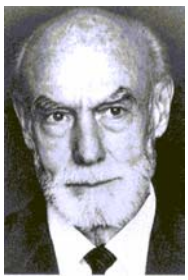
Laterality, sequential & holistic – the two hemispheres of the brain

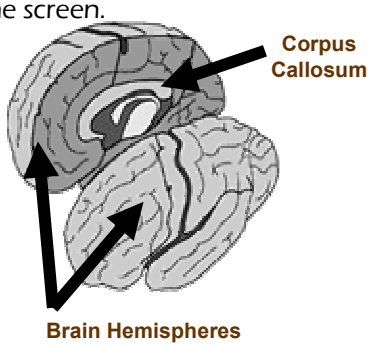
The human race has learnt more about how our brains work through the field of research, known as neuroscience, in the last 50 years than the entire history of our race. It cumulated with the award of the Nobel Prize for medicine in 1981 to Dr Roger Sperry. His work on the specialisation of different areas of the brain lead to the well known understanding of left and right brain function. His experiments in Southampton, England, clearly identified specific specialisation of the left and right brain.



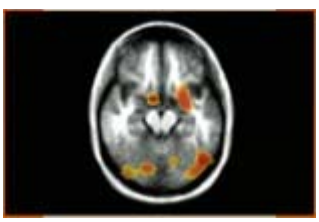
Dr Roger Sperry His Split Brain research underpins our understanding on brain hemisphere specialisation

He started with a remarkable set of experiments with patients who had undergone major brain surgery to treat epilepsy. In the cases that he focused on the patients had had their '*Corpus Callosum*' cut. This disconnected the left and right hemispheres of the brain by physically cutting the bunch of nerves that connects the side sides. Once cut the brain is no longer able to communicate between the two hemispheres. So patients once operated on lacked the ability to transfer information between the two sides, meaning that the side of the brain that received a stimulus was the side of the brain that processed the it. His now famous experiment to prove this. Known as Key – Case involved placing subject who had had their corpus collusnm cut, in front of a screen. They where asked to focus on a small dot in the centre and then on the left side of the screen the letters K-E-Y where flashed up. On the right side of the sctrr4een the letters C-A-S-E where flashed up. As the optic nerve for each of the eyes connects to the opposite side of the brain, the information received in each eye is processed in the OPPOSITE side of the brain to the visual fields on the screen.

When asked what was seen on the screen, the subject r4eplied that they saw the word CASE. This shows that the LEFT side of the brain was processing language in a sequential fashion, i.e.. Working out the word from the sequence of the letters flashed up.



However, when the same subject was asked to reach into a shelf below the screen with their left hand (the hand connected to right side of the brain and the side that saw the letters K-E-Y) and select an object by touch alone, from a selection including a spoon, an apple, a key, a ball and a rubber the subject selected the key.



High resolution magnetic resonance image of normal brain showing in orange the areas of the brain being used to process language

This response demonstrates that the right side of the brain does not put incoming sensory data into sequential order, and , therefore, does not articulate in speech what it knows it has seen. Instead the right hemisphere processes information holistically (that is all at once) rather than breaking it up into small chunks.

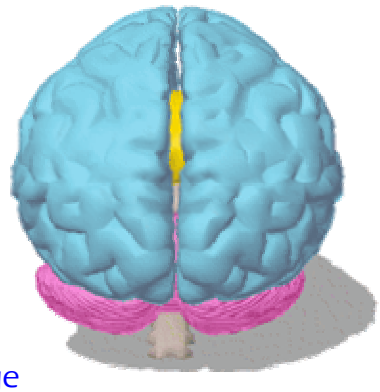
We term this split in the brain function as *'laterality'*. We all know this well as we all know people who have a classic preference in this – left or rights handiness.

We now know enough to understand that the brain is more capable as a result of this lateral specialization. Each side processes information differently and only communicates with it's opposite when it needs to. In this way the brain can, in simple terms, process two quite separate and different streams of information at once. It can then compare the data and obtain a much broader and in depth understanding of the concept or object.

