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Moving from Training/Taming to Independent Creative Learning: Based on Research of the Brain

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Additional information is available at the end of the chapter

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Abstract

Learning is the ability to cope with changes and to understand their interaction with the dynamic body. Animal brains, and specifically the human brain, are developed in such a way to make learning possible. Based on findings from brain research, we can show that this is the primary function of the brain. For survival and energy-saving purposes, the brain is developed in such a way that the learning process is as short as possible, while most energy is devoted to converting the results of learning into automatic activity. The move to automation of learning outcomes is based on mechanisms, which can be used to tame animals, including man. Humans yield most of the time to the processes of self-taming/training of the brain, even empowering them through the Western concept of learning, which idolizes focused narrow-specialization. I will present here findings from brain research and describe the characteristics of Western culture on which these claims are founded, as an expression of the threat to the continuing development of modern human culture due to characteristics which demonstrate a process similar to the cultural degeneration of past civilizations, which at their peak, could not have imagined such a fall to be possible.

Keywords: training/taming, independent learning, creative learning, brain, association, emotions, intuition, uncertainty

1. Introduction

The aim of this chapter is to describe the human brain's capacity for learning, which deviates somewhat from the evolutionary path of animal brains in related species. Although the physiological changes that took place in the evolution of the human brain compared to apes are small, these changes crucially enabled a different kind of learning capacity compared to other animals.

The secondary aim of this chapter is to show how Western culture has taken advantage of the unique learning capacity of humans to suppress these abilities beyond natural suppression due to survival needs. This led on the one hand to great technological achievements, but on the other hand has harmed the possibilities of developing human learning abilities which would allow people to broaden their learning potential. This potential, if left undeveloped, will lead to the decline and degeneration of modern culture [1] and will remove the chance of fostering a developed democratic consciousness that requires the exploitation of the brain's learning ability to combat numerous natural tendencies that are contrary to democratic ideas.

The animal brain developed to allow natural learning, without which the fate of animals would be the same as that of plants – entirely dependent on their surroundings. As their natural habitat **changes**, so their chances of survival fall. Plants have some measure of flexibility which enable them to survive when their living conditions **change**, but their ability to adapt is very limited compared to animals who, while they may be adapted to a particular habitat, have a brain which is sufficiently flexible to deal with unexpected **changes** which may occur in their natural habitat. What this means is that plants are not able to **change** their natural surroundings to improve their chances of survival. In contrast, animal brains enable them to **change** their location, and thereby to improve their survival chances even when their natural living conditions **change**. One of the best examples of this is migration in different species, which allows animals to **change** their location (and consequently weather conditions and food availability) to improve their chances of survival. Compared to other animals, man is the only creature with the ability to live in extremely diverse geographic areas, even before the human brain developed sufficiently to allow the development of technology.

The unique evolutionary **change** in the human brain enabled technological learning in humans, the first examples of which were the creation of clothing from animal skins and controlling fire – these two skills allowed humans to exist all over the planet without the need for a long evolutionary adaptation period that would be required by an animal needing to adapt to different extremes. Until then, mankind was limited to small living areas even more so than animals in a prolonged evolutionary process which created the required adaptation to different extreme climate conditions. So, for example, animals living in equatorial regions can adapt to life in snowy regions or in desert regions, but this ability to change location was only possible following a prolonged evolutionary adaptation to new living conditions. Meanwhile this developmental process reached its peak in man's exploration of life outside the planet – after conquering almost the entire planet, man set his sights on exploring beyond planet earth. This process characterized man as an animal like any other before the development of this ability for technological learning. I have emphasized here the word “change” to clarify that the animal brain, and particularly the human brain, developed in such a way to be able to cope with changes as a condition of survival. As such, the animal brain developed in such a way that it could learn to cope with changes in its environment and in the way, it relates to the environment. The ability to learn about the changing world is dependent on the brain's ability to deal with changes – this ability is so fundamental that even the most basic senses – sight, hearing, smell and touch – are merely brain potentials which turn into useful information about the outside world only through a process of active learning. The most basic senses go from mere brain potentials to fulfilling their role as agents in the perception of the world to the brain only

if the body is subject to changes while the senses are being stimulated. Learning occurs as a result of simultaneous changes in the world and the body's place in the world. The animal brain develops a natural learning ability which enables the animal to cope with changes, as a necessary condition of survival, but only when changes occur simultaneously out in the environment and inside the body. A repetitive action, be it external or internal, calms down the brain's processing activity, including learning (as there is no new information to consolidate).

2. The learning brain

The brain works as an information processor comprising a total brain wiring system that connects wires within distinct information processing regions that specialize in generating commands designed to activate certain physical systems [2]¹. This allows the brain to process information and then generate specific action commands while controlling all the bodily systems and their expressions as brain activity. In other words, in order for the body to be able to function in an adaptable way, the brain must enable adaptable information processing for specific functions, and at the same time each such activity will act in coordination with the needs of the entire body according to changing priorities in accordance with changing circumstances. Neurons in the cerebellum unite brain activity and are responsible for making the brain a single processing entity; while neurons in the cortex are arranged such that specific areas of focused information processing are created. The process of processing information into learned knowledge then involves raw information from different and sometimes contradictory sources meeting in the dendritic trees, while the type of processing is influenced by a continual flow of huge amounts of information from contradictory sources, with each new piece of information differing from its predecessor in size and frequency (flow speed) which together comprise power. Changes in the quantity and speed of information flow influence how the information is processed at any given moment – and whether an electrical command, a spike, will be passed from one neuron to other neurons, where the results of information processing are an expression of automatic learning occurring in the brain. The more powerful the information, the poorer the processing of said information (or learning), and the transition of information will maintain the automatic processes reinforcing the taming trend – no learning will occur.

So learning begins as a result of changes in the amount of information of a particular type and the speed of flow of the same information. The combination of the quantity and speed of the flow of information constitutes its power, which can change in fractions of a second, and affect the outcome of information processing in the dendritic trees. Processing the quantity and intensity of information, while relating to the changes occurring at each fraction of a second, comprise the natural or automatic learning process which occurs in each of the dendritic trees involved in information processing activity. In fact, each of the hundred billion dendrites, which form an integral part of the hundreds of millions of neurons in the brain, constitutes a specific learning unit within the overall automatic learning system. So each of

¹The subject of the brain in this chapter is based on my book and the many sources used in it related to brain research. I will minimize references, instead refer to [2].

the dozens of billions of dendritic trees found in the cortex form an automatic learning hub specialized in a particular field, while the dozens of millions of dendrites in the cerebellum form learning hubs, which together create automatic learning systems.

Each dendritic tree is designed to be able to process information which is changing every millisecond, this is a basic condition for the automatic learning ability of the animal brain. I will go on to briefly explain the structure and type of flexible information processing that takes place in the dendrites, which allows the animal to learn to deal with a changing environment. It is important to point out here that the fluency of the learning process in the dendrites enabling continuous and automatic learning. In order for the brain to be capable of flexible learning, systems communicate via the neurons, which pass the results of the information processing to other relevant neurons, which must also be flexible. Thus each dendrite processes huge quantities of changing information every millisecond, and the output of this processing includes the processing of the changes in information flow and strength, which are also products of learning. The output, if sufficiently strong, once it is past the cell body, passes to the next neuron as information (a spike) which reinforces the historical information flow created thus far. The automatic learning forms the basis of raw data for the information processing in the dendrites of the next 30,000 neurons in the cortex which each neuron is connected to, which also receive information from 30,000 sources at different levels of variability, including contradictory information, and from 300,000 sources of data in the dendritic trees found in the cerebellum, some directly and others indirectly. First, I will describe the activity of the emotional system which forms the basic communication system of the brain, operated via the associative communications system which makes up 70% of the brain cells, and which enables the creation of imagination as a basis for creative thinking. This communications system has been less researched due to the limitations of research tools [3]. Next, I will present the structure of the dendritic trees and the manner of data processing in which information passes from neuron to neuron and the influence of the results of this processing on the transfer of information to the next dendritic trees, and consequently on all of the subsequent dendritic trees. The activity of the dendrites is presented separately from the activity of the communications system due to the complexity of the interaction between them. This interaction is created due to the speed and quantity of information (which together forms the power of information) which arrives at the axon from an infinite stream of data which is then automatically processed into learned knowledge in the dendritic trees. This influences the power of the data processing in the axons in a circular process. There are in fact continuous interactions between the activity in the dendritic trees and in the axons and synapses and the level of branching between them, which turn the brain into a single united data processing system.

2.1. Associative and intuitive communication as a necessary condition for flexible survival learning

The thalamus, located in the midbrain, receives information from all of the senses and internal organs, and by painting them as emotions facilitates a prioritization system based on the huge quantity of contradictory information received, which changes every millisecond. In this way, it is the first transit station of the senses, creating an emotional level of abstraction before they undergo primary cortical processing and more abstract processing in the frontal cortex.

Several nuclei convert the various signals into primary (general) sensations: touch, heat, taste, smell, sound, light and darkness. This first distinction is crude, but essential for many of the body's automatic responses. These are unconscious primary motivational forces, which are commonly referred to as impulses. Damasio calls them "emotions," in order to distinguish "feelings" – which are later expressions of emotions, with the level of awareness distinguishing between them [4]. So, for example, the lateral geniculate nucleus (LGN) transfers emotional information to the primary cortical area which deals with visual processing. Auditory information, which arrives from the inner ear, receives its first emotional characterization in the medial geniculate nucleus (MGN) before being transferred to the primary cortex. Similarly, motor activity related to coordination receives sensory input (the person feels coordination) via the ventrolateral nucleus, which receives integrated messages from the cerebellum and the basic cartilaginous nuclei before passing the information to the primary cortical area. Preliminary processing and prioritization between the different senses also occurs in the thalamus in the lateral geniculate nucleus (LGN), based on contradictory emotional processes. Setting priorities influence the preference for activity in various brain and body systems. This preference is characterized by defining activity on a scale from pleasure to pain, the most fundamental feelings. This description clarifies the basic potential of the brain's flexible activity, which involves such huge quantities of information that no logical supervision could possibly cope with. A further expression of the prioritization of activity is the degree of alertness versus the tendency to fall asleep. The more urgent and important the task at hand is, and thus the more resources are allocated to the relevant systems, the more the thalamus will invest in maintaining alertness, and will lower the priority and calm down the systems which drive the urge to fall asleep (release of different chemicals in the relevant areas). The results of these adaptations are primary sensory characterization, the generation of attention preference and degree of arousal, which are then transferred to the more complex and abstract processing in the cortex. This is a case of two conflicting states, and the need to find balanced interactions between them, which change according to brain activity destined either for processing during sleep or for processing accumulated information continuously during waking hours. This explains the tendency to fall asleep during activity such as a lecture delivering a large amount of information, which the brain is unable to process [5]. The brain needs sleep to continue processing and assimilating the information received, and to remove unnecessary information accumulated during the day. Sleeping a sufficient number of hours also contributes to significantly improved memory [6].

