Volume II

Kinematics of the Brain Activities

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Volume II

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Contents

Preface

The second volume of the book aims to model the mentation process in a kinematical macro scale basis. It is believed that brain activities need to be quantified in mass and then be checked with experiments. To quantify that, a macro scale modeling is required. A kinematic model seems to be suitable for meeting such a requirement. A comprehensive model is not available to be founded for kinematic studies. Therefore, there is no other way to build a part of model on basis of assumptions and claims which still are not a powerful experimental evidence for them. However, this can be a starting point that either integrity of studies would approve assumptions and claims or assumptions and claims would be replaced by more contingent ones and kinematic studies would be modified.

Looking at neuron groups which are communicating in clouds and considering the fact that there are some differences in degree of freedom for such masses in groups either in substrate, pathway or layer level, compared to individual neurons firings, enable us to have an easier picture to follow what is happening in brain. It is hoped that there will be a great opportunity to comment and develop the model in this book. This is an introduction to calculate the macro scale dynamic parameters and to check it against experimental measures.

However, this is an introduction to a methodology that can open new front for future works in parallel to the works already going on.

The same order of subjects which was used and explained in volume one preface is followed in this volume.

Introduction

Present descriptive models for brain behavior and mentation activities are concentrated to study synchronized neurons firings and the established circuits in the brain. However, in this book, it is believed that concentrating on such micro scale levels cannot answer many of the brain functions. Synapses, axons, fibers and fiber networks configuration and their tiny moves around each other and other tissues play an important role in figuring the brain functions. In utter extremes, it can be said that nineteenth century believe in correlation between folds on the brain surface and the brain functions are to some extent valid, but folds as parameters should be extended to the very deep curvatures in any layers section of the brain and folds are the end products of accumulation of detail changes in curvatures, which the only available space for them is on the brain surface.

In this volume mentation is used to convey:

- Unconscious processes, like reflexive and basic behaviors,
- Subconscious processes, like inspiration, feeling and automatic thoughts,
- Conscious processes, like sensation and intentional thinking ,
- Super conscious processes, like analytical works and decision-making ,

Products or byproducts of these processes are like: reflexive and basic actions, symbolic behavior, perception, action, analysis, decision or new knowledge.

The chapters in volume II are organized according to the brain structural levels of: components of a substrate, substrate, location-continued pathways, time-continued pathways, brain layers and the brain as a whole, guiding the readers to smoothly follow and understand the proposed model on a macro-scale level of structure. Related terms which will be used through this volume are given in other columns as follows.

Energy particle	Component	Curvature	Field	Structure	Mentation type	Acting forces	State	Memory type	Size	
Firing clouds	synapses		Ion channels sizes & distribution	Molecular structures	function	(Energy density)	Physical state	*Plastic memories (instincts)*		
eddy	fibres	Fine curls	Em-fields	**sub-substrate**	Energy flow	spot forces	unconscious	Long term memories (years)	Fine amplitudes	
pockets	Fibres net	Intermediate curvatures	Integrated em-fields	substrates	Facts and events	Random stress forces	subconsciou s	Short term memories (months)	Small amplitudes	
chains	String nets	Layer curvatures and folds	Sectional stress fields	layer	Individual concepts	Layer stress forces	conscious	Short term memories (hours)	Large amplitudes	
networks	Complex net	curvature patterns	Cross sectional stress fields	brain	Social concepts	Brain stress forces	Super conscious	Working memories (seconds)	Very large amplitudes	

In chapter one, general description of model is presented. In chapter two substrate components for free energy flow is practiced for basic dynamic analysis. In chapter three flow of energy pockets are detailed. In a mentation, different substrates or pathways in different layers can be involved which is the subject in chapter four. In chapter five, impact of mentations in layer level are explained. In chapter six environment impacts on mentation are reviewed and finally, appendixes provide complementary information to some sections.

Chapter One: General

A Brief Description of Reflection and Mapping of Outside on-Goings over the Brain

Outside world facts and events are mapped over the brain in two forms of temporary changes for on-time mapping and permanent deformations for reference archives. Temporary changes are the result of viscoelastic property of brain media and input energies which introduce stress forces and temporary deformation on fibers and tissues. Permanent changes are added by consolidation of remained and confined energies in interval stages in substrates. Temporary changes are discussed as continuous dynamic behavior of brain. Physical consolidation happens in NREM, in form of permanent changes and it is a quick deformation of configuration to a balance condition and therefore instead of longer story-like scenarios of dreams during REM, in these periods quick deformations cause a hypnologic image, a fleeting and isolated thought fragment to appear. Accordingly, sleep-related-mentations are not only dreams, but also other kind of mentations. In REM periods, by gradual release of energy through the layers, geometrical balancing adjustment proceeds over the layers. Accordingly all sleep related mentations including: dreams, ongoing ruminations and verbalizations are products of those balancing adjustments. Regulated patterns of simultaneous and structured firings are a reflection of geometry changes of either temporary or permanent fiber routes.

Newly born fine curls in consolidation periods grow with a similar shape to pathway pattern consisting of potentially promoted substrates with added confined energy when were involved in a mentation. They follow the same shape regeneration rules which are followed by reproduction of many species in nature or fractals in chaotic patterns.

