements in all of the tests of fluid intelligence between the pre and post tests for the treatment group. No changes occurred in the performance of the control group. Thus the LEAP protocol was shown to be capable of changing the innate reasoning capacity of these children. It was capable of affecting profound changes including the demonstrable ability to apply flexible strategies to solve problems in their lives. Surely, a valuable life skill.

Equally as important, the complex task of digit-span (short-term memory and attention) also showed highly significant differences before and after treatment between the two groups. There was an increase in the forward digit span from 4.8 (before treatment) to 6.2 (after treatment) and an increase in the backwards digit span from an average of 3.1 (before) to 5.5 (after). Since the average adult digit span is six forwards and five backwards these children had clearly improved from deficit in this vital function to above normal (see Fig. 7).[65]

When it came to reading the results were even more striking. The treatment group contained two individuals who could not read prior to treatment. One, a 16 year old boy who had received weekly private tutoring for several years, still had not been able to read. Following the LEAP protocol, with the same weekly tutoring he was now able to read at an elementary level and is continuing to show steady improvement. Another 11 year old boy could only recognise a few small words prior to treatment. Following treatment he was able to read fluently at an elementary level and demonstrated the same improvement, even without special remediation.

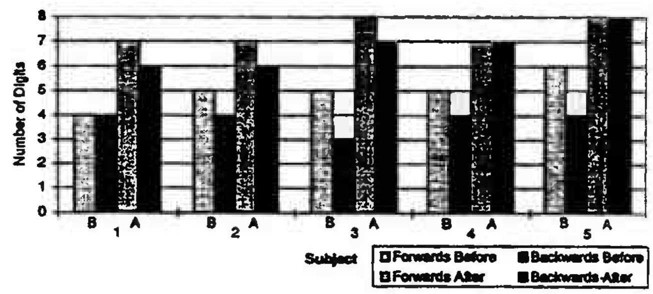


Figure 7. Digit Span scores for subjects before and after LEAP treatment. In all cases the forwards and backwards Digit Span increased significantly following the LEAP treatment.

In counterpoint, one of the individuals in the control group also could not read at the beginning of the study. At the end, he still could not read.

Reading comprehension showed equally remarkable improvements. The treatment group improved from an average of 27.5 per cent reading comprehension to 94 per cent following treatment, a massive change. The control group showed no change in reading comprehension.[66]

These tests graphically illustrate that LEAP does have significant and observable effects on the actual cortical processing in the brain and that these effects result in widespread improvement in perceptual and cognitive abilities.

Hyperactivity And Leap.

Hyperactivity, or children who display extreme distractibility, reckless impulsiveness and inability to stay still, has probably always been present in the population, but in recent decades these behaviours have been increasingly recognised as a major social problem. Hyperactivity not only impacts upon social and family interactions, but also on learning abilities with hyperactive children commonly displaying difficulties with spelling, reading and mathematics.

While hyperactive behaviour was previously given many labels, by the 1970s and particularly the early 1980s it was generally termed Attention Deficit Disorder (ADD). More recently, it has been defined more specifically with two types of attention deficit disorder recognised, attention deficit disorder without hyperactivity and attention deficit disorder with hyperactivity.[67] Children displaying the later form are said to be suffering from Attention Deficit Hyperactivity Disorder (ADHD).

Initially, ADHD was perceived as a childhood behavioural problem that children grew out of at puberty. It is now clear that ADHD continues into adolescence, and that ADHD children merely become ADHD adults. ADHD was also observed to run in families, and thus appeared to be inherited but the mechanism was unknown. Recent research suggests that ADHD is most probably a genetic disorder that affects brain chemistry and is passed from one generation to the next.[68]

My own clinical observations certainly support that it is inherited from one or both parents. In several thousand cases, during the initial assessment as I explain the nature of their child's learning problems and the behaviours likely to be expressed by the child, one or both parents would often say "that's just like me as a child". Or the mother, who often brings the child, would say "that's just like his father". Many times until the parents listened to my explanation, they did not realise that they had been hyperactive or attention deficit because these terms were not in use in their youth.