The two quite separate and different processing capabilities allows the brain to be faster and broader in it's ability to work out what is happening around it. This specialisation was diagnosed by Sperry and his team which is shown in the model below.

Left

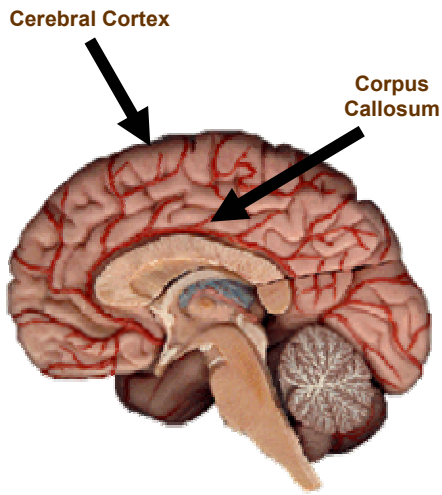
- Structured
- Sequential
- Logical expression
- Focused perception
- Analytical
- Aggressive
- Sense of time
- Literal
- Linguistic / symbolic
- Verbal intelligence
- Intellect
- Quantifiable knowledge
- mathematical



Right

- Holistic
- Simultaneous
- Conceptual expression
- Orientated awareness
- Synthesising
- Passive
- Present minded
- Metaphorical
- Configurationally
- Practical intelligence
- Sensory
- Experiential knowledge
- Patterns

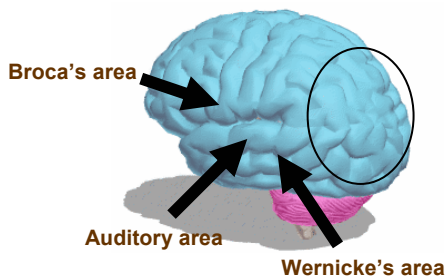
In fact we can map all sorts of different functions in the cerebral cortex, often described as '*grey matter*'. The Cortex is subdivided into several areas, each of which has a different function.



For instance, following previous research, an area known as '*Wernicke's area*' (shown below) manages the comprehension of spoken language, whist the '*Broca's area*' is responsible of the muscle control of the throat and mouth used in speech. The two areas then, manage the speech function in humans. Interesting the are for hearing, the auditory area, is just in front of this. The area ringed below is called the '*somosensory area*', which is a rather academic way of describing the part of the brain that receives and processes the messages and sensations from your skin, this also includes tasting!

The two hemispheres are highly specialised, as we have explored and each serve opposite sides of the body. For example, the touch in the left hand is perceived by the RIGHT hand somosensory area. To move the left hand and arm, then the RIGHT motor (movement) cortex brain cells would have to be activated.

In most people, the left side of the brain appears to be more dominant than the right, which explains why the majority of humans are in fact right handed. This dominance will come back into play later on.

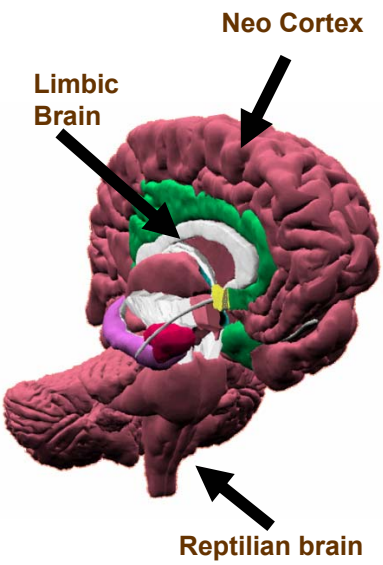


We might think that this is a new an insightful understanding of human brain function, only understood in the latter stages of the last century. But as a small aside, consider the ancient Chinese concept of Yin and Yang. Within the symbol we have two separate sides each containing a spot of the opposite side. The Chinese considered that the Yin is the feminine side associated with warmth, darkness earth, creation and emotion, whilst the Yang was s masculine standing for cold, light, heaven and dominance. Thus the dot in each represents the holistic element in that we have a little of each in either side. Whilst the Chinese did not fully hit upon the idea of laterality they did in fact get remarkably close to the correct analysis of what makes each of us tick.