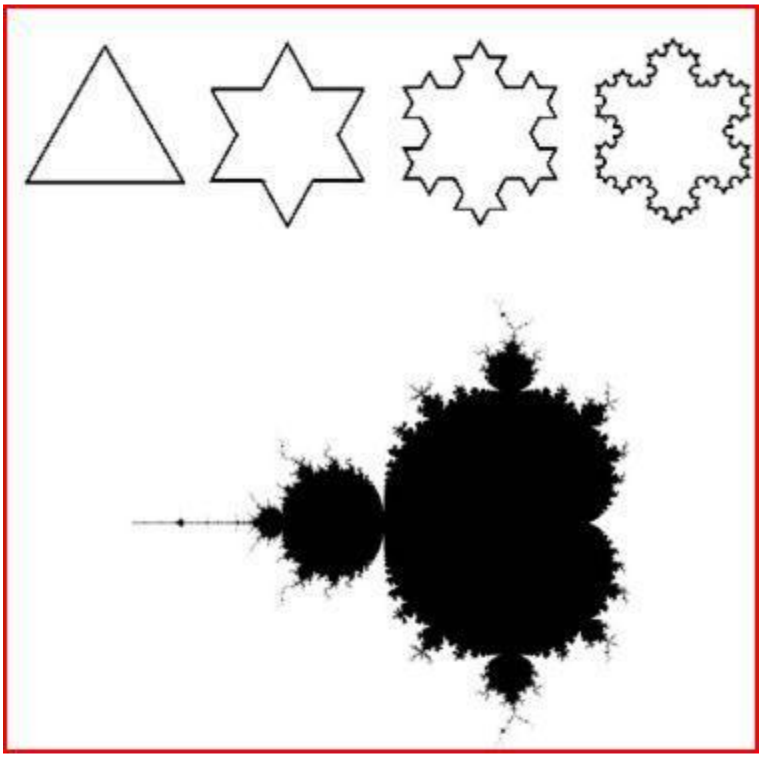


Fig001-A simple curl reproduction, when overall consolidated pattern is remained almost the same

These kind of memories, against temporary type of memories which are the result of simple spring-like behavior of neuron-networks (fibers) extension and contraction, make permanent type of memories.

Outside facts are interpreted by these deformations which are demonstrated as pattern maps. Mapped patterns of different periods interact together, producing more complicated patterns which initiate more advance actions rather straight reflexes.

Each historical interpreted map fixed by new geometrical structure becomes an inhibition or an attractor source of energy to influence new patterns which are forming shapes by new incoming energy flow. A set of attractors which geometrically are configured in a region alter the individual functioning of attractors into an integrated new complicated attractor. Further to this unification in geometrical way which is a kind of attractor unification, current interaction of coming energy, especially in front lobe, flows through pathway substrates and produce more complicated pattern waves of mentation products, like advanced decisions, delights and understandings.

Because of fine building integrating functions, integration properties are higher in the middle brain rather than inner brain and higher in outer layer and far higher in front lobe in comparison with previous areas.

The three different layers of curls and curvatures in three levels of "substrate components" (the local networks), "substrates" (the activated small world networks) and "activity feature" (the activated global brain network), build three types of very fluid, fluidizing and solid moment inertial structures which generate and transfer kinetic energy pockets over the outer brain layers. The highest random velocity of energy pockets transfer through the level of "substrate components", in comparison with the integrative substrate and layer levels.

However, since brain is a chaotic media for energy transfers, the energy fractals which are created in component level of substrate due to very high random velocity vectors, become less energetic in later two other levels in sequence. In other words, if the whole layer behave as functional operator, intermediate level of substrates functions as a connecting pathway for flowing energy and neural level of layer as the place for signal production to output. Highest inertial energy is flowing in the whole layer. Inputs enter in "substrate component" level as synchronized firings, interacting through all levels and outputs exit from neuron level again; when the energy pattern during interactions vertically through the whole layer is release to relax the layer. On other hand, the timely direction of energy flow is determined by the energy transferring toward the output zone in a discrete time frame changes. Generally, any mentation has **two sensing components of space and time** in it, which is independent from outside actual space and time measures and they are made by energy flowing directions of 1) finest curl level of sensory upward and 2) time frame changes from very tiny energy transfer forward. It will be discussed that time frames are related to physical property of a layer and the related area.

Model Basis

A free energy pocket consists of numerous neurons with almost simultaneous locked in phase firings as a pattern. Intermediate energy pockets are the elements which are flowing from an initiation point towards product/s, through an average path route.

The entire brain layers are covered by different kinds of potential substrates; although each kind has its own functionality character. Having fiber-tissue network in a substrate, reacting synchronized together and demonstrating an eddy of energy in mind gives a good picture of a dynamic pattern of group of firings in a substrate.

Mass of synchronized firings in an electrical current, which goes through convexes and concaves of axon and synapses networks, produces tiny magnetic field by direction changes in current. The field pockets impose forces on covered areas that do not exceed a substrate. The imposed forces carry an energy pocket which tries to change substrate net of fibers configuration.

The involved parameters in mentation can be summarized as follows:

1) Substrates' geometry,
2) Intensity of electrical current of synchronized firings, which changes along the pathway,
3) Flow of induced energy pockets as force field over the substrates fibers.
4) Absorption of induced energy in shape of confined energy, deforming configuration, chemistry and intermolecular changes.

The energy, assigned to geometry, including chemical, firing and neurons nutrition when the substrate is not excited is ground energy and when excited is potential energy.

The energy assigned to the flow of magnetic field energies in pockets and their corresponding induced momentum transfer can be considered as kinematics energy. Each energy-pocket, either positive or negative, is related to integrated force on substrate geometry. If the force is effective enough to change the geometry, it would change the firing density because of change in spark channel gate size and distribution as well.

Potential energy is attached to substrate while the kinematics energy flows substrate to substrate along a pathway.

The kinematics energy in addition to locally-continuous-flow is transferred between same or multiple frequency far-substrates by resonance as well. The latter interaction is called attraction.