In 1937, a Rhode Island paediatrician, Charles Bradley, found that giving stimulants, benzadrine, and later amphetamine, to ADHD children had the paradoxical effect of calming them down.[69] Since the 1950s amphetamines have been replaced by methylphenidate (Ritalin) because it has fewer side effects. In fact, now Ritalin use is becoming epidemic as more and more children are diagnosed as hyperactive. Between 1971 and 1987 there has been a consistent doubling in the number of children on medication every 4 to 7 years in a number of US public and private schools. By 1987 the use of medication had risen to between 1% and 6% of all elementary school children, and by the early 1990s, there were increasing rates of stimulant drug treatment in secondary school children as well.[70]

It wasn't until the latter part of the 1980s and early 1990s that an understanding of how Ritalin and other stimulants achieved the paradoxical results on behaviour began to evolve. It now appears that Ritalin and the other drugs, work through their effects on the important brain neurotransmitter, dopamine, because dopamine release in the reward system of the brain leads to feelings of well-being. Dopamine docks on the D-family of receptors (D_1, D_2, D_3, D_4, D_5), but most strongly with D_2 type receptors. Docking of the dopamine on the D_2 receptor gives rise to feelings of well-being and is calming, while at the same time augments the ability to maintain attention.[71]

An increasing body of evidence suggests that ADHD is primarily biologically based with studies indicating that people with ADHD may have at least one defective gene coding for the D_2 receptor making it difficult for the neurons in the reward center to respond to dopamine.[72] The reduced response to dopamine means that these people do not experience the normal reward feelings of well-being and have increased difficulty regulating their attention. Kenneth Blum has termed this the "reward deficiency syndrome", which leaves ADHD children and adults with feelings of restlessness, anxiety, feeling incomplete, difficulty focusing, and hypersensitivity.[73] These uncomfortable feelings may then be expressed as anger, aggressiveness, shyness, hyperactivity or deviant behaviour.

Perhaps equally important, in their recent book *Overload, Attention Deficit Disorder and the Addictive Brain*, Miller and Blum make a strong case for the connection between ADHD and alcoholism and drug abuse.[74] In 1990 Blum and his colleagues identified a deficit in the D_2 receptor gene that they found to be associated with alcoholism. Since then this D_2 receptor defect has been associated with other compulsive and impulsive disorders, including ADHD.[75] Drugs of addiction appear to work by elevating dopamine levels in the synapses of the reward system, particularly the nucleus accumbens. While opium and cocaine do this directly, alcohol does so indirectly.

When alcohol is metabolised it produces molecules with the impossible name, tetrahydroisoquinoline, TIQ for short. When TIQ molecules are formed from alcohol, they flood the D_2 receptors and produce temporary feelings of well-being - the alcohol high.[76] This sets the stage for the ADHD - alcoholic connection. When ADHD people drink alcohol, the TIQ produced floods their limited D_2 receptors leading to normal feelings of reward - something they lack. Thus, for people experiencing the daily discomfort and pain of ADHD, use of alcohol and other addictive drugs can give them reward: pleasure and easing of the perpetual feelings of discomfort both physically and emotionally.

While alcohol produces pleasure and reduces physical and emotional pain for everyone, the payoff for people with ADHD is more intense and more dramatic. So they drink alcohol to feel more "normal" only to get trapped in its addictive cycle of temporary relief followed by craving.

While all of this is most interesting, what does it have to do with LEAP? Many of the children we see have been diagnosed as ADHD and many are on drugs to modify their behaviour, most commonly Ritalin. As we proceed through the brain integration program, it is not uncommon to see these children calm right down, and often maintain this new state of more normal behaviour even after the withdrawal of the drug. While not observed in all cases, parents commonly report a long-term resolution of their child's hyperactive behaviour following the LEAP treatment.

Considering that the scientific evidence would suggest that ADHD is strongly linked to potential alcoholism as well as learning problems and deviant and delinquent behaviours based on a defective gene for D_2 receptors, the cessation of the hyperactivity and increased ability to learn following the LEAP treatment is remarkable. It suggests that the LEAP protocol somehow alters this reward deficiency syndrome. I postulate that the acupressure treatments and emotional defusions employed in the LEAP treatment either activate greater expression of the D_2 receptor genes, or increase dopamine levels by mechanisms that remain unknown at present. This then establishes more normal patterns of reward and attention in the brain.