So, what of learning and training? It has long been our experience that we all have two equal sized hemispheres in our brains. As we have established, each processes data differently. Each side has an equally important function for the 'whole brain' to gain the maximum understanding' In fact our brain is designed to get the most out of any given situation. Yet our experience equally shows that training and learning tends to be distorted to favour one side of the brain, at the expense of the brains' capability to process information more efficiently. In fact traditional learning techniques focus most of our formal left brained logical processes, and indeed in the formal sense scorn right brain processes. Given the Nobel prize research one must ask why that should be. The answer is really rather simple, if we apply left brained thinking to the solution then providing compatible data to each side of the brain, at the same time in the form that each side processes the data best, you get a significantly better effect.

The learning from Sperry's and later research shows that to produce effect and fast long term learning people need conceptual ideas as well as logic. Practical as well as theoretical information is also required and metaphor is as useful as being literal. Training courses need logic, structure quantifiable ideas and sequence along side concepts, metaphor, practical and experiential process. When combined practises are used the brain is able to process nearly twice the data

However, this is only part of the story. The part of the brain that Sperry was experimenting with was the grey matter – or Cerebral Cortex, also known as Neo Cortex – meaning the new cortex. It makes up about 80% of our brain mass. It actually only forms one of our three brains.

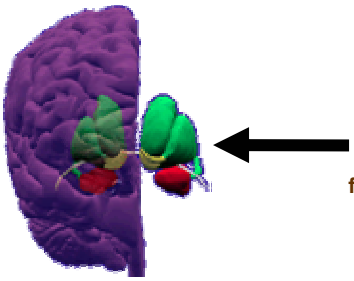


In fact the complete brain evolved from the bottom up. Work in the late 1960's and early 1970's by Paul MacLean suggested a model called 'Triune Brain Theory'. He suggests that the brain developed by keeping those specialist areas that had proved useful in the ancient past, whilst building new and more complex structures that help the species dominate in the struggle to survive and influence our environment.

The base of the brain, called reptilian brain, is where all the necessary command structure lie. It controls basic function such as sleep, waking, breathing temperature regulation and all the automatic living functions. In addition this part of the brain manages sexual and reproduction functions and basic movements. and in fact all sensory data is channelled through this part of the brain first.

Wrapped around the Reptilian brain is the paleomammalian brain, referred to as our limbic system. It further refines movement and promotes survival and refinement of sensory data. However, even more important is it's primary function of gland control, memory and emotional functions. This part of the brain in fact starts to allow social interaction and some level of control of body function. Finally enclosing the two lower brains is the Neo – Cortex, or the thinking brain.

Of the three the Limbic system seem the most misunderstood in learning terms. This part of the brain is the control centre of both emotion and memory. Indeed 'emotion comes from the Latin 'movere' meaning move. Emotion is a movement outwards. The brain mechanisms that manage emotion are different from other sensory systems. For instance, when we look at another's face we see the face directly, however the emotional display shown on their face to channelled directly to the amygdala in the limbic system. The amygdala then sends directions to act our other systems in the brain. This split in information has a profound effect on our ability to be emotional, sometimes over emotional, seemingly without control. Sudden surges of anger and aggression are often caused by this 'bypassing' of the whole brain directly to the limbic system, which is more primitive and less complex than the cortex 'thinking brain'. Daniel Goleman work with emotional intelligence stemmed from this process of emotional control. In reality the limbic brain is in constant communication with the higher cortex brain and the combined effect is one of rational yet emotive understanding of our environment which defines and controls our movement. Emotions are played out in the body by physical movements, such as heart rate, facial expression and hormonal and electrical activity. The upper cortex and limbic system are directly connected, and in fact the small emotional limbic centre has more connections to the larger rational cortex than the other way round, which may explain the dominance of emotion in determining our behaviour in our daily lives.