Some systems are referred to as automatic since most of the time the coordination between them is automatic. The level of awareness required for conscious control varies depending on previous attempts, which influence the involuntary interpretation that the brain applies prompted by physiological and social cues – parents, family, close and distant social networks and so on. This is a process which emphasizes the complexity of naturalistic activity and the dependency that exists between the different elements involved in these automated actions. We generally cannot control these actions, since they take place unconsciously, creating our unconscious urges, which drive us to action. For animals, although most of their actions are automatic, processes of unconscious learning still occur based on past events [7].

Two central nuclei in the basal ganglia are responsible for emotional and muscular activity, and receive commands from the cortex. One is the caudate nucleus, which supervises

emotional activity. It receives information from different regions in the cortex, such as the frontal lobe responsible for eye movement, and the associative areas of the parietal lobe, which are responsible for visual information. This information is passed to the Globus Pallidus and the thalamus with a circular connection to the frontal lobe. Thus, a revolving balance is created, allowing for the processing of information which is changing in real time. In combination with a communication circuit for the limbic region, a system is created that combines physiological and emotional processes, which affects the body's automatic learning process. This means that most animal learning occurs automatically, and the brain guides it according to past experience to give future action commands. Every time we need to learn something new as a result of new information, increased brain activity is required, which needs a lot of energy. The brain accordingly developed so that only when new information that cannot be ignored is presented does the brain go into intensive processing mode, investing time and resources. Creative thinking, which undermines existing models, forces the brain to act in a higher gear, therefore development and maintenance of creative thinking requires an investment of resources, which goes against the natural instinct for efficient brain activity.

The fact that emotional and physiological processes receive direct input from the cerebellum – where preliminary processing of the relationship between acceleration and delay occurs and acts on all systems, and only then receives orders from the cerebral cortex where secondary processing is performed – allows intermediate degrees of acceleration and slowing of motion signals. The cerebellum produces automatic commands, while the cortex produces commands which come from a combination of different areas. This explains why brain activity is so complex, dynamic and fast-changing that cannot be performed under conscious control, which is secondary to most brain activity. The development of the human brain, which does though allow conscious activity, facilitates the application of control in retrospect also with regard to non-automatic movements, which have become automatic habits. Conscious brain activity allows a long-term perspective, which is not possible in animals, however since it slows down brain activity, thereby endangering survival, it always occurs in retrospect – after automatic data processing and command generation have taken place. Despite the automatic activation of this complex system, humans can intervene in the processing of received stimuli. This possibility is realized via physical means which influence the range of stimuli and their intensity – increasing to dimensions (quantities and high intensities) that human mechanisms cannot tolerate. Conversely, we can reduce and weaken the range of stimuli – so as to completely cancel their effect on human physiology. This process is made possible due to the complex connectivity of the cell bridges, which produce complex links with the thalamus and different areas of the cortex, and extensive links with the brainstem and spinal cord. In this way, humans are able to influence some of the automatic processes once initial information processing and command generation have been completed. So, if we can influence automatic physiological processes, then we can certainly influence acquired physiological processes with deliberate training, and furthermore, it is possible to influence the psychological aspect via exaptation.

These two aspects – the physiological and the psycho-social – are connected by what is known as epigenetics [8], and so we can influence each one with targeted activity. This possibility can be seen in the change of genetic roles not just in the long drawn out evolutionary processes, as learned through Darwinism, but through fast genetic changes expressed via an epigenetic

mechanism called methylation [9]. The individual differences in this process are so great that they create differences in gene expressions even between identical twins as a result of exposure to different life events, even growing up in the same family, physical and social environment. In reality, the environment is never exactly the same, not even for the same person at different times, and certainly not for different people, even if they carry the same genetic material. Without this possibility, unique to man, there would be no basis to the argument that humans have the ability for conscious learning and choice, which are necessary conditions for all forms of targeted learning, which acts against the natural tendency to automatic brain activity. Awareness of this genetic flexibility requires recognition of humans' ability to develop and change more quickly than was previously thought. Later on, I will show how this ability can be developed at varying levels. In such conditions, man's creative ability – the ability to cope with a changing and sometimes surprising reality – becomes more vital than it seemed in a culture dominated by the scientific paradigm, and ensures an engineered reality that is seemingly stable and permanent, that if realized, will free man from the effort of perpetual learning. Creative learning demands a constant effort precisely because it is contrary to the direction of brain development.

In this process of flexibility to adapt to a changing reality, there are two sides to the genetic coin. On the one hand our genome manages to adapt to the environment we live in through expression and silencing of genes that allows us to react at any given moment to what we need, when we need it. On the other hand, we do not even think about the hundreds or even the thousands of genes that are constantly activated or silenced so that all of this happens smoothly until the automatic result is obtained. In other words, genetic flexibility is designed to allow adaptation to a changing environment and to find solutions to the same reality, as long as the changes are not too extreme, and the response received is expected. The automatic process becomes less and less flexible as the environment we live in changes less and less (becoming more engineered), at a slower and slower pace. Such flexible epigenetic choices would be superfluous if the brain were not sufficiently flexible to take advantage of them. Epigenetic ability is influenced by environmental events, which demonstrate the extent to which the brain is plastic and influenced by every unconscious intervention. Thus, targeted intervention would surely influence physiological and/or emotional aspects which subsequently affect the type of processing of data received in the human brain. Three mechanisms will be automatically influenced by such intervention: unconscious urges, conscious feelings and cognitive abilities. The reason for this is that brain activity is combined with circuits that are connected to complex connections between emotion and simultaneous and spontaneous awareness [10]. There are differences in the level of complexity of influence on these mechanisms and their flexibility to change the connecting circuits. These connecting circuits stem from the level of flexibility of human thought and behavior. Flexibility and complexity can be developed with appropriate education.

The influence on impulses is the simplest and most direct; the influence on feelings is more complex due to automatic internal feedback that occurs at this level, and due to the level of additional awareness via the neurons called spindle cells; and the most complex effect will be on cognitive mechanisms at different levels of abstraction. This latter effect on cognitive capacities will be especially marked from the beginning of the conscious-rational phase, since

from this time onwards there is the ability to review cognitive mechanisms and ‘control’ them to a certain degree. This is expressed in intervention through the automatic effect of impulse and feelings systems. Intervention is supposed to detach them from other mechanisms and to create critical reference, thought of as “objective” (compared to other mechanisms thought of as “subjective”), though they are never truly objective. In fact, it is impossible to completely separate these mechanisms, but we can differentiate between different stages of the cognitive process: the unconscious evaluation stage, the interaction between emotion (conscious but not controlled) and thought at the first conscious level – and at this stage conscious feelings and intuitions are produced through the spindle cells and through the conscious cognition stage. This is considered a fully conscious stage of the thought process, although it is in fact not so. In reality, research shows that even at the conscious stages, it is nearly impossible to distinguish between thoughts and feelings, for many reasons. The central reason is the high connectivity of the spindle cells to diverse areas in the brain, which connect all brain activity to emotional processing at high levels, as well as general brain connectivity created by the cerebellum.

We can see that the senses stimulate impulses, that is, the forces that motivate us to action and creativity. They activate the emotional system as a primary information processing system and the mental system as automatic mechanisms that control these forces. These processes are chemically mediated enabling a full continuum, rather than the total separation artificially created between body and mind [11]. This same continuum combines emotions and cognitive capacity, creating “emotional intelligence”, an expression of the necessary amalgamation of feelings and logic which together form cognitive abilities, which though not widely accepted can be termed intuitive rationality [12]. At every level of cognition, even at the simplest level (which is thought to be devoid of feelings and so supposedly “objective”), unconscious emotions are involved in the brain’s processing, and so enable intuitive activity at ever increasing levels of speed and accuracy. Kahneman described automatic processing as an intuitive brain system, which in the literature is defined as the number one system and very rapid, while logical thinking is the second system, and much slower [13]. The division between these three systems is then a fiction, since they influence each other and are automatically influenced. Only the differences in control capabilities of each system create the illusion that the cognitive mechanisms can act completely independently (“objectively”) of impulses and emotions.