Recent studies have found a significant correlation between abnormal P300 EEG brainwave activity and the A1 allele of the dopamine D_2 receptor gene.[77] This is the same gene defect associated with ADHD, alcoholism, drug addiction and compulsive and impulsive disorders.[78] When these findings are coupled with the recent observation that acupuncture stimulation can alter the P300 brainwave activity,[79] this may provide a possible mechanism by which the LEAP acupressure treatment may reverse or eliminate the reward deficiency syndrome.

Whatever the mechanisms, we see child after child go from ADHD behaviour, often regulated with Ritalin, to relatively normal behaviour without drugs. Susan's controlled studies confirm these changes in brain function both electrophysiologically with abnormal EEG patterns returning to normal patterns and in psychometric testing. Follow up observations even several years later show these changes in behaviour are on-going.

Since ADHD is associated with a greater likelihood of delinquency as adolescence.[80] and alcoholism,[81] cocaine addiction[82] and stress disorders[83] as an adult, each ADHD child receiving the LEAP treatment may well reduce the human cost of these destructive behaviours both on the individual and society.

LEAP Into The Future.

We estimate that in over the nine years we have been working with LEAP, we have probably seen more than 5000 people. Given that we have already taught 100 kinesiologists these methods in Australia, Germany, Belgium, the Netherlands and the US, probably double that number have by now been put through the program worldwide. Each year we travel around Australia and abroad teaching another 100 or so students. This means the LEAP program is spreading exponentially. The reason it has attracted such interest is because it gives such consistent results. It is not something only Susan and I can do; anyone adequately trained can also achieve the same results.

We could have made a very comfortable living doing LEAP exclusively in our own clinic. But what has been driving us to teach LEAP to others is that we perceive it to have profound effects on people's consciousness. They are suddenly able to realise more of their true potential.

If you are learning disabled, in a sense you are cut off from that which you could be in terms of your human potential. As you become more learning enabled you also become more able to fulfill the potential in your life. As well, if you understand why you have been dysfunctional, you can have more compassion for yourself and for other people with similar problems. When you have compassion for the difficulties someone else might be confronting, it invites that person to also have compassion for themself.

One of the only common denominators that criminologists have been able to find between people who have committed violent crimes is that they are commonly functionally illiterate. By that we mean that even if they can read and write it is only at a rudimentary level. Many people sitting in prisons today are highly intelligent, clever individuals who are learning disabled. They have never been allowed to express their intelligence in an acceptable way. How many times have you heard the expression, "If that so and so had only used his intelligence in a legal way he would probably be a very wealthy person today."

He was never allowed to express his potential because he could not read or spell well, or pass the written interview test for the job. After making at least five spelling mistakes on his application, many employers just throw it straight into the bin. The applicant might have been the smartest person interviewed that day, but was rejected because he could not spell. He knows he is smart, but is frustrated when he is never allowed the opportunity to demonstrate his real abilities. This frustration often leads to anger and violence. If such people could enter society as equals and be taken seriously they would not have to vent their frustration about being locked out, a situation that often leads them to being locked up.

We truly feel that every time we turn someone around and help them access more of their function, they will utilise it in a way that is most harmonious for them and society. One 13-year-old boy I treated had been thrown out of five different schools in one year. He was being seen by a child psychiatrist for his violent behavior and was considered a suicide risk. He was very bright but extremely dysfunctional in terms of his learning ability. He was very angry and very frustrated, and he expressed this by beating up other kids, setting fire to public buildings and physically threatening his teachers.

I was only half way through the LEAP protocols when I noticed he had calmed right down. His brain was coming together and he was beginning to realise that he could learn things that he had never been able to access before. By the end of the year that followed his treatment he was at the top of his class. Previously, he had been headed towards either suicide or delinquency and that would have been a loss for society either way. Society would have lost potentially a highly productive member. Instead, I was able to open up a highly productive future for this lad who is now in university and doing very well with his studies.

This has happened time and again.

To this point we have been talking about how limited academic functions can be improved. But brain reintegration can affect a person's life in many more (and perhaps more profound) ways. The most profound effect is undoubtedly a change in a person's level of self-confidence. Long before changes in academic performance have been perceived, parents often comment on changes in the child's level of self-esteem.