The ground energy facilitates all kind of functions, including long and short term memories, influences in current mentations and genetic behaviors like instincts. A memory is outcome of excitation of a specific substrate or a specific combination of substrates which have saved a pattern of similar fact, event or procedural, if a free substrate was stimulated by similar input at present and every condition was maintained as before. Of course, change of efficiencies at two different periods is to be considered.

Mentation process is a sequence of local interchange between operating patterns of energy pockets with procedural functions in order to establish a new balance in a substrate, having memories and other attractors as boundary limits for interactions. The balancing approach will be achieved by means of absorption of a portion of reacting energy in range of local elasticity properties and transfer of excess of that to other substrates.

The elasticity properties are referred to three levels of overall layer elasticity, substrate elasticity and fiber-tissue elasticity. Accordingly, energies can be absorbed in three different levels making general character, long and short term memories and plastic changes like instincts.

During active waking because of input energies, there is an excess of kinematical energy over any substrate that is to be absorbed as confined energy.

During the sleep, there is an excess of potential in the form of confined energy that is to be converted into kinematic energy and released. Input energy is absent due to input channels blockage. Release of that is somehow connected to memory of input sources of confined energy, presenting subconscious thoughts or dreaming which is cored by those inputs.

Substrates work as media for interactions are not free substrates, but specialized by saving a fact, event or function, while some components of substrates (as genes) are acting as catalyst for interactions.

Mentation products, in parallel to being sent by motor signals, will be located as small changes in their ground energy contents or configurations. Therefore, they can become a temporary or permanent component of local curvature of a location.

Interactions may occur in different types of parallel, series, complex and independent pathways. In case of independent interaction type, normally one of routes, depending on how energetic it is, is dominant. Dominancy depends on interchanging rates and degree of reinforcing attractors. Mentation with higher rate and reinforcing attractors is the one that overrides the others.

If any mentation would be considered from higher ending to lower potential energy state in a pathway, then there are several minor potential hills and valleys of substrate levels in between.

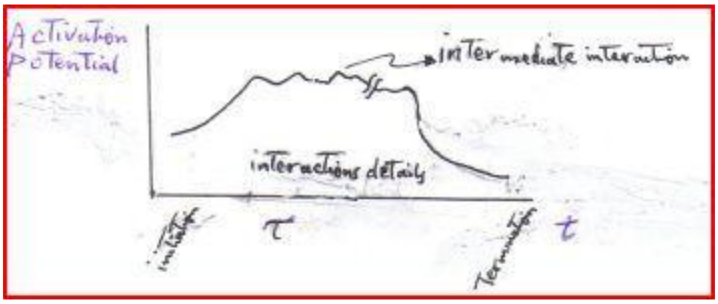


Figure 002: intermediate potential changes between an initial and final states of an interaction

If any hill and valley unit in a pathway would be mapped as a saddle, then any substrate and any pathway may be predicted by its stability approach. The stability approach is the state all kinematic energy is converted to potential.

In this study: 1) energy flow and interaction through and with substrate structure, which is made by past experiences with similar inputs, will be explained. 2) Decay in substrates and deactivation of them, which make normal mentation to stop, will be discussed. 3) Regeneration of the brain during sleep will be followed and 4) Finally, the state of mentation on the basis of mentation kinematics parameters, like rate, pathway bond width, firing density and inhibitory properties against degree of curliness of its substrates will be discussed. This latter information enables us to define a mean pathway for a mentation.

Mentation Process

Mentation process is a chain of interactions, consisting of:

1) Initiation: formation of an active intermediate eddies in fine curvatures of a substrate.
2) Chain transfer: interaction of an active intermediate with others or product/s to produce another active intermediates, developing the pattern through substrates.
3) Termination: deactivation of the active intermediates, ending in a clear pattern of pathway.

An energy eddy consists of numerous firing neurons that have exactly the same activity time and by that they are segregated from other eddies. Segregation is not absolute and degree of segregation defines how much they overlap each other. It is a function of the variance of its firings durations (synchrony probably) and variance of substrate frame time (frequency). For ranges that a substrate preserves a recognized synchronized firings, it maintains its identity[1].

Flow of eddies, as momentum elements creators, impose force field over transferring pathway.

Accordingly, mentation is a chain of eddy interactions that grow all along a pathway with an infinitive tiny frame time sequences. Interaction will be in three level of components of substrate, substrate and layer levels.

[1] Please refer to simultaneous firing simulation section

Number of growing eddies in a pathway process is a function of the pathway mean activity time and standard deviation of its mean path.