The associative communication system, which drives the emotional system and is driven by it via the associative cells, is both reinforced and restrained on a scale from general emotions to subtle nuances by the biochemical activity of more than 80 neurotransmitters. These affect brain activity in broad regions of the brain and in very precise locations at the micron level. The main reinforcement pathway in the brain is the mesolimbic pathway, which includes the nucleus accumbens, the amygdala and the hippocampus. One branch reaches the prefrontal cortex. The activity of this pathway is expressed by the neurotransmitter dopamine. The nucleus accumbens is fed by neurons, which release dopamine, found in the midbrain region known as the tegmentum, part of the mesolimbic pathway. The role of this system is to reinforce new stimuli which are interpreted as positive after processing [14]. They are reinforced by producing a feeling of pleasure, which encourages the repetition of the same behavior that produced the stimulus identified as positive. As certain bonds become stronger, the hippocampus releases to the same region of the brain stem cells that develop into neurons

that strengthen communication based on neurons in the same region. This process can lead to addiction of behavior considered positive, such as eating which may become over-eating, or love that becomes addictive love. In contrast, serotonin can cause addiction to behaviors considered to be negative such as restrained eating to the point of anorexia, or love that turns to uncontrollable hate. The two systems work together to create balance – one encourages while the other suppresses at different levels of the scale from positive to negative, as the contexts change, and context is constantly changing. So, for example, curiosity can be interpreted as positive, but over-curiosity can cause damage by diverting resources. In addition, directing curiosity to a certain behavior is done at the expense of the curiosity required for other activities such as watching the landscape at the expense of caution against falling on a dangerous path, which is no less essential, and possibly more so. Therefore restraint is required using inhibitors. Exaggerated emotions or emotional suppression harms normal functioning, making balance very important between contradictory emotions as a condition for normal life [15]. In light of the dangers of addiction, research is now investigating the functions involved in addiction, loss of control and the loss of freedom at the physiological level (of the brain) and at the biochemical level that activates all brain systems. These affect the connections between the amygdala, which generates emotional-associative memory, and the hippocampus, where representational-declarative memory is reinforced in the process of consolidation [16]. These two act simultaneously, and while it appears that they are independent of one another, in fact there is constant interaction between them. However the emotional system is always stronger than the representational system, demonstrated by the fact that the nerve fibers which go from the cortical regions to the amygdala are infinitely weaker than those that go from the amygdala to the cortex [17]. Add to that the brain's ability to create chemicals which suppress cortical activity in the prefrontal cortex and the orbital-parietal cortex, which together create logical thinking which oversees and is supposed to restrain emotional activity. Due to the technological capabilities humans have developed, they created conditions which enable these same systems destined to cope with a natural environment (technology-free) to become addicted more easily to almost anything. However, since these are not one-way or binary processes, activation of the different supervisory mechanisms of the brain in a targeted way allows a degree of control via education. But in contrast to Western traditions, which see emotions as negative, or at best a motivational force, a learning perspective must change fundamentally if we understand that emotions are an inseparable component of the learning process, and particularly if we want to nurture creative thinking.

In order for unconscious brain activity to happen at high speed, the messages that are passed to specific regions of the cortex must already be “painted” as unconscious emotions. Direct interaction with the limbic system – the diencephalon – which includes the amygdala and both hippocampi, creates a process in two stages: in the first rapid process the amygdala defines the different activities on a scale from fear to terror and from confidence to arrogance. Without this characterization, there can be no awareness of the automatic response of the brain to different situations; the second process takes place more slowly, since it is affected by the multidimensional interaction created by the complex connections between different cortical regions. In this process, the hippocampi define the emotions in a more focused way

(a range of emotions – impulses – unique), and convert them into conscious feelings, which enables a fast and focused conscious control of feelings, although it is slow in comparison to the expression of feelings on the scale between fear and confidence, with anxiety at one extreme and arrogance at the other.

As mentioned, the two main systems responsible for emotional processing and making us aware of our emotions are the amygdala and the hippocampus, which are often referred to together as the limbic system. Studies, which investigated the addition and extinction of memories, attribute these regions to the formation of memories [18]. As I will show later, memories manifest themselves in the rate and intensity of information flow in the various axons, reducing associative communication as the myelin thickens, thereby increasing cognitive control over emotions. So the amygdala and hippocampus act both to accelerate and to wipe out memories – “memory engines”. These small regions of the brain are not capable of containing all the information received by the brain, and certainly not its processing into conscious and unconscious knowledge.

The main emotion created in the amygdala is the relation between fear and confidence. This is a relative scale affected by the circumstances in which the animal finds itself. Since this may involve multiple variables from multiple sources with conflicting information arriving via the senses, it is impossible to make an accurate risk assessment in the logical sense – a ‘perfect’ causal relationship only in a closed logic system. Therefore at any given moment, the brain has to evaluate the circumstances (feasibility rather than probability) and to constantly update its evaluation. This is the infrastructure for the entire emotional system. Since this involves joint processing of large quantities of infinite information, the brain has to make use of schemas to gather this vast amount of data, based on the ‘principle of negligence’ which omits a lot of information as if it were obvious and expected. This principle is created in reality and leads to the suppression of large quantities of information as ‘irrelevant’ to the event being processed. The result of this is that emotions are necessarily created first and even automatically activate cognitive mechanisms, whose response always comes later, and so initial judgment is carried out by emotions together with intuition and cognition as a basis for the ability to respond to surprising/unexpected situations (unexpected in a scientific – logical way). Only afterwards, if the person consciously desires, and through a large effort, can he activate complex cognitive abilities, which are also more abstract. Through this abstraction, the individual will improve his ability to control his emotions and the ability to create a more deliberate process of intuition. Therefore, the broadening of knowledge will be possible while expanding intuitive abilities through the expansion of learning circles and domains of knowledge, so the Western expectation of “purely logical” thinking is fictitious [19]. Added to that, when we use free will as a secondary motive of brain activity, and not as a result of external stimuli, the associative connections in the brain do not allow absolute awareness and control. This is because associations automatically involve an infinite number of brain variables, which are mostly unconscious. About 70% of brain cells are associative, and randomly stimulate multiple areas of the brain, and activate dormant memories, which continue to be activated. Science currently does not have the intellectual ability or the tools to learn about this communication system. Put simply, science cannot examine how information is processed in the brain, but only its observed results, and certainly cannot access the

associative communication in the brain that drives the entire emotional system, and about which current science remains in the dark.

Humans' ability to independently control emotions and feelings varies according to personal and environmental factors. It is this ability which creates the illusion that impulses and emotions are 'subjective' – arbitrarily, and that cognitive processes are supposedly 'objective' and able to be completely controlled. In reality, thought processes act automatically, and conscious thinking – as well as conscious feelings generated by the cortex – are activated in post-automatic stages. However, the amygdala (which automatically activates the emotional system and cognitive system in the right and left hemispheres) has infinitely greater control over the cortex than vice versa, which explains the difficulty of acting freely and the tendency to addiction. Education is aimed at developing and improving our ability to control these processes, although this control can never be absolute. Only in systems which are completely logic-based, there can be total control, through the creation of an artificial environment; and the more artificial it is, it becomes more detached from reality. In the same way, the more we give in to the automatic processing of the brain, our creative ability fades and brain activity becomes controlled more and more by our own personal brain history – both emotionally and cognitively. The brain works in this way since conscious activity consumes a large amount of resources. The brain therefore tries to regulate these relationships so that a sense of calm is created, which is in contrast to the conditions required for creativity. Small changes are ignored as negligible, but as the changes multiply and get bigger, it becomes necessary to activate the sense of fear, as a warning agent that increases alertness in the thalamus region and from there to the retinal configuration. This is important in order to allocate resources to the processing of new data. So when changes are small and slow the brain can adapt without raising the fear threshold to the highest levels, at which anxiety is produced, although this threshold differs between individuals. It is therefore not surprising that the level of anxiety present in the post-modern society is higher than in traditional societies, although it may appear otherwise, since people are exposed to many frequent changes. These changes have made psychology, psychiatry and dependence on technological applications into flourishing fields which are supposed to save modern humans from existential anxiety.

As described above, the hippocampus is directly connected to all the areas in the cortex characterized as sensorial processing regions – sight, hearing, touch, taste and smell [20]. The connection is bi-directional in that the information received is broken down by signal types and sent to the relevant lobes for information processing. In this way, the hippocampus sends stimuli and receives feedback. The more signals it receives, the more it produces feedback that serves as a constant stimulus for stimuli between processing areas. And since neuronal memory is expressed in the quantity and speed of flow in different neurons, as well as the extent of their wiring, the hippocampus has a central role in the creation and maintenance of memories. In other words, it serves as a kind of motor which stimulates the neurons. This stimulation causes the signals to move at different speeds according to the level of activity of the attracts, which develop in the various lobes, and are specialized in different activities. The longer this activity continues, due to additional stimuli, it activates a process of reinforcement created by the hippocampus, which turns memory in the axons and in the relevant synapses, which communicate together into attracts, from short-term memory to long-term

memory, which is stable [21] to the level of taming. This happens via protein molecules called CREB, which are responsible for switching between the two types of memory [22]. This is an inverse process which removes some information considered irrelevant, and gives priority to 'known' information. Only when information arrives which causes sufficiently strong feelings (a combination of frequency and power), influenced by the neurotransmitter acetylcholine [23], which improves the ability to remember, it will be possible to overcome the effect of the protein as an existing memory conserver, and enabling the transfer of the new information into the overall system of information processing as essentially unconscious knowledge, and only part of it will become conscious knowledge. We can then understand that basic physiological (biochemical) 'memories', which activate the relevant neuronal system more intensively, are retained for a longer time as a memory that characterizes the stability of the physiological system [24] to the level of creating automated habits and taming. In fact, if it is not impaired, it is constantly activated, both in the associative process and as ongoing activity, so physiological memory is more easily converted to long-term memory. In this system too, there are differences which arise from focused training expressed as expertise in the physiological sense: in musicians – the developed sense of hearing and operation of systems including hands, feet, mouth, etc.; in athletes – according to their sport and so on. However, these physiological memories, if they are not activated on a regular basis (referred to as the training regimen), waste and fade like cognitive memories, when we stop using them. Focused training, as well as content memorization, is an artificial (and planned) way of reinforcing memory, similar to automatic reinforcement, seen in savants where some areas of brain communication have been damaged, [25] and prevent creation of divergent thinking. The weakness of 'normal' humans is the need for continuous training or memorization as opposed to daily activity that activates these memories through relevant experiences, emotions and relevant cognitive activity. This process leads to reinforcement of memories through ongoing varied activities, which combine necessary repetitions with the expansion of associative connections that activate connected neuronal systems, which are interwoven with sufficient connections – and produce attracts to the level of taming. So in order to reinforce certain cerebral capabilities, as a condition for improved thinking and functioning, humans must inhibit the automatic processing of the brain, slow it down and take advantage of the processing of contradictory information to change the automatic preferences created by the brain, which are always possible in retrospect – after the automatic processing of the brain, and not in its place. Put simply, the automatic processing of the brain cannot be neutralized, but we can alter the involuntary prioritization which is automatically produced. On the other hand, automatic processing can be reinforced to the level of expertise or taming, which constitutes the main aim of the educational system.

