10 Things You Need to Know About Your Brain - and the Implications for How We Learn

1. The brain has a fundamentally simple purpose.

The cleverest thing about your brain is that it persuades you that you have one. Yet, you are your brain. Your brain and the mind it creates is you. No more, no less. The main reason we have a brain is to enable decisions (unconscious as well as conscious) to be made to move away from things that are harmful or dangerous and to move towards things that are beneficial in meeting needs, however defined. This is true for all animals from amoeba and sea molluscs to primates such as ourselves. Plants don't need brains because they do not move of their own volition, though they do have simple reflexes. The sheer power of the decision-making brain enabled early humans to survive and pass on their genes while competing hominid species became extinct.

The purpose of your brain is to collect and interpret information from outside the body, inside the body, and its archive of memories in order to make decisions to move towards or away from things that will enhance its chances of survival and also meet its goals whatever they may be.

2. The human brain is stunning in its complexity.

The human brain is the most complex organ known to man. From the outside, its appearance is unimpressive. It weighs around 3 pounds, and has the cubic capacity of the engine of a small family car (around 1500cc). It has a wrinkly surface like a walnut, and the consistency of a soft-boiled egg. Inside there is a wondrous complexity; a universe all its own.

There are about 100 billion neurons in the human brain. Neurons are specially adapted brain cells extending to all parts of the body that transfer electro-chemical signals from one to another and there are at least 50 different neuron shapes. A neuron is designed to receive electrical signals from other neurons through a branching structure known as dendrites and to pass on signals generated in its axon to the dendrites of other neurons. Between 10,000 and 100,000 neurons can send signals to a single neuron at any one moment in time. As a result of this barrage of input the single neuron may or may not trigger its own electrical signal in response. This is typically 90 milli-volts and is generated with varying frequencies travelling down the axon at speeds up to 220 mph! The gap between neurons at the point where they communicate with each other is called a synapse. It has been estimated that there are up to 1,000 synapses in a piece of your brain the size of a grain of sand.

At any one moment 10% of the billions of neurons are chattering away to each other using enough electricity to illumine a 10-watt light bulb and consuming 20% of the body's oxygen supply. If you counted the connections

Michael Pearn

between neurons in the cortex alone, at a rate of 1 per second, it would take 32 million years! It has even been estimated that the number of potential possible combinations of connections between neurons in the human brain exceeds the number of particles in the universe.

There seems to be no limit to what we can potentially learn.

<u>3. The brain has only two core operating principles</u>

In contrast to the overwhelming complexity of the brain is the stunning simplicity of its two core operating principles. The first is the on-off principle that for many years was considered the fundamental operating system of the brain. An electrical signal (the result of multiple inputs from many other neurons) passes from one brain cell (neuron) to another. It either switches on the next one (excitation), or switches it off so that its signal is not passed on to the neurons in interfaces with (inhibition). That may seem simple enough but one neuron does not just communicate with just one other neuron at any one moment as it will be sending its on/off signal to as many as 100,000 other neurons at the same time. The excitation/inhibition principle is immensely powerful in terms of the huge number of possible connections between neurons, but it pales into insignificance when the second operating principle is introduced.

Modulation is the capacity to affect or influence how any one neuron communicates its excitation/inhibition signal to any other. Modulation is essentially chemical and plays a critical role in the gaps (synapses) between neurons where signals are transferred to other neurons. One may well ask why chemicals, that require a few milli-seconds, should moderate communication between neurons rather than rely solely on electrical impulses which are almost instantaneous. The answer seems to lie in the immensely increased variability of signals available as a result of chemical transmission and the scope for chemical influencing of the signal in transmission from other sources.

Electrical transmission is fast and efficient but chemical transmission is variable and diverse. Neurotransmitters released by neurons into synapses can influence how other cells receive signals biasing the response of target cells for a period, in effect putting them on red alert to respond, or alternatively lowering their readiness to respond. In addition, hormones are released in parts of the brain and the rest of the body and influence the level of receptivity of neurons to incoming signals. The result is almost infinite variability, resulting from just two operating principles. Clever stuff. All the time new hormones and neurotransmitters are being discovered by neuro-scientists and painstakingly understood.

Chemical modulation more than anything else separates the human brain from the analogy with computers which are essentially based on fixed electro-physical connections and the on-off principle. Learning appears to operate on similar principles of connectivity. It is fragile and powerful, limitless and constrained. It is the process that makes us who we become. Learning is our

Michael Pearn

single most important asset as individuals, groups and as a species. It offers us unending hope.