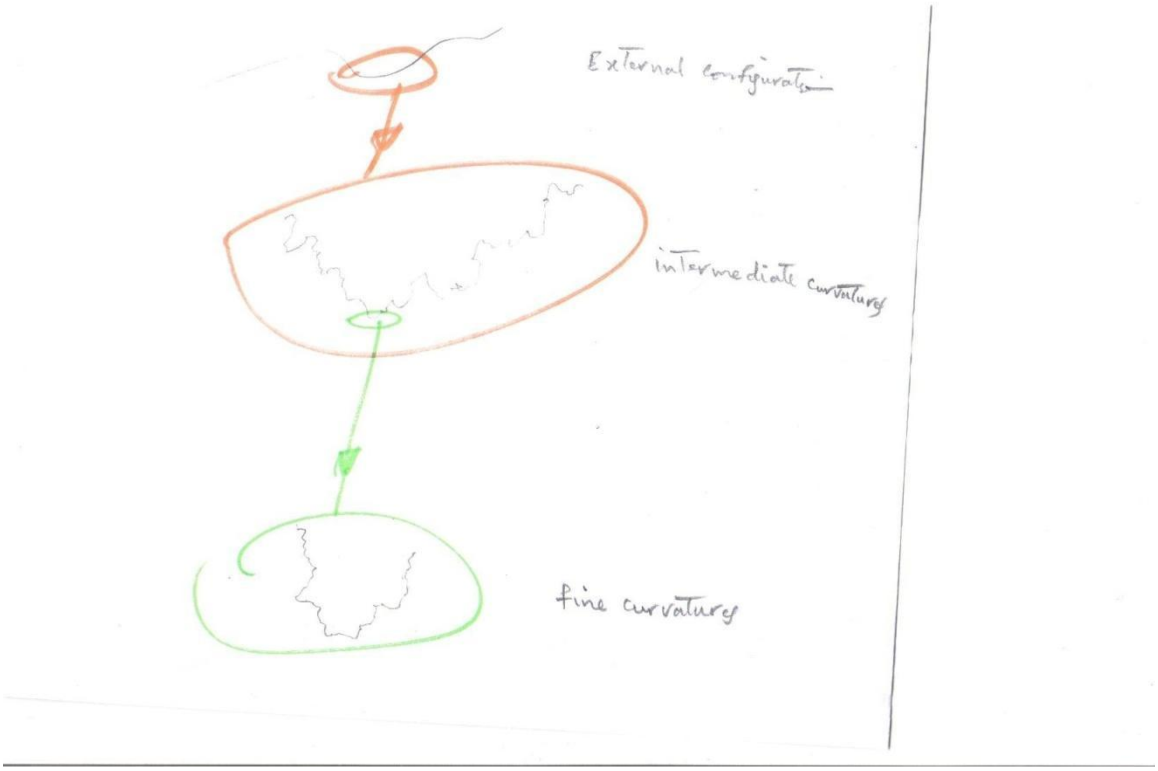


Figure 003: curvature in three levels of sub-substrate, substrate and layer

Mentation from Dynamic Point of View

In any place, if the firing density is considered as through-input, then synapses geometry pattern is an indication of functional operator on the location. Fibers become solid in structure and make substrate functional specialty by time. Most solidified portion of synapses geometry patterns is very obvious as folds in brain surfaces. Folds have found such a condition of plasticity during a long history of evolution. The phenomena of increasing in folds also happen during individual life period in minor scale. This phenomenon is due to accumulation of fine curvature increases by daily consolidation of memories made by daily events for a person. Although such developments are fluctuating and changing during life but some of the long term stable folds might be genetically transferred from parents to children. Functional areas are coded with curvatures of synapses layers for more stable geometry. However, the temporary curvatures which fluctuate in different intervals determine secondary functions to process the current inputs.

Depending on time scale, these temporary changes in fiber curvatures or in other words, substrate’s functionality are categorized as working, short and long term changes in potential lines through the layer, as instant responses or behaviors moods. These categories show the way normally a person behaves in time frames of immediate, days, months and years intervals which are related to working, short term and long term memories.

The complex pattern of potential curve lines, reflecting condensed standing portion of pathway, would be mapped as memory of that experience which guides the later related judgments as referred cases. Individual memories will be integrated as procedural functions or central pattern generations. Patterns of longer term memories are potentials for moods, habits, character or personality. These potential changes occur in long term, for instance in decades.

If in current of new information which is in the form of free energy, an excited memory does not confirm or satisfy the location functions, then it interacts with the substrates, imposing emotional (anxiety) stress on them and physically trying to change the curvature on the location. It means people have freedom to either adopt them to what subconsciously they believe or to become aware of the conflict and modify their substrate specialty by training. When the worrying stress sources are gone, like leaving the place which excites the memory, imposing forces disappear as well. The initiation for flowing energy might be external (during waking) or internal (during not-focused waking, relaxation, snapping or sleeping). However, internal stimulus as recall of memories is a major source of the initiations, either as free recall or attended recall.

The long term potential curvatures may unfold due to new stresses imposed by shocks or physical injury or even repeated opposite experiences. Childhood stress-made curvatures which are accompanying brain growth remain more stable.

Change in Degree of Freedom

Changing the frame for energy flow from fine curvature substrates to intermediate level and then layer level accompanies with change in degree of freedom. The number of geometric dimensions will be reduced significantly by transfer from substrate components level to substrate level itself. If the degree of freedom is defined as set of variables which are independent, then by such a transfer to substrate level and higher, there would be much more freedom rather than exact neurons' firings. Therefore, energy pocket flows in pathways are much free from their media than individual spikes. It is said that flow ability is increased so that it can be called as a spirit.

Different Mentations, Different States of the Mind

Sensory input which act as active energy pocket intermediates start to flow in fine curvature of substrates. They have interactions with potential hills and valleys in different levels, developing a pattern of pathway made of substrates which during the process of interaction would be conversely affected and distorted. When all transferring kinetic energy is absorbed in pathway, the energy transfer is terminated and a product pattern is completed. Intermediate patterns are developed by experiencing dynamic and kinematic states with variety of interaction rates through pathway.

Finally, it will shape in a pseudo- static condition. Pseudo- static pattern product/s will ignite motor outputs either for an action or are presented, after a modulation process, in symbols to communicate. In parallel, a small portion of pseudo- static pattern energy will be absorbed in substrate's component level as its memory saving in the following processes.