Limbic System

The limbic brain is split in two halves as shown here from the front view of the brain

The limbic system is also split on a left and right basis and is a small way is also specialised on either side, in much the same way as the cortex discussed earlier. This small more ancient part of our brain in fact has more control than we first imagined. Activation of our systems by arousal, such as fear cause an outpouring of messages for action. At the same time the amygdala sends messages to the cortex to evaluate the incoming data.

The cortex then passes this back to the limbic system to action a response. These responses will in the first instance be within the autonomic system – or motor (movement) system. At the same time the endocrine system will active the bodies organs to adjust to the demands of the situation such as heart and breathing rates, muscles reaction etc. Meanwhile chemical neuro – transmitters in the central nervous system are being sent throughout the body and activate hormones are then used to manage the overall response of the body.

This complex process happens at lightening speed, often un-noticed. Yet it allows us to interact with the world in a responsive and safe way. If we consider an example such as juggling, the process is working at such speed as to allow us to manipulate the three moving objects – almost at will. However, when juggling the person can instantaneously respond to other stimuli as well. A performing juggler will 'work' the crowd, responding to the audience, smile and pick individuals to respond to. They will add in additional movements to move toward or away from different people watching.

The key role of the limbic brain is to transform information as is it enters the brain system, allowing correct placement for further processing within the brain. For this reason the limbic system has the most major effect on memory. The limbic system therefore is surprisingly organised and structured as well as emotional. Work by Ned Hermann in the 1980's in fact began to trace a laterality of these functions with the limbic system.

What we can deduce from this in terms of learning is that emotion is in fact the first and foremost process used by the brain to 'process information'. In fact the organises yet emotional limbic response guides the higher cortex brain in many ways. We can also reason that the limbic control over memory is also an emotional process, not a rational one. This is borne out in our everyday lives in that the easy recall of past memories, tend to be the ones with a higher emotional content.

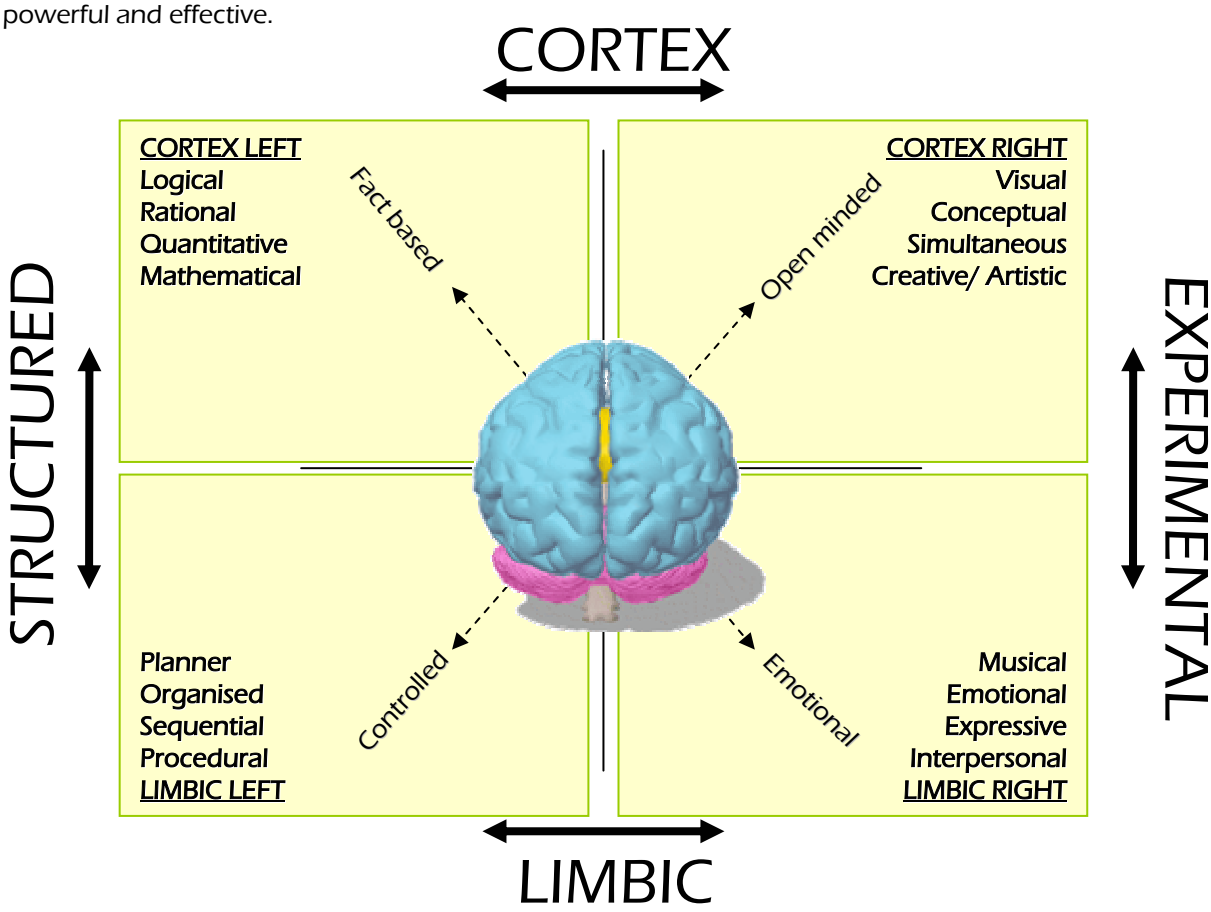
The limbic system is the master at structuring our interactivity with the external world with out personal internal world. The limbic system in effect decides for us how we feel, in relation to our external circumstance and responds in a physical way, by processing information using the rest of the brain. The result is our physical response to any given situation. This direct link between the limbic emotional processing and our physical body response is critical in how we feel. This link means that emotional is a physical process, involving chemical, electrical and hormonal responses within our brain and bodies, resulting in specific and specialised physiological body activities. The adage of how we feel is seen in the body, is accurate. Every emotion IS cumulated in our body language.