<u>4. The brain is highly structured (but immensely adaptable at the same time).</u>

The structural feature of the brain with which most people are familiar is the duplication into two hemispheres a left and a right. The left hemisphere has traditionally been associated with logic and reasoning, the use of numbers and the comprehension of speech, syntax and meaning. It is thought to favour linear thought processes, analysis of information, cause and effect relationships, focusing on detail, making plans and deciding to execute them. It creates and sustains belief systems that "make sense" of experiences and tends to assimilate new information into these systems. It prefers certainty to ambiguity.

The right hemisphere by contrast is geared to more holistic thought processes, giving a broader awareness of issues, responding more to nuances, patterns, metaphor and allegory, interpreting facial expressions, and is tolerant of ambiguity. This hemisphere responds more to rhythm, dimension and colour. It has a greater acceptance of the new or unorthodox and is less protective of the status quo.

Each hemisphere has local control over "its" half of the body. The right hemisphere controls left-side activities and the left controls right-side activities. The hemispheres are thoroughly connected and are constantly communicating in an endless flow of signals. They work together as an integrated system. It seems that the right hemisphere is better equipped than the left to draw on several different brain modules at the same time. Though one side or other will dominate this can alter according to circumstances such as mood, drugs etc. In reality it seems that both sides are equipped to handle language, thinking, pattern recognition, emotions, etc but it now seems the right side is more geared to novelty, new experience, interpretation and learning whereas the left side is more to geared to routine production, regularities and automated (learned behaviour). It is not either-or but a matter of degree.

Within the hemispheres there is a high degree of specialised function and structure. There are areas for language, different types of sensory input, motor control of limbs, laying down of memories, producing emotions, humour, pleasure, reasoning, etc. and even our sense of ourselves as conscious beings. These are not stand-alone localised functions but rather form part of a wider inter-dependent system across the brain. Removing or damaging some of these functional areas can cause dysfunction but can also result in regeneration of other parts of the brain to take over or partially recover a degree of normal functioning.

The structure of our brains enables constant learning; its plasticity makes us unique.

<u>5. The brain has almost limitless adaptability</u>

Michael Pearn

The brain is not a physically fixed object that we acquire at birth and release when we die. Each of us is born with a brain that is genetically programmed to grow and develop in a particular way. Just how that development occurs is the result of a complex interplay of genes, the brain's physical environment starting from conception in the womb, experiences in the womb, and at an exhilarating rate from birth onwards and for the rest of our lives. Our brains are changing physically all the time. No two human have identical brains. We each of us physically alter our brains to make us the unique beings we are.

The brain is constantly in flux and it is this plasticity that gives the human brain its stunning potential, adaptability and capacity for learning. The human brain with 100 billion neurons, virtually infinite chemically modulated connections, has phenomenal learning power that is just not available to a worm that has only 302 neurons! The overall number of neurons in our brains does not change over a lifetime but the amount of connectivity (the dendritic branching between neurons, (sometimes called neural embroidery) changes dramatically. The connectivity between neurons grows from birth until it reaches a maximum at around age six and then a form of Darwinian neural selection takes place. Regularly used connections get stronger and unused ones literally wither away and disappear.

This operating principle of neurons that "fire together wire together" stays with us for life and is the basis of all learning, stopped only by the ravaging effects of Alzheimer's and other degenerative conditions.

Every sensation that comes into the brain, every thought, every memory and emotion requires new patterns of connections between neurons. As Ian Robinson puts it, experience literally sculpts the brain. It need not be the same physical connections for each sensation or thought or memory for even the vast human brain would run out of space but rather the pattern of firing relationships between them, the neural networks.

When we learn, neural connections become established and are strengthened with use. Dendritic branching between neurons occurs to the point that they can fire as patterns without conscious control. Brain scans of violinists reveal that a much larger area of the motor cortex responsible for control of the fingers is devoted to the left fingers when compared to non-violinists. The auditory parts of the brain of a person who is born blind will expand and strengthen the neighbouring but unused visual areas. London taxi drivers have been shown to have enlarged spatial memory areas in the cortex, as a result of acquiring "the Knowledge", a major feat of memorisation. Each brain in the world is physically unique in its patterns of physical connections resulting from the experience and learning of each individual.