Better mixing with highest random velocities with inputs in level of substrate components increase the conscious level so that the feedbacks in all input dimensions would be checked either internally or externally. Since feedbacks are ahead of pathway terminations, then a mentation consists of several pathways, utilizing past inputs (memories), present inputs (incoming sensory inputs) and future (reasoning possible pathways conclusions). Higher number of inputs and wider time frames conclude more conscious thoughts. Finally, the production depends on converging, parallel or diverging tendency of pathways and can be one, many or none. Therefore, consciousness of a mentation increases by higher chaotic state influenced with more number of inputs and more number of attractors. Especially, environment actual and possible feedbacks are very essential. Influencing feedback simulates the pathway for possible alternatives of substrate and substrate's components. In other words, the same frequency bound pathways in layer level provides wider substrates distributions. Similarly, the same substrate finds a range of components activity distributions. Motor outputs depend on how integration of all dynamic patterns would settle in one or none or several equilibrium points.

Number of dimensions is very high in substrate's component level rather than substrate level and obviously rather than layer level. As an ultimate, naturally any flow follows shortest time and shortest pathway to reach an equilibrium position. Therefore, a mentation should happen in shortest time and shortest length of pathways on the layer. It means that substrates with highest interacting rates and generally transmitting energy flow in forwarding direction, are to build the pathways, but pathways with shorter time frame and length are selected. Any following pathway is discriminated from the previous one for more feedback inputs. Similarly, within a substrate, most effective components with catalytic sites will interact. In short, shorter frame time and shorter length (which introduce geometrical dimensions) and energy exchanging rate are critical parameters. In addition to these parameters, number and strength of attractors and sensory inputs are other influencers in interaction dynamics. There is an index which combines all these parameters and indicates millstones in mentation state changes. In these milestones, sensation, feeling, running of automatic thoughts and thinking regions are distinguished (Refer to “Change of Mentation State”). Obviously, related states of non-consciousness, sub-consciousness, consciousness and super-consciousness are minding modes for corresponding mentations.

Chapter One

Saddle Bricks

Considering that a potential plan is made of hills, valleys and flat surfaces and a saddle is a combination of all those shapes, then any layer, for its potential energy can be demonstrated by assembling of saddle bricks. Saddle shape is most realistic geometry to demonstrate any interaction, transfer and production over a substrate by having stable, semi stable and unstable conditions during a movement over it. Geometrically, an elastic saddle, after any deformation, will be reshaped in order to approach more stable configuration, which most probably would be its original shape. If timeframe does not allow for a final stability, the configuration is an intermediate structure. By travelling energy pockets through a substrate, both substrate and energy pocket will find a change in geometry which is a configuration neither of original substrate structure nor of original energy pocket shape. While there is a continuous of energy travel through a substrate, its configuration fluctuates continuously and in the same way energy pockets, which are travelled through it, find change in identity.

Saddle shape can be considered in different scale to cover a substrate or a region carrying a pathway. In any case, input, simulation, interaction and transmission of energy flow undergo a challenge with local geometry of substrate. Resulting configuration changes can be demonstrated in a saddle coordination, however for convenience, substrate structure is assumed as saddle itself. Any energy pocket in order to enter a saddle should have sufficient kinetic energy to overcome its hills even if its product settles in lower potential point of valleys. Energy consumed to reshape the saddle is a confined energy and because of elasticity by release of the confined energy during relaxation, it returns back almost to origin shape. Actually returning to original shape is not complete and a part of energy is trapped. With accumulation of trapped energies, returning to overall origin shape is possible by addition of some fine curls in curvature. As a result, saddle of substrate transmits and confines energy and then releases confined energy in daily intervals while digests a part of that by fine curls in its overall configuration. These are the ways a viscoelastic saddle part of brain can undergo to keep its identity. A saddle approaching to retain the equilibrium condition of its geometrical energy: 1) in substrate scale, guides a kind of interaction; 2) in region scale, directs pathways and 3) in layer scale, makes moods and characteristic behaviors.

When interactions due to frame time are not complete, a mean path defines the curl lines. The time frames of substrate interactions are in scale of milliseconds; and time frame of substrate components of substrate can be determined by velocity of sparks of 1 to 100 meters per second and are in scale of microseconds. Substrate components changing velocity is a random and fluctuating velocity around average velocity of energy travelling through bulk of substrates which should be in term of few meters per second.