Indeed one mother told us that when she arrived to collect her son from school one afternoon, she saw a boy running towards her car. He looked vaguely familiar, but it was not until he reached the car she recognised this was her own son. "He just moved so differently and with so much more confidence and coordination than he had before, I didn't recognise him until he was literally getting into the car."

The Success Loop.

Dysfunction that results from brain disintegration can become a cycle. When you are starting a new, previously untried task, it is uncertain and uncertainty creates fear. If the fear is strong enough, or if it is linked to past failure, it can generate enough stress to cause a loss of brain integration. In a state of disintegration you are dysfunctional and will tend to fail again.

The next time you attempt that or a similar task, you are not only uncertain but obsessed by a fear of failure. This, ironically, can become a positive feedback loop of fear-dysfunction-failure, then fear of failure-dysfunction-failure. It leads unerringly to negative outcomes and the greatest loss is to self confidence and self-esteem.

On the other hand, if you are challenged with a new learning situation, and despite the uncertainty have managed to maintain your brain integration, you remain functional and figure it out. You are successful and with success comes reward, both externally and internally. Every time you figure it out and say "Ah, ha! I've got it", endorphins are released in your brain, creating a sensation of pleasure. At the same time, praise generally comes from outside in the form of approval from a teacher, parent, peer or colleague, releasing more endorphins, further reward.

These positive rewards do two things: They make you feel good about yourself; and they make your brain integration more robust and resilient. After a series of successes you can even allow yourself to make an error and not lose integration. Instead, you can see where you went wrong, what you need to learn from the mistake, try again and succeed.

You have met the challenge and you have succeeded. When we have a history of success, challenges are no longer seen as problems but rather as opportunities to learn. People who are successful tend to continue being successful, whereas people who experience failure tend to repeat that failure. Success makes you confident.

In contrast, people who have tasted repeated failures tend to lack confidence in their abilities and in themselves. This is powerfully reflected in your states of motivation. If you believe you are incompetent and lack confidence, you tend not to give it a go - that way you can't fail again. If, however, you do have a sense of confidence, you will try anything because what do you have to lose except something new to learn? You're in a positive spiral (see Fig. 8).

If you can maintain integration, you can figure life out and get it right. Success is confidence, and confidence strengthens brain integration allowing you to hold integration long enough to be successful again. Each success makes the brain integration more robust, which means you can hold integrated brain function under higher and higher levels of stress thus reaping the reward of success. Your brain integration is soon robust enough to allow you to make a mistake, and instead of falling apart, look at what you've done, see where you went wrong, and be successful again laying the foundation for future success.

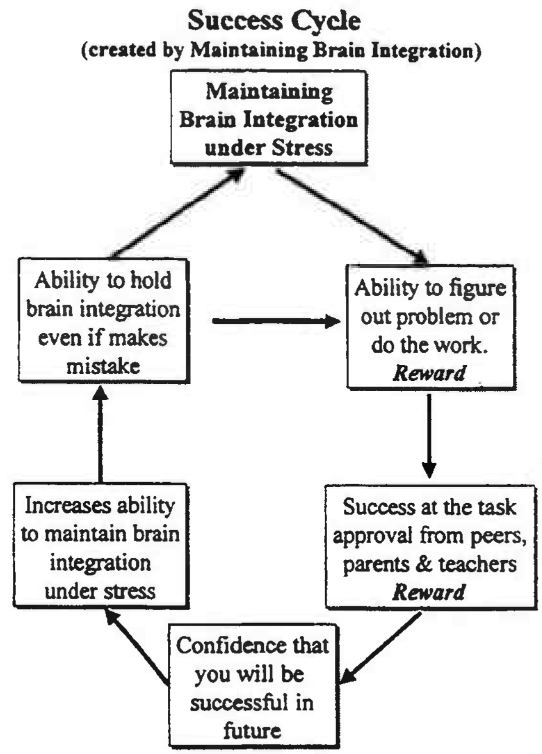


Figure 8. The Success Loop created by maintaining Brain Integration under Stress. *When you can maintain your brain integration under stress you will be able to figure it out and receive the reward of being successful, which increases your ability to maintain your integration under even higher levels of stress and be successful again the next time. This leads to increased self confidence so essential for success in life.*