'Spatial memory', an example of complex processing of memory in the brain, is dependent on the ability to simultaneously activate several areas of the brain. Every addition, such as voice, smell, sound and symbolic abstraction, stimulates and stabilizes the spatial memory. Those with a more multidimensional operation in the hippocampus will find this easier, and if necessary secondary stimuli may awaken the imagination, as a prerequisite for creating imagined pictures of the place. These processes are essential for the development of creative thought. The more we activate different areas of the brain, the hippocampi grow and enable

the activation of more connections and the development of a more flexible memory. This process goes counter to the academic system of specialization and focusing on a narrow field to become an expert.

These procedures allow for the creation of finer distinctions between feelings (impulses) and their characterization as emotions, which are the abstraction of feelings. Accordingly we can see the midbrain in general, and the limbic system in particular, as an 'engine' for the activation of the various and unique brain memories. We can see that these systems transform the signals into emotions – impulses (accelerating) on different scales: hedonistic pleasure---masochistic pain; overconfidence---terror; boundless curiosity---emptiness/inanity; depression---ecstatic joy (manic depression); anger---calm; disgust/rejection---affection/attraction; satisfaction---wanting; excitement---indifference. All of these are commonly termed 'inner feelings'. All these scales work together at every event involving conflict or tension, and can be enlisted to exert conscious control over automatic emotional processes. Control over this range is indirect and difficult, requiring complex actions, the components of which are not always easily identifiable. So, for example, in many cases a person may find it difficult to explain what makes them afraid, or why certain things arouse their curiosity, why they are depressed or happy, angry, or why they feel affection or alternatively disgust. Why do they feel satisfaction in some circumstances, and in other situations which may appear similar they feel emptiness. This lack of clarity is because the system works automatically and associatively before conscious thought is involved, forming a unique brain history for each of us. The inability to obtain total control over these systems enables creative and intuitive processes to continue to act, but less and less so as control gets stronger in specific fields. The more a person specializes in a narrow field, their creative ability in that field improves up to a point, but it decreases as the level of expertise reaches the level of automatic brain activity that comes with taming.

Additional emotional abstraction through hippocampal activity turns general emotions into more distinct feelings (conscious impulses). But even these cannot always be explained clearly enough because of the multitude of contradictory information involved in their formation, yet the relationship between the circumstances and their arousal or inhibition is more targeted. This abstraction occurs with the help of activity in specific cortical regions, which specialize in focused information processing, and which convert emotions to more confined feelings, which operate on an internal scale of strength within each emotion, and on a scale of opposing emotions. This is contrary to the approach developed in Western culture which tends to characterize emotions dichotomously as good or bad:

Love---hate; revenge---forgiveness; jealousy---surrender; compassion---cruelty; generosity---greed; courage---cowardice; disappointment---surprise; responsibility---impulsiveness; shame---pride; embarrassment---impertinence; empathy---detachment; admiration---abuse; trust---suspicion; suffering---pleasure; tolerance---selfishness; patience---haste; desperation---hope; humility---arrogance; wonder---pettiness; boredom---activity; passion---control; guilt---renouncement; regret---vanity/arrogance; modesty---ostentation.

We could find more pairs. This pairing of emotions, as an expression of being on a continuous scale, is intended to illustrate the vague boundary between these couples, as well as the idea that

encouragement or restraint of one emotion occurs by encouraging or restraining its emotional opponent. The relationship is in fact much more complicated due to the effect of interaction between the pairs, which arises from the direct, indirect and associative connections between them which the brain as a single system creates. More abstract feelings are created, such as a relative sense of the scale between justice and injustice, fairness and unfairness, credibility and fraud, good and bad, which in different cultures have different and even reversed meanings, which is contrary to the dogmatic Western belief of categorical division between “good” and “bad”. This calls for a moral education completely different to that which has developed in Western culture. In each such activity, the underlying emotions and processes of reinforcement and suppression of the system are involved in the brain’s mesolimbic pathway, which reinforces activity perceived as successful, and this perceptions of success is influenced by different circumstances and a great deal of arbitrariness. So there is no room for binary judgments, as required in logic systems, even though mathematics does not have such a basic possibility, as Kurt Gödel’s theory of incompleteness proves. This lack of possibility allows flexibility of brain processing and humans’ changing responses by the millisecond. Changes are a necessary condition for dealing with surprises where the field of creativity is expressed. This capacity for flexibility can develop if these fields are not systematically relegated with repetitive habits, both on the physiological level, on the emotional level and the abstract level of thought, which are interrelated in their automated processing, created on the basis of mechanisms that enable the cultivation of expertise to the point of taming which suppresses self-learning and creativity.

Golemn presented psychological research which demonstrates that if we artificially activate emotions in different ways, a physiological response appears in the relevant involuntary systems, with concurrent expression in the relevant brain areas [26]. This explains our ability to affect the structure and taming of our emotional responses, and our ability to learn to ‘control’, to the point of suppression, the array of forces that control us, including the removal of unwanted memories [27]. Without this option, there would be no point in education or the discussion of ‘freedom’ and ‘responsibility’ and certainly we would not be able to claim flexibility of brain activity as a condition for creative thinking. However, it should be remembered that these possibilities provide educators with the ability to restrain and suppress the range of forces that spontaneously activate the various emotions, thereby suppressing the associative and creative abilities of the brain – to tame the animal, including humans. It follows that in order for these mechanisms to be effective in changing situations, a mechanism is needed that will create their flexibility of action. This same mechanism would enable them to act at different levels of power (response speed and strength of action) according to the changing circumstances. In order for this flexibility to exist, all human action mechanisms are activated by mutual restraint and relaxation. The more they are operated, their ability to operate – in the long-term – is impaired, and in the end the flexibility of the system is suppressed [28]. Thus, the greater the level of specialization or expertise, the more the capacity for creativity is suppressed. In order for the system not to be suppressed, it is necessary to take a break from the action – to rest. But resting too much leads to wasting of the system. Hence, the system’s ability to operate depends on the ratio between its operation at appropriate and variable doses and breaks in its operation. At one end of the scale, there is an uncontrolled impulse to action, and at the other end this impulse is so suppressed that it can no longer stimulate

action. The effectiveness of the operation of the mechanisms is also dependent on the ability of the system to react at various intensities in accordance with the changing circumstances. If one of the human mechanisms of action – senses, impulses and emotions – is activated at a certain intensity, after a while, a stronger stimulus is required to activate the relevant sense, and consequently the impulses and feelings that accompany it. A lack of stimuli that activate a certain sense will lead to suppression of the impulses and feelings that accompany it. As these processes become more extreme – excessive frequency of the mechanism of operation or activation of excessive power – increases the possibility of addiction. Alternatively, the lack of activation of certain mechanisms will result in their total suppression. The outcome of this process is that we are less and less able to control our mechanisms of activation. Therefore, over-control – characterized by a high level of expertise to the point of addiction, and insufficient control over the content and skills – that characterizes laity, both reduce the brain's flexible processing capacity and creative ability.

2.2. Dendritic trees as a dynamic learning system

On the dendritic trees of the 100 billion neurons in the human brain, there are up to 30,000 dendrites and around 300,000 dendrites on the neurons in the cerebellum, which unify the brain and body into a single system. The structure of the dendritic trees and their way of functioning is the basis which enables the brain's ability to create changes in functioning according to the changing environment, including surprising changes of different strengths, as a necessary condition of survival [29]. In order for this system to truly function flexibly, it must work on the principle of 'weak contradictions' [30], of which the mathematical complexity upon which neurologists base their theory [31] is merely a superficial image. So, for example, there is a defining influence on information processing in the dendritic trees as a result of the structure of its representation as a geometric cone shape, the length and location of the synapses along it through which information arrives from other neurons. This influences the dynamic development and extinction of the spikes that form the surface of the tree [32] on the amount of information the dendritic tree receives from various sources, as a result of the level of connectivity and the hidden complexity of the unique activity within the dendritic tree, which in turn influences the information processing activity of the whole cell, which is critical to understanding brain activity.

Neurologists taking part in the Blue Brain Project decided that it is possible to convert the infinite complexity of the total functions which arise from the special structure of the dendritic trees, designed to deal with millions of conflicting sources of information every fraction of second. In order to propose a mathematical model, they simplified the complex structure of the dendritic trees to a 'pipe' model, in the belief that the level of detail they created would be sufficient. Only Stettiner refers to this conversion in the following words:

For single neurons, there are mathematical models (the best known of which is the Hodgkin-Huxley model, which won the Nobel Prize for Physiology in 1963, which describes the electrical and computational activity in them), but a full and detailed mathematical description of a neural network (made up of a collection of hundreds and thousands of such cells) would require computing resources which are not feasible, and the networks that are currently available for modeling are over-simplified and approximated, as well as disregarding many biological specifications. [33]

In reality the problem is much worse than the technical limitations presented by Stettiner. Attempts to create a mathematical model with information coming from up to 30,000 synapses from conflicting sources every millisecond is an over-simplification which shows neurologists' lack of understanding of learning because they are caught up in the prevailing paradigm of learning whose characteristics I will present below. Harel makes it clear that even a quantum computer would not be able to overcome the limitations of Thesis-Church-Turing. So even if quantum computers were invented, they would not solve the computational obstacles [34]. Thus, he confirms Stettiner's claims, as he explains that computational analysis cannot deal with logical contradictions in principle, which the information processing in the dendritic trees does deal with, and not incidentally. The dendritic trees are not designed to make binary decisions between contradicting information since the information, received in the fraction of a second, cannot be deleted as mistaken (as binary activity would do) because in the next fraction of a second, when information arrives contradicting the previous result, the brain will need the previous information which would have been deleted. Put simply, the way the brain conducts information processing allows it to contain contradictions and not to delete them in a binary fashion. Without this capacity, humans would be unable to survive. Furthermore, the synapses are located at different distances from the cell body, and at different levels of development due to having different histories of activity in each synapse, and so they dictate the quantity of information which passes through them and its power. These synapses are also divided into those that accelerate, around 80%, and those that delay, around 20%, where most of the delaying synapses are found close to the cell body, and can therefore slow down the results of the processing. This prevents the creation of a command to action, and its delay if it turns out that the result of the previous processing is now irrelevant.