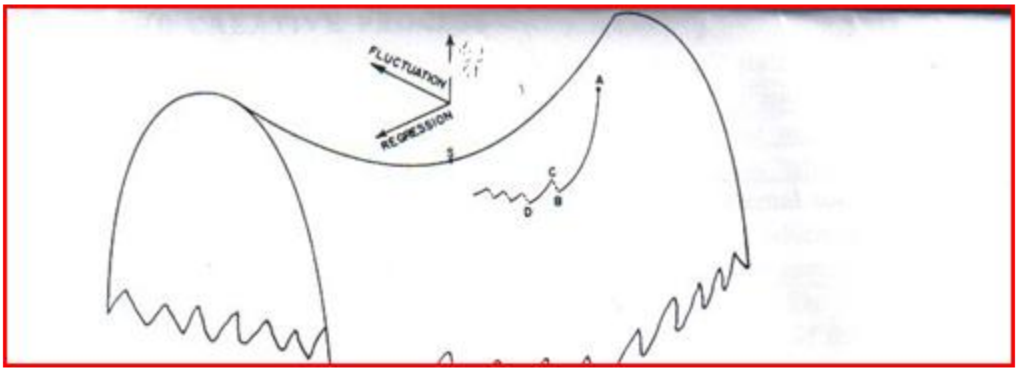
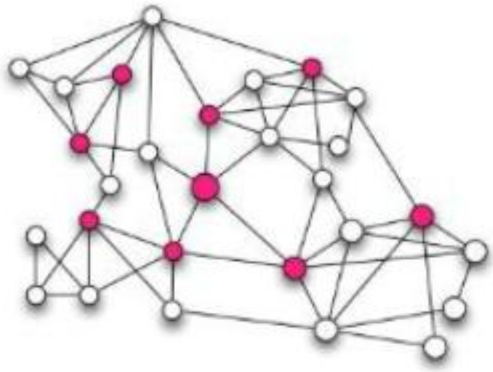
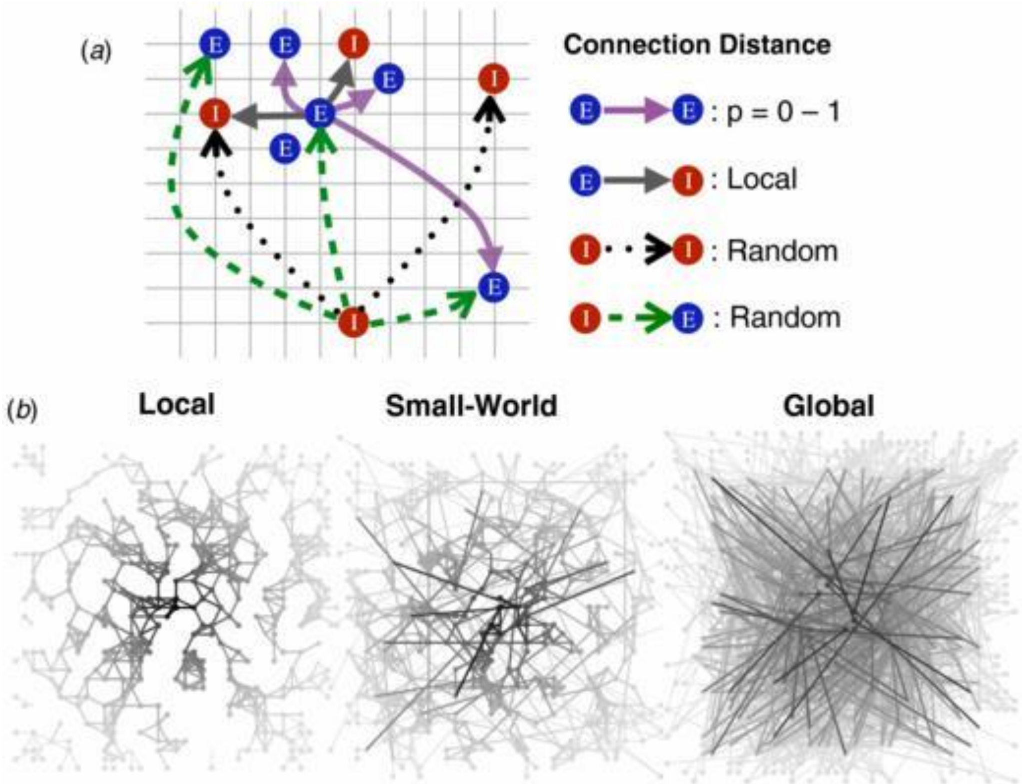


Figure 004: a saddle and different condition of stability over it

Neural network Substrate types: Local, Small World and Brain Global





Correlation between Kinetic Energy and Moment of Inertia in a neural network substrate; when it is exposed to an imposing stress force

Kinetic Energy

The kinetic energy in a neural network substrate can be expressed as $E_s = 1/2\ I\ \omega 2$, where:

1. E_s = substrate kinetic energy (erg, micron*micrograms)
2. I = moment of inertia (microgram* micron2, microgram*microns2)
3. ω = angular straining frequency (1/s)

Moment of Inertia

Moment of inertia quantifies the reconfiguration inertia of a neural network and can be expressed as I = k m r2, where

1. k = inertial constant - depends on the shape of the active neural network substrate;
2. m = network plasticity (micro-grams) r = equivalent radius (microns)
3. Inertial constants (k) of different types of networks depends on the neurons as the network component and network intensity; the layer that the network is part of it (for the local networks); as well as the confined (residual strains) loaded the network; like a fresh network ; heavily loaded by strain residuals, but uniform loaded over the network; semi-loaded network with residuals; network with circular sections; semi-circular; irregular; circular with one-side branching; circular with opposite side branching; network with rectangular section. The magnitudes of k are relative and to be corrected by experience by time.

Activation Curve for a Substrate

Activation is a state that entering energy pocket overcomes minimum required energy to initiate interaction and by that the substrate internal energy increases in order to lose present configuration of energy pocket and new established configuration would be more stable with lower potential energy than initiating energy. Except reflexive cases, it is not a one-step interaction and consists of several intermediate states to approach the final partially stable condition.

It is similar to activation energy for a chemical reaction which is required to break present bonds and form new bonds with lower potential level. If the difference of output and input integrants potential energies are converted to heat or mechanical energies, the difference potential energies for an energy pocket between entering and outgoing through a substrate will be converted to its kinematic energy to overcome next adjacent or far substrate required activation energy to enter and a part of that will be accumulated as confined energy.

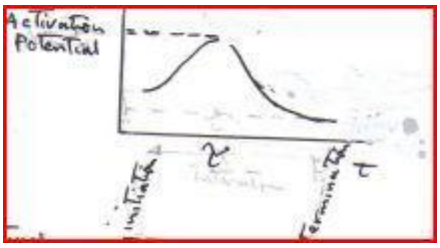


Figure 005: activation energy and input-output potential energy difference

Because a substrate is made of several synapses and axons in mesh, activation energy for a substrate should be a combination of these figures in a matrix way, when for a spark, action potential energy rises from rest potential (for about 100 milli-volts) and (after about 0.5 milli-seconds), it drops to lower than the rest potential.