Physical and/or mental repetition and rehearsal play a critical part in laying down the new neural networks that constitute learning.

<u>6. The brain and our minds are the product of evolution.</u>

Michael Pearn

Humans share a brain stem with reptiles such as crocodiles. It is the oldest part of the brain. It evolved some 500 million years ago, and controls the automatic body functions such as breathing, digesting, and temperature regulation. The cerebellum, the cabbage-like bit at the back of the brain, evolved 400 million years ago. It controls the body's position in space and stores memories for practical physical skills, once they are thoroughly learned. The limbic system evolved somewhere between 300 million and 200 million years ago. It maintains blood pressure, heart rate and blood sugar levels and its different components are involved in establishing emotional responses to experiences and in laying down memory patterns. The cerebrum, the wrinkly exterior of which is the cortex, evolved around 200 million years ago. In humans, it is by far the largest part of the brain, about 40% of its volume, and its various parts are responsible for organising perceptions, for building memory patterns, for speech and communication, for making decisions and for generating ideas.

Whether we like it or not, we are essentially animals that have developed brains of huge potential that we are still learning to harness. As a species we evolved over millions of years. The hominids living 300 million years ago had brains resembling the present human brain but only about one-third its size. The huge development of the cerebrum was almost certainly linked to another anatomical change, the lengthening of the neck. Perhaps necks grew longer simply to facilitate looking around as early hominids descended from trees and learned to survive on the savannah grasslands. This change had enormous consequences. With a longer neck, the voice box was lowered down the throat, creating resonant cavities in the vocal tract. At the same time, the tongue was given greater freedom of movement up and down, forward and back. It became possible to make a much bigger variety of vowel sounds and consonants. It was also possible to engage in (guttural) grooming at a distance from each other.

Three million years ago Australopithecus Africanus had a fairly human shaped brain but it was much smaller than our brain. About one and half million years ago the cortical area of the brain underwent an explosive enlargement for reasons that are hotly debated today. The growth was exclusively in the cerebrum with its outer layer the cortex, seat of thinking, planning, consciousness, and above all communicating. So great was the pressure of enlargement it seems to have pushed the skull backwards and upwards to make more room, thus differentiating homo sapiens from other related flat-headed hominoid species which gradually became extinct, though of course chimpanzees our closest cousins did not.

The human species has gone one step further than all other animals and has evolved the ability to communicate through oral and above all written language thereby creating culture that can be passed on through learning from one generation to the next, rather than wait for millions of years of biological evolution to do its business by passing on improved genes. We now pass on learning from one generation to the next and have freed ourselves from Darwinian evolutionary processes. That does not of course

Michael Pearn

mean that we are free from influence of our evolutionary past. As one authority put it, we are not slaves to our genes but we are influenced by them.

The key point to remember is that our brains did not evolve as an integrated functioning system but as successive evolutionary layers, overlaying or enlarging previous functions, not replacing or supplanting them but interdependently extending them. This helps us understand why as a race we continue to experience so many currently insuperable problems which at the level of the intellect should be easy to resolve. Biological as well as cultural evolution gets in the way.

7. The brain is essentially emotional (whether we are conscious of it or not)

Not only are we animals that have evolved brains with enormous processing power we are also very emotional beings. Charles Darwin noted, over 100 years ago, that human emotional expression was the same in all cultures and societies around the world but it was not until quite recently that his view that our emotions are part of our common evolutionary heritage has been investigated scientifically.

There is no one seat of the emotions in the brain, though the limbic system does play a critical role. Nor can we say that raw emotion is primarily located in the reptilian brain stem, though it does have a critical role to play especially in the release of neurotransmitters that affect all parts of the brain. We also know that the higher brain areas such as the cortex are closely linked to our emotions. For example, when we are depressed, the pre-frontal cortex is unusually active. We also know that there are centres in the brain which if stimulated causes a feeling of pleasure that we are disposed to keep going for as long as possible. These are our pleasure centres. The brain also has arousal centres which if stimulated puts the brain and parts of the body on special alert, sensitising us to incoming stimulation.