This structure allows the brain to process information according to the feasibility principle, which is in contrary to the probability principle on which computers compute their statistical calculations, and through which neurologists assess brain functioning, and psychologists evaluate the range of human behaviors. So, for example, the way in which information processing occurs in the brain allows us to treat one-off events as important for learning in relation to future events, while from a statistical point of view, based on the principle of probability, such a single event would become meaningless in the framework of statistical calculations. Furthermore, no statistical calculation could replicate the processing of information in the human brain that combines a complex number of events with their varying intensity in every fraction of a second. This shows us that information processing in the brain's dendritic trees – or learning – is fundamentally different from statistical processing of information. Statistical analysis of information as a tool to evaluate human behavior was developed based on the fictions of rational-logical man and which Western culture adopted since Plato, turning it into the ultimate desire of modern man. This explains the results of Kahneman's research according to which not only laymen are affected by mistakes, which he referred to as heuristics. From similar studies carried out by experts in statistics and probability, who should have been better able to deal with such errors if the human brain were to process information in a probability manner, it would seem that they failed the tests just as laymen. Richard H Thaler, similar to Kahneman, also received a Nobel Prize on the basis of his theory of the irrational man who makes mistakes in general and regarding economic considerations in particular. In contrast to other researchers, he denies the possibility that humans can function in a

rational-logical way as modern scientific thought developed. In his book he presents humans as falling into the 'heuristic trap' – a rational prison [35], however he does not propose an alternative perspective for the rational man. Thus, the scale of the irrational man he refers to, though unconsciously, is the rational-logical person on which scientific research is based. An understanding of the information processing in the dendritic trees requires renunciation of the perspective of the logical-rational man which science has sanctified, which as I will go on to show, is by definition contrary to the principle of creative humanity.

Moreover, a statistical calculation is aimed at the average and gives a supposedly unequivocal mathematical result, thus losing the information which results from contradictory sources. These contradictory sources are actually processed through biochemical processes that enable the interactive expression of such contradictory information and is unique to each individual according to their own personal brain history in general and of the creative person in particular, when it comes to high levels of creativity. It follows then that no mathematical algorithm, as complex as it may be, is capable of representing it **in principle**. A logical algorithm is incapable of relating simultaneously to conflicting information without making a binary choice choosing between them. Biochemical interactions are able to do this, so the products of a neuron are mediated through biochemical processes in biological (not mechanical) structures that are translated into analog electrical signals rather than digital (monocultural) signals. Many neurologists, and particularly computational experts who work with them, are convinced that this information is superfluous [36], and that it is possible to convert these complex processes into mathematical algorithms without losing significant information. But it is just this conflicting information which is unable to be computed, which creates the special flexibility of the human brain, and therefore gives rise to multiple sources of information coming from different body parts and their representation in the millions of cells in primary brain regions [37], and the secondary relationships that influence and are influenced by interactions of local networks and links between groups to expandable communication systems that act together with associative stimuli. The obvious conclusion is that no mathematical model is capable of representing these infinite and conflicting relationships, which occur in a fraction of a second. No mathematical model which purports to be logical, but which in principle cannot be so, and so has never yet been built, can be logical according to the Gödel's proof of incompleteness [38], to cope with conflicting processes while renouncing the option to decide between them in a binary manner. Despite such a model were built anyway due to the human need to refute the unexpected, it would lose the connection with the complicated and dynamic reality, in our need to be logical, as Godel showed in his theory about the absolute gap between logical structure and reality.

The picture of the contradictory relationships involved in any information processing in a particular neuron is even more complex and dynamic than the complexity involved in processing information in each dendritic tree in the cortex because each neuron in a particular sub-region, known as a cortical column, affects the total activity that occurs in each column. In fact, every neuron in the brain affects the entire brain's activity by means of a vast communication system which the cerebellum creates with all brain areas, and whose connections cannot fully be described here. This creates the possibility that any neuron present in a certain cortical column in a particular subset of the cortex affects the processing of information relevant to a minor subject, and that these linked columns can communicate and influence the overall decision the brain makes the brain's overall information processing. This means

that each specific learning process that the brain automatically generates affects all the learning processes that the brain produces directly or indirectly in a unique historical process for each brain. This is the result of changes taking place in the communication systems that routinely transmit the information processed in each of the billions of dendritic trees involved in information processing – automatic learning. The significance of the meeting of an enormous amount of information from conflicting sources in every particle of each of the billions of dendrites indicates why information that comes from digital electrical signals (spikes) undergoes a transition to chemical interactions converted to analog electrical signals created in the neuron cell fluid rather than through direct electrical transitions between the dendritic trees and the axon that passes the result of automatic learning outcomes as information to the next neurons. This process allows learning which is not deterministic, similar to the way in which computers process information. In fact, this is the transition of information processed by biochemical processing, also unlike the direct (linear) process that electric circuitry produces in artificial systems. Cellular information processing occurs through infinite interactions, which the dendritic trees send regularly and in contrasting ways (accelerating and inhibiting), but in varying doses every millisecond, to the cell body. Although the cell body and its activity are of interest, their contribution to understanding the brain's ability to create flexibility is marginal, and therefore I will not go into greater detail here.

It follows then that no electrical system – either analog or digital – is capable of operating the combined and conflicting processing which occurs so fluently in the dendritic trees, therefore only the chemical structure found in the dendritic trees and in the cell body, enables great flexibility of information processing sent by the thousands of synapses (which differ in power and direction – stimulating and inhibiting) in every fraction of a second without losing the infinite complexity in direct electrical processes. More simply put, the processing of information in each of the billions of dendritic trees in the brain, which contain vast quantities of conflicting and constantly changing information,, all the while processing the contradictions without canceling them in a binary manner, are those which allow the flexibility of information processing in the brain, and thereby **produce the flexible learning potential of the human brain** specifically due to the processing ability of the frontal pre-cortex which is evolutionarily unique in size and strength. No logical, mechanical or mathematical formula could characterize this processing of information without losing huge amounts of data which allows the animal a flexible and creative learning, certainly not at the level at which the human brain is capable of functioning. Therefore, all thinking that claims to be completely logical (this is impossible according to Gödel's proof of incompleteness) with no contradictions, and the abstract models and technological tools upon which science relies, based on the dogmatic assumption that logical thinking and its mathematical and scientific extensions can describe the activity of the human brain and human learning methods, are completely baseless. Even more absurd is the belief that complex, and 'learning' algorithms could replace brain learning while overcoming the problems that the brain makes as a necessary condition for the flexible information processing method that it allows, and especially with the ability to deal with surprising – or unexpected – events, and to propose creative solutions which fundamentally could not be perfect – since a perfectly logical system cannot in principle enable creative learning. Hence the dogmatic claim of mathematicians according to which mathematical

calculations are the basis of all that is important to humans represents the central belief of standard science and rational-logical man, but it is fundamentally wrong based on Gödel's proof of incompleteness. In fact, the things which are most important to us, which make us human and creative, cannot be computed mathematically. First, I will dedicate a section to the importance of subjective markers as an inseparable part of the flexible information processing and creativity specifically, next, I will present the potential for flexibility found in the intracranial communication systems, and the reasons for survival that make the brain itself limit the flexibility and creativity of the human brain.

2.3. Axons and synapses: from flexibility to mental fixation due to specialization and expertise

Communication within the brain between the billions of dendrite trees, each of which process huge quantities of information which is constantly changing, occurs via several interacting systems which allows the transfer of large amounts of information at the same time with a large degree of flexibility. In the previous section, I presented the basic associative communications system, which simultaneously stimulates multiple areas of information processing which are essential for emotional activity as a fast call to action. This associative communication system acts in parallel to the highly branched neuronal communication system, based on axons and synapses, which I call the direct communications system. These two systems of communication – associative and direct – are connected to each other, so that as the direct system grows stronger, or becomes more developed or trained, it reduces communication in the associative system in the specialized area and makes connectivity with other areas more difficult. One unique characteristic of the human brain is the amount of connections between each neuron in the cortex (30,000) which is by far the greatest number among animals. This enables great connectivity within each cortical column, which is an area for specialized processing of specific information, and at the same time enables the creation of more multi-system connections in humans compared to any animal through the neurons in the cerebellum, each of which can absorb about 300,000 data sources per fraction of a second and transfer the results to all areas of the brain. This means that all the dendritic trees in the human brain can receive every millisecond a much larger amount of information from conflicting sources than can any other animal. It is this multiplicity of conflicting encounters that allows the human brain to learn more flexibly than any other animal. Even more importantly, the abundance of connections gives humans a creative capacity at a level that no other animal possesses. This is because the multiplicity of connectivity connects vast amounts of emotional (primary and strong) and cognitive information (secondary and reinforced), which is an expression of the amount of information that turns all the information in the brain into a single processing system. The direct information processing system will be presented briefly below.