Acknowledgments

Much of the above discussion on LEAP has been exerpted from Susan McCrossin's Honours Thesis and Charles Krebs & Jenny Brown's book *A Revolutionary Way of Thinking* and the manual for the LEAP course by Charles Krebs & Susan McCrossin. I thank Susan and Hill of Content publishers for their permission to use the information in this manuscript. I would also like to thank Louise Barrett, my secretary extraordinaire for her efforts in preparing this manuscript.

References

1. Kussmaul, cited in Kolb, B & Whishaw, I Q, *Fundamentals of Human Neuropsychology*, 3rd Ed. W.H. Freeman & Co, New York, p.778, 1990.
2. Berlin, as cited in Kolb, B & Whishaw, I Q, *Fundamentals of Human Neuropsychology*, 3rd Ed. W.H. Freeman & Co, New York, p.778, 1990.
3. Kolb, B & Whishaw, I Q . *Fundamentals of Human Neuropsychology* (3rd ed.). New York: W H Freeman & Co, 1990.
4. Geschwind, N. & Galaburda, A.M., *Cerebral Lateralization*, Cambridge, MA: The MIT Press, 1985
   Galaburda et al, Planum temporale asymmetry, reappraisal since Geschwind and Levitsky, Neuropsychologia, 25:853-868, 1987.
   Duffy, F H, McAnulty, G B & Schachter, S C. Brain Electrical