We saw earlier that chemical processes resulting from proteins, neurotransmitters, and hormones exercise huge control over the brain by means of chemical modulation of the electrical signalling between neurons and the establishment of neural networks of laid down memories and skills or habits. When you still shudder at the thought of a very embarrassing incident long ago in your life, you are accessing the emotional charge at the time and its persistence in your brain. When you see a stranger’s face and you feel uncomfortable for reasons you cannot fathom it is because your brain is accessing memories and associations that trigger emotions outside consciousness. Some experiences are so emotionally charged that we have evolved mechanisms not only to keep the emotion out of conscious experience but also consciousness of the memory itself.

The hypothalamus, which functions a little like a railway junction bringing different kinds of brain information together and then passing them on to different parts of the brain, plays a critical role in releasing hormones that have critical affects on our internal workings making us feel aroused, sluggish, depressed, manic, confused, elated among many core human feelings. Too

Michael Pearn

much or too little of certain hormones can have disastrous consequences for us.

Every experience that is laid down by the brain in longer-term memory has a positive or negative emotional charge. There is, for example, a measurable emotional response in the brain (even though we may be unconscious of it) when we look at faces and places and objects, listen to sounds, recall memories, and dream our dreams. Some of these emotions can be strong and uncomfortable and others can be pleasing and re-assuring. It is surely this underlying emotional process that artists, poets and musicians are exploiting (again often without being fully conscious of the underlying mechanisms) when they create what we call works of art. As children we are at the mercy of our emotions and part of our concept of adulthood is that we can exercise a degree of control over our emotions though we also recognise that there are special circumstances when it is OK to give in to our emotions. Even in seemingly logical decision-making it is likely that our emotions are playing a part at all times which may help explain our intuition or what we call gut-feelings

There is often strong emotion involved when we are learning, or more accurately being “schooled” which for many people was a disheartening experience that discouraged them from undertaking more formal learning after they had “escaped” from school. Fear of failure, the dread of exams, the humiliation meted out by bad teachers, the sense of disappointment, and lowered self-esteem can all get hold of young people as a result of predominantly negative school experiences. Others learn to be cynical and learn to do what the system appears to want, viz a conformist acquiescence and the acquisition of the skills necessary for passing exams. As adults we still feel a dread of being exposed, of being wrong, appearing stupid.

Most of the effects that emotions have on our functioning as human beings lie outside our consciousness and are mediated by complex chemicals in the brain. It is not insignificant that the neural connections from the rational, reasoning cortex to the emotional sub-systems of the brain are smaller than the neural connections from the emotional subsystems back to the cortex. Our emotions have much greater influence on our conscious behaviour than we realize. The human brain is not primarily logical and analytical. It is powerfully and inescapably emotional as well. Our emotions, positive and negative, conscious and unconscious, plat a key role in the way we learn.

8. Our brains are social

Humans are essentially social animals. Most of us like to live in small family units and to varying degrees be part of communities, groups, associations, societies and networks. Most of us work in groups, teams or companies. Human society is built around and dependent on cooperation and sharing. There can be little doubt that a genetic disposition to form groups, to cooperate, and to share resources for hunting, disposal of food, defence, etc had enormous survival value over millions of years when different hominid and other species were competing for survival.

Michael Pearn

If our brains are denied contact with other brain at early stages in life it simply fails to develop properly. Although genetically programmed to acquire spoken language it needs to engage with other brains to learn to speak. This could be one of the reasons for the long period of helplessness in human infants compared to other animals. Children who lost all contact with humans at a young age and who were kept alive/raised by animals do not learn to speak, though basic language skills can be achieved when brought into human contact.

It is not just acquisition of language skills that is dependent on contact with other brains but also emotional development in relating to others. The haunting images of children in the state-run orphanages in Communist Rumania should convince anyone that emotional contact and interaction with others is crucial to healthy brain development.

Much of our sense of ourselves comes from our experiences of others and their reactions to us. Babies learn not only a sense of themselves but also a sense of the existence of others by observing the relationship between their own behaviour and the reactions of others. Most of us seek the approval, recognition and praise of others. Very few people can live without some form of approval, though of course there are circumstances when strong individuals will fight against the majority and incur their wrath and opprobrium as when civil rights advocates in the southern States of America took on and eventually beat the established order. Higher ideals such as equality and fairness are still social phenomena.

The traditional struggles of teenagers are partly the result of social learning processes but also of chemical maturation in their brains enabling strong emotions to come under a degree of control from the cortex. Anti-social behaviour can be learned just as easily as socially acceptable behaviour. It is all a question of reinforcement of patterns of behaviour, internal representations of the outer world based on complex memories, all subject to emotional forces moderated by hormones and neurotransmitters.