The emotional system is what makes the mirror neurons in the brain capable of imagination, and because of the amount of connected information in the human brain at every fraction of a second, the human imagination is incomparably greater than that of any other animal. Moreover, because learning always occurs when new information is received that contradicts the results of previous brain processing, the human brain, because of the greatest development

of the cortex in general and the forebrain in particular, is a logical control system for the emotional system, thus creating a contradictory collision of information that does not exist in any other animal. This collision of contradictions is unique to human beings, combined with the unique imaginative capacity of humans, and is what allows creative potential at such high levels not found in any other animal. The level of brain flexibility in humans is the most flexible of all animals to allow for creative ability that is the product of surprising connections designed to cope with situations so unpredictable that no other animal could cope with them. The level of brain flexibility, including in humans, decreases as the brain specializes as a result of the strengthening of the direct communication system at the expense of the associative communication system. This means that each specialization produces a more focused response system than those created through the associative communication system. As a result, the elasticity of data processing is reduced in those dendritic trees that are activated triggered by the same process of specialization. Thus, the more specialized the brain is in a limited field, the communication systems that operate for information processing in the dendritic trees intended for that narrow area will lose the flexibility of transferring information within them, thus providing the same dendritic trees with information similar to previous information received by the brain, which will lead to reduced information processing flexibility to the point of closing communication channels with other areas of the brain. In other words, specialization leads to tightening certain brain connections at the expense of flexible/associative connectivity with other brain regions. This process has obvious survival benefits that allow the animal to move as quickly as possible from a brain that learns flexibly to a specialized brain capable of coping with its current environment with increasing efficiency. This means that survival requirements cause the brain to begin its coping as a flexible system, as a necessary condition for its ability to exist in different and changing environments, but the brain will diminish its brain-flexing capabilities as it succeeds in existing with increasing efficiency in its habitat. The brain will do everything in its power to move from a flexible learning mode to fast, unconscious, automatic processes of operation that are characteristic of high levels of specialization/expertise similar to taming mode. In these automatic situations, the brain invests little energy in the unconscious processing of vast amounts of information, which as it becomes more automatic (unconscious), the learning process is reduced or even muted to zero. This endangers the animal when it encounters highly unpredictable changes. When events are more expected, the brain does not require learning that requires it to invest large amounts of energy by removing information that is slightly contradictory to brain expectations. This creates a lack of response to changes in general and especially to unpredictable changes, accompanied by a feeling of insecurity and anxiety associated with situations that are uncertain. As I will show later, Western culture, by sanctifying logical connections (expected connections that are supposed to be deterministic) as if they are the expression of a “true reality” free of error, has made specialization the pinnacle of Western culture. Therefore, in the Western education system, most effort is invested in memorization to artificially accelerate the stage of specialization at the expense of shortening the learning stage in general and creative learning in particular.

Direct wires (brain connections) are formed by the axons, which at the beginning of their operation enable flexible but more stable connections than the connections created by the

associative communication system that drives emotions and feelings. The intuitive communication system is affected by electromagnetic fields generated in areas of increased electrical activity in the brain in the direct communication systems. As stated above, the stronger direct communication becomes as a result of specialization, it reduces the other communication systems until they become meaningless for other areas of specialization because of the reduction of associative-connectivity with other brain regions. Mechanisms for reducing flexibility work so that the more an axon and/or group of axons are activated, the greater the amount of data transmitted and power at the expense of connectivity with other brain regions. The levels of information transfer in the axon are enormous, and can be described quite schematically on the following scale: starting with a **minimum activity** of one spike per second – which causes the axon to degenerate and stop transmitting information (a reversible process made possible by the creation of a new axon); through **sparse activity** – that allows for a small amount of information to be transferred. The level of randomness is high, and expertise is weak; and up to a **maximum level of activity** (up to billions of activations with increasing frequency), which causes an axon group to operate automatically, and even reaches a level of activity characteristic of overpowering and addictive specialization. When you reach the high levels of information transfer in certain axons, information transfer becomes increasingly uncontrollable even when the conscious activity of the brain arises in an attempt to restrain or inhibit the activity. An extreme example of this is autism, which is an expression of impairment in emotional communication, and Alzheimer's as an expression of impairment in motor communication. The brain's degree of flexibility and creative processing capacity lies in the range between great levels of information transfer and too much data transmission activity. Quantitative measures cannot be produced for the terms "great" and "too many," because they are relative to the different subjects and to each person's unique brain history.

In order for an axon to be able to transmit information on such a wide scale of flexibility – from deterioration to addiction – it must have a modified configuration, influenced by the activity generated within it and its biochemical and electrical environment. The axon is connected to the cell from which it receives the information that is processed in the dendritic tree. This connection is called an axon hillock, which collects the cell processing processes and transmits information by means of an electrical signal that has a common code for all the electrical signals in the brain, called a spike. The electric signal, as a potential for action, is created only if the processing of the information coming from many conflicting sources accumulates into sufficient biochemical action so that it is converted into an electrical signal that is passed on to another 30,000 neurons. The axon is built in the form of a cylinder with a central axis (the word 'axon', which is taken from Greek, expresses exactly the combination of a cylinder and an axis), and the electrical signals move in liquid. The pipe itself is made of a membrane encased in myelin, and the myelin is fragmented at regular intervals called the nodes of Ranvier. These spaces allow complex biochemical interactions with fluid found outside the axon. It is not necessary here to detail the structures and materials involved in this process, but to point out that their purpose is to ensure that the electric signal is always moving in one direction and with the same intensity throughout the axon and its extensions that connect to other nerve cells. The axon structure is such that it allows flexible reception in terms of data transfer speed, which changes the amount of information passing through the

axon. This elasticity varies from axon to axon depending on the number of nerve impulses per second that pass through it, called Rate Code, and their rate of appearance per second Temporal Code. The number of nerve impulses is affected by the amount of information of the same type that the senses pass for brain processing. The speed of transmission per second allows for a growing amount of the same information to pass through the axon. The combination of these is the neural code that characterizes the uniqueness of the data in one axon compared with the rest of the axons, and each unique combination transmits a command to a particular activity, which characterizes the different types of information that pass through each axon. This means that when an action order is generated for a particular area of the brain and/or for physiological activity in the body, it is the result of a meeting of tens of thousands of axons each with their own specific neural impulses, both in quantity and in the rate of their appearance.

As the processing of information in the axon multiplies, the myelin wrap changes and thickens the axon tube, and as it thickens, the axon tube becomes increasingly insulated from external interference created by the electromagnetic field that arises in that area due to increased electrical activity. As a result, as the wires become more insulated, they transmit the signals at a higher speed, and the faster the speed, the greater the amount and frequency of the signals, causing the myelin to thicken. In fact, there is an interaction here between the amount of flow of electrical signals in the axon tube and their velocity and the formation of myelin, and so forth. This means that as more information of a particular type is processed in the brain, making the owner of the brain an expert in a given field by repeated engagement in a particular activity and/or via deliberate memorization, the relevant axons thicken and create a preference for this information type over information coming from other sources. This thickening reduces external electromagnetic interference, but also reduces the activation of the associative communication system. This is the process that makes it possible to tame animals, including humans, and in this respect, there is no difference between them. This is because electrical signals are actually electromagnetic interference. However, the electrical signals moving inside the axons will be less disturbed as the myelin in them thickens and reduces the Ranvier intervals, which will reduce the interference resulting from activity outside the axons, especially the electromagnetic interference generated by millions of axons in their ongoing activity. Electromagnetic interference and their effect on the brain can be studied using transcranial magnetic stimulation (TMS), a machine which produces an electromagnetic field outside the skull that can paralyze specific areas of activity in the brain.

As a result of the myelin thickening process, which insulates the specific axon, the electrical signals within the more insulated axons will move more rapidly, so that the relative effect of the friction within the membrane fluid will decrease. Disturbances within the membrane are created by the fact that the electricity generated in the dendritic tree, which has not matured into a spike (the signal strength of the inhibitors is greater than the force of the impulses), must be released through the axon so that it creates electrical interference perceived as 'electric noise'. This means that competition is created between the spike transmitted by the axon and the electrical noise that passes through the same axon. The results of the specialization/taming of a particular axon array increases the amount and intensity of signals that come to certain dendrites as a result of the preference generated for the reception of certain

information (which it has become specialized in processing). This reduces the possibility that contradictory/inhibitory information will reach specialized/tamed dendrites. So, spikes will be more easily produced in those dendritic trees which will reduce the electrical activity that did not mature into spikes, so the speed and intensity of the spikes will keep increasing. As a result, the inhibitory electrical energy will decrease, which will result in decreased disturbances/noise within expert or tamed axons. The range of these changes will affect the areas of increased information processing because it gives preference compared to other areas of processing in the brain where less information is processed, even though they produce stronger electromagnetic fields than other areas of activity.

To sum up the interaction between flexibility and specialization/expertise, the relationship between extracellular electromagnetic activity and intracellular electrothermal activity, which has matured into spikes, will change in favor of an increased flow of spikes and at the same time the electromagnetic disturbances within the axon resulting from information processing in the dendritic tree that did not mature into spikes (information which will pass to the following neurons) will decrease. Information passing to the next neurons will be reduced. This process reduces the elasticity of information transmission in areas where it is highly active (e.g., areas of high brain activity in experts) because of the myelin thickening in the same brain area and the reduction of inhibition of contradictory information that can be processed in dendritic trees specialized to the point of taming. This process leads to the fact that the relative weight of nerve cells that are frequently activated in the dendritic trees to which they transmit information increases – both in areas of specialization in the cerebral cortex and in relevant dendritic trees in the cerebellum. This is because neurons in the cerebellum are linked to many areas of the cortex, allocating more resources to those regions as they specialize until the person becomes a well-trained – or in other words ‘well-tamed’ – expert. At this stage the activity in that area becomes more and more automated, less conscious and therefore less controlled. In this state, brain activity requires less energy, but it also reduces its ability to change – for learning in general and creativity in particular.

This is how expertise is formed, as the brain gives preference to specific brain activity over other brain activities. This can be demonstrated through all types of physical, cognitive or mental activity. The brain areas which create and send commands to the relevant muscles in a musician, who practises playing his instrument for many hours, will thicken, and simultaneously those muscles will become more developed compared to other muscle groups. It follows that the hand muscles and fingers of a professional piano player will be far more developed than a professional footballer, who will have much more developed leg muscles. Of course, there are exceptions who invest enough effort to become experts in both fields. This example can be applied primarily to topics that are mainly emotional, such as religious belief (or any type of belief), artistic specialization, etc., **where logical abilities are minimally involved as inhibitors; with less intensity in cognitive fields**, in which a more balanced competition is created between emotional and logical capabilities; however, emotional abilities still dominate. The least intense competition between emotional and logical abilities occurs in subjects where expertise develops in different disciplines where scientific pretensions attempt to impose logical abilities to the extent of negating emotional capacities, perceived as disruptive to scientific understanding. The differences would of course be huge between

someone who has specialized in a certain field compared to someone who has not. As logical capabilities take over emotional capabilities via training/practice, which can take years, so the expert becomes more and more autistic (emotional capacities become suppressed) to a level close to autism, where the autistic person is incapable of activating the emotions required in order to understand reality, particularly social reality. These differences are expressed in the thickening of myelin in certain areas of the brain, which are exposed more to a specific type of information compared to other types of information; if it concerns information with dominant emotional content the person can become fanatical or addicted to the subject. In the same way, if the information has dominant logical content, the individual will become more autistic in their particular field, up to the point of being socially inept due to attempts to control emotions with logic. Most people are creative at a low level sufficient to cope with daily life since their emotional capabilities remain dominant. In contrast, creativity at high levels becomes less prevalent due to the need to combine high levels of logical abilities, which as mentioned impairs the automatic process of emotional and logical integration. Mainly because of the control of logic over emotions, the latter of which activate associative connections, imagination and intuition. As these abilities fade, the creative ability of the brain is diminished.