Activity Mapping.. In N Geschwind & A M Galaburda (eds.) *Cerebral Dominance* (pp. 53-74). Cambridge, Massachusetts, USA: Harvard University Press, 1995.
5. Fawcett, A. Dyslexia: a personal view. In A Fawcett, & R Nicolson (Eds.), *Dyslexia in children*. Hemel Hempstead, UK: Harvester Wheatsheaf, 1994.
6. Fawcett, A. ibid.
7. Aiken, L R. *Assessment of Intellectual Functioning* (2nd ed). New York: Plenum Press, 1996.
8. Aiken, L R. ibid
9. Rutter, M. & Yule, W., The concept of specific reading retardation. J. Child Psych & Psychiatry 16:181-197, 1975.
10. Gaddes, W. H. Prevalence estimates and the need for definition of learning disabilities. In: R.M. Knights & D.J., eds. *The Neuropsychology of Learning Disorders*. Baltimore: University Park Press, 1976.
11. Kolb, B & Whishaw, I Q. *Fundamentals of Human Neuropsychology* (3rd ed), 1990.
12. Kolb, B & Whishaw, I Q. ibid.
13. Kolb, B & Whishaw, I Q. ibid.
14. Hughes, J.R. Electroencephalographic and neurophysiological studies in dyslexia. In: A.K. Benton & D. Pearl, eds. *Dyslexia: An appraisal of Current Knowledge*. New York: Oxford University Press, 1978.
15. Farrow, M. et al. Prefrontal & parietal deficits in ADHD suggested by Brain Electrical Activity during Children performing the AX-CPT. Ed. Develp. Psych. 13:59-68, 1996.
16. Kolb, B & Whishaw, I Q. *Fundamentals of Human Neuropsychology* (3rd ed), 1990.
17. Douglas, V.I. Perceptual and cognitive factors as determinants of learning disabilities: A review chapter with special emphasis on attentional factors. In: R.M. Knights & D.J., eds. *The Neuropsychology of Learning Disorders*. Baltimore: University Park Press, 1976.
18. Serfontein, G . *The Hidden Handicap*. Sydney, Australia: Simon & Schuster, 1990.
19. Damasio, A R . *Descartes' Error: Emotion, Reason and the Human Brain*. New York: Grosset/Putnam, 1994.
Nunez, P.L. *Neocortical Dynamics and Human EEG Rhythms*. Oxford University Press, New York, NY, 1995.
20. Krebs, C.T. & McCrossin, S.J. *Learning Enhancement Advanced Program (LEAP)*. Melbourne: Melbourne Applied Physiology, 1994.
21. Damasio, A R. *Descartes' Error: Ibid.* p.94, 1994.
22. Utt, R. *Applied Physiology Acupressure Formatting for Brain Physiology*. Applied Physiology Publishing, Tucson, AZ, 1991.
23. Jackson, G. Personal Communication, June 1990 - July, 1992.
24. Krebs, C.T. & Brown, J. *A Revolutionary Way of Thinking. From a Near Fatal Accident to a New Science of Healing*. Hill of Content Publishing, Melbourne, 1998.
25. Krebs, C.T. & McCrossin, S.J. *Learning enhancement advanced program (LEAP)*. 1994.
26. Krebs, C.T. & Brown, J. *A Revolutionary Way of Thinking*, 1998.
27. Levy, S.L. & Lehr, C. *Your Body Can Talk. The Art and Application of Clinical Kinesiology*. Hohm Press, Prescott, Az, pp.4-5, 1996.
28. Utt, R. *Applied Physiology Acupressure Formatting for Brain Physiology*. 1991.
29. Kandel, E.R. Brain and Behavior. In Kandel, E.R., Schwartz, J.H. & Jessell, T.M. (eds) *Principles of Neural Science*. 3rd ed. Appleton & Lange, Norwalk, CN. pp.997-1008, 1991.
Kupfermann, I. Learning and Memory. In Kandel, E.R., Schwartz, J.H. & Jessell, T.M. (eds) *Principles of Neural Science*. 3rd ed. Appleton & Lange, Norwalk, CN. pp.997-1008, 1991.
Damasio, A. *Descartes' Error. Emotion, Reason and the Human Brain*, 1994.
Restak, R.N. *The Modular Brain*. Touchstone Book, New York, NY. 1995.
30. Hannaford, C. *Smart Moves*. Great Ocean Publishing Inc. Arlington, VA, pp.177-197, 1995.
Hannaford, C. *The Brain Dominance Factor*. Great Ocean Publishing Inc. Arlington, VA, 1997.
31. Parker, A. & Cutler-Stuart, J. *Switch onYour Brain*. Hale & Ironmonger, Petersham, NSW, 1986.
Springer, S.P. & Deutsch, G. *Left Brain Right Brain*, 3rd Ed. W.H. Freeman & Co, New York, 1989.
Dennison, P. & Dennison, G.E. *Brain Gym, Teachers Edition, Revised.* Edu-Kinesthetics, Inc., 1994.