As a result, a brain that is kept alive in a jar cannot possibly develop a personality, a sense of itself. First there is no sensory input, nothing for the brain to act upon and process. Secondly without any experiences, there will be no memories, without memories there are no emotions. Without emotions there can be no consciousness. But imagine we could wire one brain in a jar to another brain in a jar. Suddenly everything changes. Each brain now has the possibility of input, something to process, emotions to trigger, memories to lay down, hormones and neurotransmitters to release, identities to develop. Without other brains to interact with we are nothing but organic material.

Solitary learning through reading, listening to lectures, and reflection can be powerful, but learning through shared experience, collective dialogue and group problem solving is even more powerful. It is a more natural form of learning for the brain.

Michael Pearn

9. The brain constructs the world rather than merely records it

Our brains convince us that there is a real world out there and that we merely record what it is in order to make decisions. Most of us are not aware that the brain is really constructing and creating an interpretation of the external world. For the most part this representation of the external world is accurate as indicated by the perceived consequences of decisions made. If the interpretation or representation is sufficiently correct the brain gains in confidence, if not it revises its interpretations in the light of experience. The brain's raw material is electrical impulses coming from many sources, e.g. light waves hitting the retina, and sound waves reaching the ears and other electrical signals coming from the other senses. Out of this unpromising input the brain creates the world as we know it.

No one part of the brain is responsible for any aspect of brain functioning. For the most part several processes are going on in parallel. Within any general brain region (e.g. the basal ganglia) the component parts are not autonomous but are functioning in an incessant dialogue with each other and other brain systems. It is now thought that there may be as many as 30 different parts of the brain for processing visual information that are integrated in the pre-frontal lobes into the coherent experience of the visual world. When people suffer brain damage some of these systems fail to work correctly. As a result there are people who can see form and movement but cannot identify common objects. This is because different parts of the brain are responsible for the separate activities and still other parts for putting them together to see the object in motion. This can make crossing a road very hazardous experience for those people who suffer from a failure of the brain to integrate the two processes.

An example of failure in the integrative process is people suffering from Capgras Syndrome. They can recognise people who are close to them but genuinely feel they are impostors because there is no emotional tone to their perception. They experience the appearance but not the expected feelings and emotions associated with them. They are therefore forced to believe, compellingly, that they are impostors. Intriguingly, Ramachandran tells how one such patient had no such difficulty recognising his parents when speaking on the phone but when he saw them thought they were impostors. There was clearly a failure of integration of visual and emotional information in his brain. The problem lay not in a particular location but in some form of balanced dialogue between key regions within the brain

The study of visual and other kinds of illusion provides insight into how the brain creates its own reality and does not always get it right. Richard Gregory describes the brain as a probability computer. He sees perception as an active hypothesis-testing process that enables the brain to escape from the constraints of total reliance on sensory input and make reasoned interpretations to guide behaviour by making interpretative assumptions about what it sees. Visual illusions are a powerful reminder that our senses are not passive receptors but are actively making sense of the incoming stimulation. Seeing faces in the clouds is another example of the brain adding meaning to

Michael Pearn

its input. Our rational cortex has no power to change the perception even though it knows it is experiencing an illusion..

Magicians, illusionists, artists, and possibly many people who claim paranormal powers are exploiting the automatic processing of visual information by the brain, the selective focus of our senses as well as habits of the brain to respond in particular ways, even though rationally the brain might know otherwise. Visual illusions such as the Muller-Lyer do not disappear even when the people measure the two vertical lines. One still looks longer than the other. Conditioned responses of the brain can be powerful enough to overcome what the brain "rationally" knows. Equally, expectations and emotional states also influence what is attended to, what is "seen" and also how transient experience is interpreted. Recently bereaved people know how easy it is to momentarily 'see' others as if they are the deceased person or to hear his or her voice.

Two people can have identical external experiences and yet internally experience them differently. No two brains are physically identical. Laid down memory patterns, whether conscious or not, will influence how new experiences are processed by the brain, and how they are emotionally tagged. Learning is as much to do with conjecture, imagination, and probabilistic interpretation, and hypothesis formation as it is to do with providing answers and certainties. The former is much closer to the way in which the brain works.