The process described above, regarding the decrease of flexibility in the brain due to strengthening of the direct communications system, also affects the degree of flexibility of information processing in the dendritic trees. The flexibility of the brain stems mainly from the fact that a command is created as a result of the relative weight (quantity and strength) of millions of sources of information, some of which support one another while others contradict each other, which are mostly charged with conflicting emotional abilities, and their emotional strength is stronger than the logical strength. The relative weight of the supporting and contradictory nerve impulses can change every fraction of a second, thus responding to the enormous amount of information that a reality full of contradictions provides to the brain. This is not a matter of binary decisions, but of the decisions taken by the relative weighing of the amount and intensity of information that reaches millions to billions of dendrites every millisecond simultaneously, and which process the same information and are constantly changing its relative weight. The more a person specializes in a particular field, the more he reduces his ability for flexible processing (adaptation to conflicting information) by the dendritic trees which process similar information, as a result of a preference created for the same type of information over other types, which therefore reduce conflicting forces and more easily create electric signals which support previous decisions. This is a result of the fact that information is prioritized in which the emotional contradictions are reduced as a result of the increasing control of the logical abilities over emotional abilities. This means that the acceleration of direct communication created by changes in the axons and synapses, which I will describe next, comes at the expense of reduced associative communication, which impairs the ability to activate the imagination and intuition and causes a continuous decline in the elasticity of brain processing in the dendritic trees, and consequently the brain's creative abilities. It should be remembered that the acceleration of direct communication is intensified not only as a result of the deliberate specialization that developed in human culture in general and in the West in particular – which reduces the flexibility of processing information in dendritic trees – but first and foremost as a result of the continuous experience of life in the same

existential and social environment, which leads to over-thickening of axons where the flow of information is reinforced as they are more activated. This process creates a unique brain history for each person, which influences the direction of his brain processing to the point of expertise and taming.

The process in which axon connections are loose at the start of activity (they degenerate if they are not activated) and become tight connections with different neurons to which information is passed, involves the synapses. The Greek origin of the word expresses its function as a **connector** between the axon and around 30,000 dendritic trees of the subsequent neurons, to which it passes information. The structure of the synapse is such that one part forms the end of the axon, and the second part forms the entrance to the dendrite tree of the next neuron. On the axon side of the synapse, there are axon bulbs with different types of neurotransmitters which excite or inhibit the transmission of information, and on the dendrite side of the synapse there are receivers – each of which can receive a particular type of neurotransmitter which causes excitement or inhibition of the information transmission. Between these two parts is a gap called the synaptic cleft. When the activity of both parts of the synapse is repeated, these connections are interpreted as essential, and are therefore reinforced and stabilized through reducing the gap so that information can travel faster and in a more stable way [39]. Every transfer of accumulated information is interpreted as a success via a signal back toward the dendrites, called ‘hand shaking’. As more series of nerve impulses are generated on the receiving end, the synapse receives more ‘hand shakes’, which move the synapse backwards reducing the gap and so making the transmission more efficient. This occurs as the returning signals multiply, and they cause the receptors to converge to the side of the synapse margin on the dendritic side and to approach the bulbs storing transmitters on the axon side of the synapse. Thus, a large number of neural conductors are used in any future electric signal that passes through the axon. This increases information transfer between the two sides of the synapse. As a result, the impact of synapses on the creation of information preferences in the next dendritic trees is intensified by the accumulation of connections that results from a large number of synapses working simultaneously, up to 100, or many more if at the same time inhibitory signals are applied. Add to this the constant change in the number of connections, caused by the creation of new synapses and the disconnection of others, this physiological flexibility [40] as preliminary potential decreases as the transition in some synapses becomes more efficient and more easily overcomes the electromagnetic disturbance created in the fluid (exocytosis) found inside the axon. This process affects short-term memory, and if the situation is maintained for a long period, may also affect long-term memory [41], combined with the ‘passive flow’ (minimum flow which exists even when there is no information transfer – one nerve impulse to the next) in the axon tube. If the number of ‘hand shakes’ decreases, this affects short-term memory first, both by preventing the formation of long-term memory and in the slow decay of the long-term memory created and by the weakening and disconnection of the bond between the two sides of the synapse. Each synapse is connected via a spine, a small bump (measured in nano-millimeters) through which the synapse connects to the dendritic tree. Even if a synapse comes from a particular axon which has degenerated, and in its place a new synapse has been created which connects new ports to another neuron, the spine maintains the strength of the memory that characterizes the receiving neuron. This

creates additional flexibility based on a change in the order of priorities between the various types of information as a result of the provision of new information and learning, which gives preference to certain information over the previous information to the level of expertise and taming through deliberate practice.

Axons which do not find new connections over time, and so become weak and degenerate, reduce the potential for information processing of the whole group of neurons wired together, which process information together, although in imaging it appears as a disorganized interaction not logically or linearly understood. Wiring between groups of neurons produces complex memories represented by expanding wires, the activity of which can become stronger or weaken in different doses, which affect the intensity of memories. In long-term processes, memories that activate very wide circuits can become stronger or weaker in varying doses. For example, even an expert who has not worked for many years in his field of expertise, who clearly has long-term memories stored in his brain, will find it difficult to function at the same level as when he was active in the field of expertise – both with regard to the volume of memories, and their power and accessibility. From this we can learn about the importance of the synapses for memory and learning and their level of flexibility [42], as those responsible for completing the process of creating and transferring information via the axons.

3. Fundamentals of Western thinking which lead to indoctrination and taming

We can learn about Western culture's relationship with learning from its attitudes to the unexpected [43], through the word 'unlikely', one of the meanings of which is unexpected or unlooked-for. The Merriam Webster dictionary gives two definitions. The first is described thus: 'not likely – used to say that something probably **will not** happen or is not true'. This definition suggests something that is not expected to happen, and therefore is not right/true.

The second definition is described in the following words: '*always used before a noun*: not seeming to be right or suited for a purpose'.

The meaning of this definition is that there is an expected or desired outcome and anything which is unexpected becomes 'not right/true or 'not suitable'. The beginning of this approach in Western culture was Plato's idea that in the face of an unexpected world which humans must cope with we can discover a perfect world where everything is expected, freeing humans from the terror of uncertainty. Plato invented the perfected 'logos' world, where everything works as expected, so those who discover such a world in its entirety would be able to accurately predict the 'real' or 'proper' future. This would allow a person (not any person but a philosopher who could see all the ideas in a perfect logos world) to completely distinguish between 'truth' and 'lie', 'good' and 'bad', and in modern terms, between '0' and '1'. This would allow him to predict the perfect future accurately. Plato's student Aristotle adopted his idea, but instead of a logos world and his theory of recollection, he proposed that the 'perfect'

or 'true' world is hidden inside the world we know. The problem of humans is that they do not discover the 'true' world – the 'objective' world – due to human weaknesses which arise from our subjective abilities, such as emotions, imagination, associations (random connections) and intuitions (imprecise estimates). While Aristotle believed that these attributes are important in daily life to cope with reality at a level he called 'phronesis', he argued that if one is careful to activate his logical abilities and simultaneously neutralize his subjective abilities, he will succeed by means of logical thinking to rise from the stage of 'phronesis' to the stage of 'sophia'. A stage at which the "objective" world – the "real"/"perfect" world – will be revealed, allowing him to distinguish between what is "real" and what is "false," and hence a distinction between what is "good" and what is "bad", a necessary condition to fully discover the 'truth' hidden within reality. Put simply, logic, for which he laid down the foundations, will allow a person to accurately predict the "real" future from the unexpected future, and only those who are strict in thinking logically can reach the 'knowledge of truth'.

In light of this, it is not surprising that logic was based on the assumption – which in 1930 turned out to be dogmatic – that "deterministic consistency" is a necessary condition for the "truth" of logic, which will necessarily lead to the discovery of 'true' reality. Accordingly, Western culture established the perception that whatever is unexpected is also undesirable, when the ultimate human desire is to achieve certainty, so concepts which express uncertainty are termed 'unlikely'. Since this involves what we 'like' and what we desire, like translates into 'want', 'wish' 'will', and these are supposed to 'please' us – which is also the common courtesy word in English (i.e., intended to please people). When we combine the meaning of 'like', as an expression of what we desire, to 'unlikely', which expresses the feeling that accompanies people in unexpected situations, it is clear that humans relate to unexpectedness as a negative state, that the brain accompanies with fear and anxiety.

Because learning occurs only in situations of uncertainty, where the unexpected is greater than the expected, we can understand the negative attitude of humans to learning, and the attempt to extricate themselves from this situation through training, which is supposed to lead the person as soon as possible from a state of uncertainty (more unexpected than expected) into a state of certainty, in which the "real" future can be accurately predicted and the unexpected – the "false" – which is improbable – can be avoided. As a result, the attitude toward learning in Western culture developed so that a minority are able to learn – to lead to the "truth" (philosophical or scientific) – and the rest will engage in imitation and practice of the "real" learning outcomes 'discovered' by the few.