Hannaford, C. *Smart Moves*. .... 1995.
32. Noback, C.R., Strominger, N.L. & Demarest, R.J. *The Human Nervous System*. 4th ed., Lea & Febiger, London, pp.398-401, 1991.
33. Kolb, B & Wishaw, I.Q. *Fundamentals of Human Neuropsychology*. 3rd ed. ...... pp.185-189, 1990.
34. Devlin, T. & Williams, H. Hands up those who were happy at school. New Scientist 135(1840):40-43, 1992.
35. Restak, R.M. *The Brain*. Bantam Books Inc, New York, NY, pp.45-47, 1984.
Jessell, T.M. Cell Migration and Axon Guidance. In Kandel, E.R., Schwartz, J.H. & Jessell, T.M. (eds) *Principles of Neural Science*. 3rd ed. Appleton & Lange, Norwalk, CN, 908-911, 1991.
36. Briggs, G.G., Freeman, R.K. & Yaffe, S.J., (eds), *Drugs in Pregnancy and Lactation*. Williams & Wilkins, Baltimore, MD. 1986
Tortora, G.J. & Grabowski, S.R. *Principles of Anatomy & Physiology*. 8th ed. Harper Collins College Publishers, New York, NY, p.983, 1996.
37. Walsh, K. *Neuropsychology*. 2nd ed. .... pp.94-98, 1987.
Kolb, B. Whishaw, I.Q. *Fundamentals of Human Neuropsychology*. 3rd ed......., pp.130-136, 1990.
38. Walsh, K. Ibid., pp.94-98, 1987.
Kolb, B. Whishaw, I.Q. *Fundamentals of Human Neuropsychology*. 3rd ed ......, pp.136-139, 1990.
39. Freud, S. *Lectures on Psychoanalysis. Standard Edition*, Strachey, J (ed), Norton, New York, NY, Volume 24 Indexes and Bibliography, p.301, 1974.
40. Kolb, B. Whishaw, I.Q. *Fundamentals of Human Neuropsychology*. 3rd ed......., pp.361-411, 1990.
41. Levy, R.J. Right brain, left brain: fact and fiction. Psychology Today, May, 1985.
42. Domasio, A.R. & Domasio, H. Brain and Language. Sci. Am. 237(3):62-71, 1992.
43. Just, M.A. & Carpenter, P.A. *The Psychology of Reading and Language Comprehension*. Allyn & Bacon, Newton, MA, 1987.
Bootzin, R.R., Bowen, G.A., Crocker, J. & Hall, E. *Psychology Today: An Introduction*. McGraw-Hill, Inc. Sydney, pp.290-291, 1991.
Crowder, R.G. & Wagner, R.K. *The Psychology of Reading*, 2nd ed. Oxford University Press, New York, NY, 1992.
44. Birdwhistell, R.L. *Kinesics and Context*. Allend Lane, London, 1971.
Mehrabian, A. *Silent Messages*. Wadworth Publishing, Belmont, CA, 1971.
Pease, A. *Body Language*. Carmel Publishing Co., Sydney, 1981.
45. Pease, A. Ibid., pp.9-10, 1981
46. Walsh, K. *Neuropsychology*. 2nd ed. pp.288-289, 1987
Kupfermann, I. Localization of higher cognitive and affective functions: the association cortices. In Kandel, E.R., Schwartz, J.H. & Jessell, T.M. (eds) *Principles of Neural Science*. 3rd ed. Appleton & Lange, Norwalk, CN. pp.831-832, 1991.
47. Troup, G. Bradshaw, J.L. & Netttleton, N.C. The lateralization of arithmetic and number processing: A review. International. J. Neurosci. 19:231-242, 1983.
48. Aisbett, N. Recession years hit school skills. The Western Australian, August 21, 1993.
49. Cytowic, R.E. *The Man who Tasted Shapes*. G..P. Putman & Sons, New York, NY, pp.153-162, 1993.
Damasio, A.R. *Descartes' Error, Emotion, Reason and the Human Brain*. pp.94-96, 1994
Nunez, P.L. *Neocortical Dynamics and Human EEG Rhythms*. Oxford University Press, New York, NY, 1995.
50. Agnati, L.F., Bjelke, B & Fuxe, K. Volume transmission in the brain. American Scientist 80(4):362-373, 1992.
51. Damasio, A.R. Descartes' Error. .... pp.84-113, 1994.
52. Damasio, A.R. Ibid., pp.84-164, 1994.
53. Damasio, A.R. Ibid., p.95, 1994.
54. Kolb, B. Whishaw, I.Q. *Fundamentals of Human Neuropsychology*. 3rd ed......., p.504, 1990.
55. Damasio, A.R. Ibid., pp.101-103, 1994.
56. Damasio, A.R. Ibid.,pp.106-107, 1994.
57. Silberstein, R.B. Topography and dynamics of the steady state visually evoked potential: A window into brain function? Brain topography 5:64-65, 1992.
58. Silberstein, R.B. et al. Stead- state visually evoked potential topography associated with a visual vigilance task. Brain