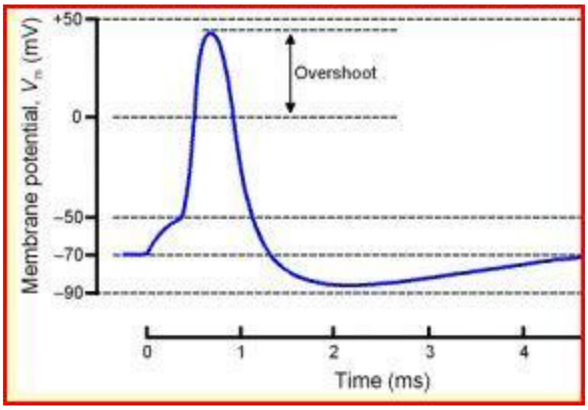


Figure 006: Typical activation potential for a spark

Energy Pocket Build Up, Inducing Electromagnetic Forces on Substrate Fibers

As it was discussed, in volume one of the book, any string of simultaneous firings, as an electrical current, flows through fibers, when the current have frequent changes in its route direction. The produced electromagnetic field induces forces on fibers themselves to redirect them and consequently make energy pockets which are the source of stress on pathways. By buildup of energy pockets and resulting stress function, it acts as a force function to form the substrate topology in a new shape. By consumption of force function energy, em-field will die out, substituting with new em-fields created by new incoming inputs.

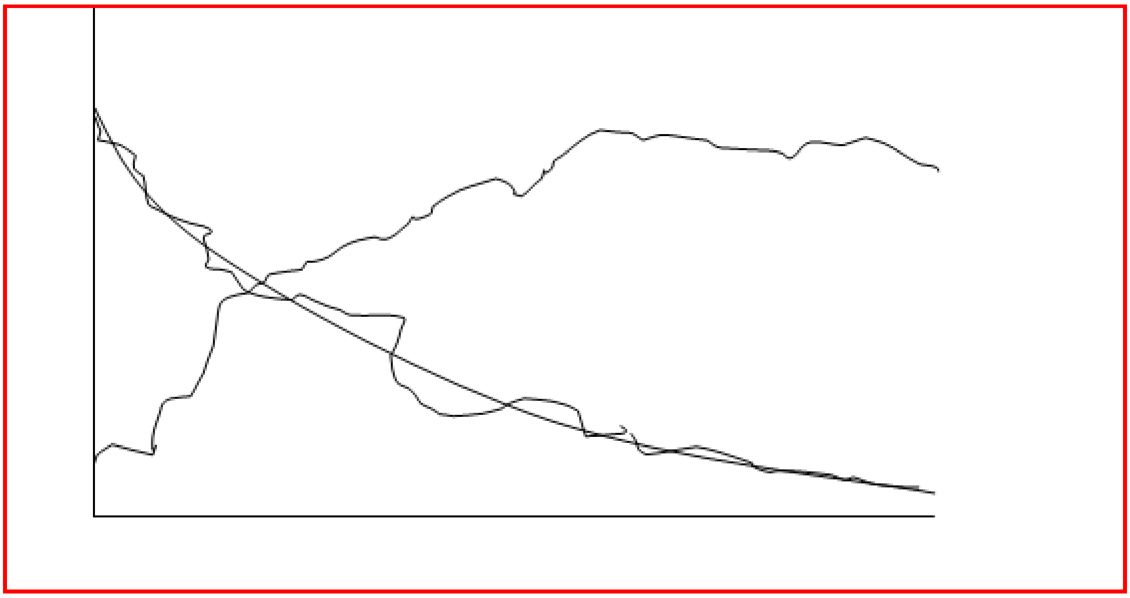


Figure 007: Electromagnetic field would decay by converting its energy to create a stress function formation.

The stress function includes the following periodic elements:

1) Stress inducing phase,

2) Inducing-absorbing balance

3) Stress-relieving phase

All these stages build a fluctuating phase for the substrate position. A phase in the substrate stress oscillating includes creation and decay of involved e.m. fields. Frequency of oscillation within substrates depending on layer structure and physical properties is different for different layers and regions. For example, the frequency of substrates oscillation in outer layer is between 30 to 80 hertz and in front lobe up to 140 hertz and more, while frequency of coupling between energy pockets is 3 to 7.

The time frame for each substrate is about 100 to 400 msec. Variations in any phase involve ground and geometrical changes as standing part of the wave and kinematical changes which accompany the energy transfer as moving part of the wave.

Any substrate, when exposed to stress, changes in strain according to layer strain-stress characteristics. When stress approaches the plasticity range, it experiences a pseudo-plastic character of fibers which damps new stresses up to an incipient point.

At this stage, a pocket of energy in shape of stress will desorbs from the substrate to the next substrate in the pathway.

Kinematics of the Forced and Free functioning of the Brain

(An introduction to the theory of "Kinematics of the Brain Activities")

Introduction

- Viscoelastic tissues stress-straining curves, when the tissues are exposed to a stress load, demonstrate stress-rising; and when the stress source is removed, demonstrate stress falling.

- In the first stage, stress rises up to a turning point of the climax.

- Down the climax point, falling stress stage starts and it continues up to the point that the energy absorbed by the viscoelastic fibers would be removed and a dynamic balance between stress absorption and desorption would be approached. That stage will be the termination point remarked as the general response to the stress load.

The above rising and falling trend is the simplest possible response to arrive in a new homeostatic balance position for the exposed viscoelastic fibers. However, the response generally is composed of different shorter stages of periodic stress-rising-falling shape with a degree of complexity in its pattern. Accordingly, deformed shape of connectivity in networks approach one or several balancing states.