10. <u>The human brain has a unique capacity to reflect upon itself</u>

It is likely that the brain's capacity for self-consciousness and the ability to make itself the object of its own thinking had survival value in evolutionary terms. Abstract thought and the language abilities that make it possible enabled a level of forward planning, anticipation, problem solving and decision-making that gave the species advantages in social organisation and defence.

Having recognised the enormity of the task in seeking to understand the brain we must also recognise a unique constraint that we face in unravelling the mysteries of the human brain and the mind that it generates. Unlike any other quest in the history of science we must use our own brains to study how the human brain works. In principle there ought to some advantages. Using our minds to study the brain should give us a degree of inside knowledge but it seems that examining our own brains through introspection and philosophical analysis gives us very little reliable verifiable knowledge of how they really work. Subjective experience is unique to the individual and there is no way of getting inside the mind of another human being.

Just how the brain creates a sense of consciousness is the greatest challenge facing brain researchers. It is possible that because we need to use our consciousness to study and unravel the secrets of how the brain creates consciousness (a problem that is unique in science) we might never manage to do it. The philosopher, J. R. Searle has argued that " subjectivity is beyond

Michael Pearn

the descriptive resources of objective science as we currently conceive it" but therein lies a clue to the future. Science and what we are capable of achieving through scientific investigation is changing and evolving all the time. Revolutionary changes in our understanding of genetics and also cellular mechanisms, have recently replaced what were once mysteries with scientific fields of investigation. Without the discovery of the principles of electricity we would never have begun to unravel the secrets of the brain.

People use the term consciousness in so many ways that it can be difficult to ascertain what each person is talking about. How should we define consciousness? What are its characteristics? We are aware that consciousness is intermittent and does not cover all our bodily experiences. In good health, our brains and senses carry out most of their highly complex and subtle operations without conscious interference from their owners. We are completely unaware of 90% of what really goes on in our brains. Certainly, we rarely notice the workings of the autonomic system – breathing, sweating, digesting, eliminating waste – or even of the coordination of skills required to carry out everyday movements. It takes disease or trauma to raise these events to conscious level and prolonged training and discipline to extend any conscious control over them. In biological terms consciousness appears to be almost a by-product, of the brain's ceaseless activity. Gerald Edelman has come closest to a formulation of subjective consciousness that stems directly from what he calls selectional re-entrant activity of neurons in the core. By this formulation mind is created solely from material matter.

The human brain with its almost limitless capacity for thought and ingenuity is surely capable of re-framing the problem of subjective experience in a form that makes it possible to fully understand and explain how the brain does it. The endeavour is beset with problems both of definition and of methodology. Our high level consciousness is our most precious gift. It is what differentiates us most from the rest of the animal kingdom and from those humans in a vegetative state (or coma) who can feel everything but are not aware of feeling. Consciousness is not an absolute but rather a continuum. There are levels of consciousness and it would be a mistake to thinks that animals do not possess a degree of consciousness.

We know that chimpanzees are aware of themselves enough to recognise themselves in a mirror and not to confuse the image with another chimpanzee. When presented with a mirror, chimpanzees react to it as if they were confronting another animal but after 5 to 30 minutes they will engage in self-exploratory behaviours (e.g. trying to get a view of their bottoms) as if they knew they were in fact seeing themselves. They will also follow the gaze of an experimenter as if they knew that eyes can be used to direct attention. Human babies learn to look in the direction of something that someone is pointing to between 18 and 24 months, suggesting a sense of 'self' and 'other'.

It is widely recognised by neuroscientists, uncomfortable as that may seem to many of us, that this consciousness without which science, art, religion, philosophy, and human culture in all its manifestations and diversity is a

Michael Pearn

biological phenomenon that is realised in the brain. By studying the brain from every conceivable angle we may move towards a greater understanding of what consciousness actually is and how the brain creates what we experience as self-consciousness. Our brain affects us but also 'we' as the conscious manifestation of our brain can also affect and influence our brains with a puzzling circularity.

Free will or choice could well be an illusion. The likelihood is that the range of possibilities is so immense in terms of neural activity, and the complexity of neural organisation is so great as to constitute virtual infinity, that the experience we have is as if we had free will. In practical terms, although there is a high and variable degree of determinism that can be conscious and not conscious, we are both free and not free from biological influences arising from the workings of our brains. Sometimes we appear to control it; sometimes it appears to control us, and most often it is probably a blend of both. Much of our learning is conscious, but perhaps most of it is unconscious.

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