Topography 3:337-347, 1990.
Silberstein, R.B., Ciociani, J. & Pipingas, A. Study-state visually evoked potential during the Wisconsin card sorting test. Electro-encephalography and Clin. Neurophysiol. 96:24-35, 1995.
59. Farrow, M. Unpublished data, Swinburne Centre for Applied Neuroscience, Swinburne University, Melbourne, Australia, 1995.
60. McCrossin, S. Changes in SSVEP topography, digit span performance and reading comprehension in response to acupressure treatment. Unpublished major research thesis, Swinburne University, Melbourne, Australia, October, 1995.
61. McCrossin, S. Ibid, 1995.
62. Eyseneck, H.J. *The Structure and Measurement of Intelligence*. Springer-Vulag, New York, 1979.
Murphy, K.R. & Davidshofer, C.O. *Psychological Testing*. 3rd ed. Prentice-Hall, N.J., 1994.
63. Cattell, R.B. Theory of fluid and crystalline intelligence: A critical experiment. J. Educational Psych. 54:1-22, 1963.
64. Lezak, M.D. *Neuropsychological Assessment*. 3rd ed. Oxford University Press, 1995.
65. McCrossin, S. The Effect of Acupressure treatment on standard intelligence test scores for children with learning difficulties. Unpublished honours thesis, School of Biophysical Science and Electrical Engineering, Swinburne University, Melbourne, Australia, Nov, 1996.
66. McCrossin, S. Ibid, 1996.
67. DSM-IV: Diagnostic and Statistical manual of mental disorders, 4th ed. American Psychiatric Association, Washington, DC, 1995.
68. Comings, D.E. *Tourette Syndrome and Human Behaviour*. Hope Press, Duarte, CA, 1995.
69. Bradley, C. The behaviour of children receiving benzedrine. Am. J. Psychiatry, 94:577-585, 1937.
Bradley, C. Benzedrine and dexedrine in the treatment of children's behavioural disorders. Pediatrics 5:24-37, 1950.
70. Safer, D.J. & Krager, J.M. A survey of medication treatment for hyperactive inattentive students. J. Am. Med. Assoc. 268(8):1004-1007, 1988.
71. Miller, D. & Blum, K. *Overload: Attention Deficit Disorder and the Addictive Brain*. Andrews & McMeel, Kansas City, MO, pp.38-39, 1996.
72. Miller, D. & Blum, K. Ibid., p.39, 1996
73. Miller, D. & Blum, K. Ibid., pp.55-67, 1996
74. Miller, D. & Blum, K. Ibid., 1996
75. Blum, K. et al. Allelic association of human dopamine D_2 receptor genes in alcoholism. J. Am. Med. Assoc. 263:2055-2060, 1990.
Miller, D. & Blum, K. *Overload* p.60-61, 1996
76. Miller, D. & Blum, K.Ibid., p.70-71, 1996
77. Blum, K. et al. Prolonged P_{300} latency in a neuropsychiatric population with the D_2 dopamine receptor A1 allele. Phramocogenetics, 4:313- 322. 1994.
78. Blum, K. et al. Allelic association of human dopamine D_2 receptor genes in alcoholism. J. Am. Med. Assoc. 263:2055-2060, 1990.
Miller, D. & Blum, K. *Overload* p.55-67, 1996
79. Abad-Alergria, F., Adelantado, S. & Martinez, T. Changes of cerebral endogenous evoked potentials by acupuncture stimulation: A P_{300} study. Am. J. Chinese. Med. Vol XXIII (2):115-119, 1995.
80. Feldman, S., Denhoff, E. Denhoff, J. Attention disorders and related syndromes in adolescence and young adult life in minimal brain dysfunction: A developmental approach. In: Denhoff, E. & Stearn, L. (eds) *Minimal Brain Dysfunction: A Developmental Approach*. Masson Publishing Co, New York, NY, pp.144-148, 1979.
Hechtman, L. Adolescent outcome of hyperactive children treated with stimulants in childhood: a review. Psychopharmacology Bull. 21(2):178-191, 1985.
81. Blum, K. et al. Allelic association of human dopamine D_2 receptor genes in alcoholism. J. Am. Med. Assoc. 263:2055-2060, 1990.
82. Noble, E.P. et al. Allelic association of the D_2 dopamine receptor gene with cocaine dependence. Drug & Alcohol Dependence, 33:271-285, 1993.
Uhl, G.R. et al. D_2 receptor gene – the cause or consequence of substance abuse. Trends in Neuroscience, 17:50-51, 1994.
Comings, D.E. et al. The D_2 gene, a genetic risk factor in substance abuse. Drugs & Alcohol Dependence, 34:175-180, 1994.
83. Comings, D.E. et al. The dopamine D_2 receptor locus as a modifying gene in neuropsychiatric disorders. J. Am. Med. Assoc., 266:1793-1800, 1991.
Blum, K. et al. Prolonged P_{300} latency in a neuropsychiatric population with the D_2 dopamine receptor A1 allele. Phramocogenetics, 4:313- 322. 1994.