Practice, in the Western approach to learning, has become the main focus of students in the education system, from nursery to university. As we know, little time is devoted to the learning stage – coping with the unknown, which is accompanied by a feeling of uncertainty and fear – which is in fact an imitation and not learning in the sense that I refer to learning. In contrast, the vast majority of 'learning time' is dedicated to training to improve memorization, which is really one step away from taming. So, in fact Western educational systems are mainly involved with taming rather than learning. A result of this trend is that the outcome or solution becomes the main point, especially if it is achieved quickly. Speed of finding the solution, in which most time is invested in Western educational systems at all ages, is achieved

through artificial practice and training using methods that train the brain to react as quickly as possible. This is of course at the expense of developing learning abilities and specifically creativity in different and diverse ways. While in some languages there is no difference between taming of animals and training of people, in English there are two distinct concepts, one for animals (taming) and one for people (training). This artificial distinction is meant to hide the fact that it refers to the same process whether for people or other animals. As we can learn from the structure of the brain and its activity, there is no difference between humans and animals regarding the changes which occur in the brain as a result of taming. With regard to the functions of the brain this is the process which causes thickening of specific axons and reduces the gap in the relevant synapses, which suppresses the ability to process information in the dendritic trees. This leads to suppression of associative abilities of the same brain region, and the ability for associative communication with other brain regions. A process which as it becomes more powerful, leads to expertise and additional reinforcement levels for taming. When we look at synonyms of the word “teach” they are: tame, train, acquire knowledge, learn, repeat, instruct, direct, show and other words that have little to do with leaning. In fact, the word ‘teach’ is not incidental in this context. A train consists of carriages – *students*, led by the engine – *professor*, – and at the different stations – *nursery, school, university*, they take on board cargo which the teachers/professors decide are important. The head engine is represented by the minority of professors who ‘reveal’ new knowledge – *additional stations where more information is loaded on the carriage/students* – when they believe that the rails on which they are traveling – *logical thinking and the tools formed on this foundation* – will lead to the final station – ‘the truth’ – either philosophical or scientific.

This culture of supposed ‘learning’ was developed on the basis of assumptions dating back 2500 years, and it continues to dominate Western educational systems today. This despite their coming to be seen as dogmatic in 1930 when Werner Heisenberg’s uncertainty principle was published, which brought to the forefront Aristotle’s assumption about the world being built on foundations of logic, that if we just stick to logical thinking, and develop scientific tools using logical methods, scientific ‘truth’ will be revealed. Which will once and for all remove uncertainty, and allow people to march consistently into the “real”/“perfect” future. In the same year, Kurt Gödel published his theory of incompleteness (he subsequently published two more theories of equal importance) according to which mathematics, which until then was considered completely logical, and also confirms the findings of science (was therefore termed ‘the queen of sciences’), was proposed to be a system which is not perfectly logical. His proof makes it clear that there will always be mathematical theorems that cannot be proven, making it impossible to decide whether they are “true” or “false.” This is not a temporary situation but a matter of principle. These two theories are sufficient to reverse all the assumptions on which the development of Western learning was based into a fundamentally refutable and dogmatic approach similar to the dogmas of monotheistic religions. Nevertheless, scientists have been going on in the same way for almost a century, as if nothing had happened in the scientific world. This is for two main reasons: the first would require all “scientists” to fundamentally change their modes of thinking and how they use the tools they developed. This is intolerable to the human brain, and to scientists who have invested their entire careers in this approach. The second reason for ignoring the implications of the

principle of uncertainty and the principle of incompleteness, is that the academic world in general and science in particular, which led to enormous successes in matters important to the human race, reached a hegemonic status. Like anyone who reaches hegemonic status, there is no chance that he will agree to give up his status to a new generation of educated people who will re-invent science [44]. Moreover, as the research on brain information processing activity has shown in the previous sections, the belief that a person can be “objective” is fundamentally unsubstantiated. As a result, Kant’s mighty enterprise to prove the existence of a rational-logical man has finally collapsed. His attempt to prove the feasibility of synthetic – a priori theory to refute David Hume’s argument that logic is a human product based on cognitive habits has finally failed. Not only is his proof based on dogmatic assumptions about science (a posteriori), and not only because of his inconsistency in relying on metaphysical philosophical assumptions (a priori), for which Kant’s most important research characterizes him as “more dogmatic than Descartes” [45]. The principle of feasibility according to which the brain processes information, and the processing of the brain’s automatic information before a person becomes aware of the results of that processing, puts an end to the person’s ability to free himself completely from uncertainty and to be rational-logical as modernity expects him to. This puts above all else the assumptions and beliefs on which the perception of Western learning/training was based as leading people to finally be saved from the unexpected if they would only learn according to the training system that developed in the West.

4. Conclusions

The main conclusions to arise from this discussion are that in order to adapt to the environment in which it will be born into, the animal brain must meet reality equipped with the highest level of flexibility. For the same survival reasons, it must be capable of automatic learning of the ever-changing reality. In reality, the world overwhelms the senses with an infinite amount of information in every fraction of a second, which directed or aware learning would significantly slow down the rate of processing compared to automatic learning. At this stage, through automatic learning, the brain suppresses the vast majority of the information that floods it through its representative use of the brain’s ability to create basic patterns which are then complemented through information already stored in the brain unconsciously. In this way the brain does not need to make an effort every time to convert all the information to brain information, flexibility enables the brain to avoid having to remember entire knowledge schemas but rather builds them again every nanosecond. This allows changing knowledge in the brain on an ongoing basis. This mode of activity allows the brain not to have to process all the information it receives every time, or even most of it. The more new information resembles information that was previously received, the brain will take it for granted as if it were exactly the same. This creates efficiency of attention to similar information, which requires a high investment of energy to relate to the difference from the ‘known’ information. Automatic learning shortens the process, as a necessary condition for the brain to turn to new learning, and especially to creative learning in which the unexpected (uncertain) information is far greater than in new learning in which the expected level is high.

In light of these things learning situations created competition between curiosity (the need to know) and the fears that accompany uncertainty which the need to know awakens. So, the brain naturally acts to move past the learning stage as fast as possible by creating a reasonable solution (satisfactory but never perfect) as if this is the only possible solution. This reinforces the sense of security as long as the solution that is obtained enables the animal to survive. As long as the brain successfully manages to deal with reality, the solution becomes an automatic solution through the “reward” that neurotransmitters give to successes that are never perfect, despite the illusion that they are. That is, the brain does not have to work hard to provide a new solution. On the other hand, neurotransmitters give “punishment” for failures that the brain cannot ignore even if they are repressed. Only when the solution fails drastically, or it leads to repeated failures, does the brain become aware and consciously activate learning abilities. However, learning is very slow and therefore in survival conditions it poses an existential danger. Each state of learning activates all of the brain’s abilities, of which the most dominant are emotional abilities, imagination and intuition via the associative communication system. At the same time, learning activates the critical/judgmental skills, which always involve emotional and logical criticism – combined automatically – and yet we remain unaware of most of the information even at the conscious stage of learning. Conscious learning, which, as mentioned above is very slow, makes it possible to increase the weight of logical abilities in the learning process.

Western culture, out of a dogmatic belief that dates back to Plato and Aristotle, adopted the assumption that logical thinking without emotions is possible, allowing the avoidance of mistakes by inventing an ideal, fictional reality (the true reality) which is supposedly completely logical. The discovery of this reality, which dogmatically was assumed with certainty to exist, will enable us to anticipate the future by eliminating its uncertainty. Understanding how the brain enables information processing that enables learning – coping with a changing world – cancels the possibility that the human brain could be capable of processing information in a purely logical way. On the contrary, the more a person specializes in a particular field, the brain becomes more and more autistic – complex social contexts are damaged as social circles expand. In fact, not only does the brain not process information purely according to logical rules, it does not even process information according to probabilistic rules, but according to the principle of feasibility. According to this principle, a statistically insignificant variable can be crucial in an existential sense because the brain is designed to deal first and foremost with immediate existential dangers in which a small detail can become critical. The brain therefore creates judgments that necessarily combine emotional abilities and logical abilities, and these are created automatically. A conscious judgment that tries to be more logical (it is never purely logical) is always applied in retrospect. The existential reason for the human brain working in this way stems from its inability to rely on the exclusivity of conscious logical thinking. This is both because it neuters our understanding of reality, and because conscious learning is very slow compared to the natural automatic learning of the brain. In terms of existence, humans would not survive if they had relied only on their logical abilities, even under conditions of accelerated technological developments, and certainly before the development of technology over the last century. Werner Heisenberg’s uncertainty principle makes it clear that the world in which we live is not only highly contingent, but also fundamentally full of uncertainty. Kurt Gödel’s incompleteness theorem makes it clear that we cannot create logical tools that will allow us to explain the whole of reality in a “perfect” way, and this inability is not temporary but rather fundamental. Humans will need their creative abilities in the future no less than in the past, but these abilities have been neglected.

As technology evolves, humans will increasingly need their creative abilities precisely because technology will perform essential activities more efficiently than the human brain. But this is not the main reason, and the main problem stems from the fact that as technology develops, especially since Galileo's use of the telescope, the level of uncertainty for the human race is only growing. Therefore, without developing man's creative potential, humanity will fade away. This decline will accelerate if democracy continues to develop based on the foundations of Western consciousness that sanctified logic, because the increased cultivation of logical abilities comes at the expense of cultivating emotional and creative capacities, which are essential in preventing the majority of people from becoming technicians whose autistic characteristics grow stronger and stronger, and their flexible learning skills become more and more limited until it is impossible [46]. In such a culture, the democratic consciousness of many is flawed even though they live in democratic administrations.

In light of all of this, the defining features of Western learning – which is largely concerned with training – must be fundamentally changed, and the sooner the better. The question is, how do we change the concepts of teaching so that learning becomes the main focus, and taming takes a back seat? Which will lead to a change in the modes of thinking required for an era in which creative thinking is the lifeblood. Learning that will turn people more and more into self-learners who can independently assess the world, and reduce their dependence on others to manage their thoughts through demagoguery, “scientific” information overload and providing rituals and applications for every aspect of their life. The way in which we can encourage and nurture such learning is discussed elsewhere [2].

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