What is most interesting in all of this quadranted model of brain specialisation, is that fact that we all seem to demonstrated different preferences to the quadrant of the brain processing used more often. Malcolme Knowles work in General Electric demonstrated that we can identify distinct preferences in individuals for their mode of thinking. The data was conclusive ion that in the 200,000 people who were research there seemed to be a fairly even distribution to each of the four brain quadrant specializations. Knowles went further and stated that in fact, individuals in similar professions displayed similar profiles in brain quadrant thinking preferences.

This research has significant and serious implications for learning. Traditional training once again can be impoverished as it not only tends to focus on left cortex brain processing and also left limbic brain processing. In traditional learning, emotional content is not regards as very useful and rational 'cortex' thinking tends to be rewarded. However, again we can demonstrate that in terms of the brains capacity to learn this one sided approach to learning disallows the brains' full capacity to process, understand and store new data.

As we have identified this stops the brain from physically processing information in the most effect way, influencing the understanding and retention through memory as well. Whole brain processing is an obvious conclusion from all the research in this area. What that would mean is rethinking the complete training process in some cases.

The model shown below is a simple way of graphically demonstrating preferences as well as what is needed in any training event. Again, a holistic and rounded approach to providing information to the learner is critical to maximising the brains capabilities. Balance of both left and right and limbic and cortex processing is one of the primary reasons that the very latest accelerated learning technology can be so powerful and effective.



The brain quadrant model above, whilst a simplification of a hugely complex process has dramatic implications for human beings. In particular how we learn is dramatically transformed when this model is applied to the process of structured learning. Using a brain to it's real potential is the underlying methodology that has been specifically developed by Paul Dunn to advance the accelerated learning thinking through this and other areas of brain research.

Like all good ideas, it appears to be obvious when we think about, yet it is the accumulation of many years of research and scientific thinking. Learning processes should purposely involve emotion, conceptual procedural as well as logical exercises and input. Whilst many training programmes can be perceived as logical and sometimes dull, equally unbalanced to the right brain processing preference may be called 'tree hugging'. The knack then is to get the balance right. When this balance is achieved we can then measure a resultant increase in learning. Classically this methodology can increase the learning by some 30% or more. Simple but effective.