The area under the two overall curves of rising stress and falling stress indicates a lost energy; either as a confined energy or deformation in shape of new connectivity forming in the networks structure of the fibers.

Rising/ falling- stress periods for brain fibers

Responses to a stress input can be categorized based on the time lags they have from the exposing time: 1) reflective, when the response would follow immediately. 2) delayed response, when it goes under further processes. In any case, the rising period is the stage that a network substrate receive, prepare and react the stress information; and the falling period is the stage that prepare, record and reflect the response. The first stage is a forced stage; and the second stage is a free stage, reacting under internal (will) forces.

- What makes the forced period of brain functioning segregated than free functioning, is the degree that the executive part of the brain (frontal lobe) delays the respond to be integrated or counterchecked with additional fibers stress-straining. The higher the frontal involvement; the stronger the stress loading complexity. Consequently, the general stress-rising curve would be a complex combination of the finer stress-rising/ falling periods; although the overall trend will be stress rising.

- Similarly, the functioning of the brain during the free functioning is a combination of the finer stress-falling/ rising periods; although the overall trend will be stress rising.

Connecting the electrochemical property of the brain neural networks to their stress-straining property

- "Stress" has a dimension of force per acting area (F/A); when "strain" is dimensionless indicating the ratio of changes in length (after imposing the stress force) per the length (before imposing the stress force) (l/l.)

- In a coordination of stress versus strain, the “stress*strain“ area under the two curves of rising and falling stress (which indicates the consumed energy) is a multiplication of stress magnitude and the resulting strains (F/A*l/l.=(F*l)/(A*l.)); while, F*l is the moment of force associated to a substrate of volume A*l.

- The force (F) is the Lorentz force created by the electromagnetic force; as the result of synchronized firings (F= q(Electric field)+(velocity of q charges*magnetic field). Because the second term is relatively zero, then F=q*Electric field; when q is the mass of sparks that fire together.

- By increasing the firings synchrony in a network, the electric charge (q) will increase proportionally

- In the other hand, the fibers straining causes that sparks to be synchronized. So, firing synchrony is proportional to the tissues straining which make a mass of synapses in a neural network to be situated in a required cleft distance to fire together. The stronger the stress force; the larger the straining substrate.

- In short, the synchronized firings develop as a function of straining effect; when wider synchrony itself causes larger force to strain wider field. These two opposite phenomena of " increasing stress to increase strain " and "decreasing strain to remove stress" set the two opposite trends of stress-rising and stress-falling, as well as setting a balancing limit between the two opposite trends. The phenomena of "rising and falling of stress" forces during a unit of brain activity will be discussed in a separate section. These trends depend on the rate and power of synchronized firings in any location, showing as below:

1. $\partial q/ \partial t$ ampere (I)= ∂straining/ ∂t

2. $\partial I/ \partial t$= voltage (V)= ∂^2 straining/ ∂t^2

Stress-straining substrates

- In both rising stress and falling stress trends, the consequent straining fluctuates. However, during the forced stress loading, the process is active and during the free stress releasing the process is passive.

- The stress changes along the rising stress, are more energetic; so that the excess energy than absorbed by the tissues; and the related activities are extroversion.

- The stress changes along the falling stress, are less energetic, because already lost an amount which is absorbed by the tissues. Therefore, the related activities are introversion.

- Along the stress-rising stage, strains increase positively in amounts; when along the stress-falling stage, strains are increase negatively to reduce the stresses accumulated in rising period.

- The changes in neural network sections are in a combined shapes of convecity and concavity; and in opposite ways along rising-stress and falling stress.

- Firing synchronization, during each step of rising stress, in a substrate will increase, forming an image; when will decrease during each step of falling stress, when images start to disappear.

- The changes in stress-rising/ falling over "activated neural network **substrates",** causes that the substrates be variable in boundary limits.

  In later sections, it will discussed that the substrate variability in boundary limits helps to describe that they will decode different types of images like appearance of the static images (like characters and scenes) or dynamic images (like behaviors). Furthermore, a substrate with a strong-coherence in connectivity provide a “recall image”; when those with weaker connectivity can combine and form new combinations of decoding and provide “created images”.
- The chains of substrates in a rising stress trend, will follow less chaos principle and follow higher plasticity strength of the connections. The turning or climax point is limited to the networks in the chain that present more elasticity. The climax in stress fluctuation is the reference point for moment of stresses.

- The climax continues by a free falling stress, which follow chain of substrates that are more chaotic, because of increase in entropy and loose connections.

- The moment-of-stress is the moment of area for a neural network substrate which because of plasticity in connections shows resistance to any imposing shear stress. It is associated to a substrate of area A with a volume of (A*l.).

- Having the above explanations, a brain activity is made by a moment-of-stress transferring from its from initiation to termination.

Conclusion

In this article, it was discussed that any brain activity is based physically on the viscoelastic property of the neural networks. The electrochemical basis of neurons firing and synchrony of firing are the concepts that support the brain activities in higher scales of neural network.
Furthermore, it can be said that each brain activity is made of an initiation stage that a stress force will activate networks in different parts of brain, when those activated networks spatially and temporally are connected together.
The integrated activating networks after initiation of the activity, go under a set of stress fluctuations that overally form a stress-rising curve.
Rising of the stress will stop in a climax which balances the stress absorption and desorption. After the climax limit, the activity continues with fuctuations of stress aborption and desorption that has a general trend of falling stress.
The activity terminates in a termination with a possible conclusion or resolution.
The whole process of activity formation from the initiation to termination can be described with a phenomena of "moment-of-stress" transfer over the activated neural networks.

Definition of Moment-of-stress:

- Moment is a combination of a physical quantity and a distance**,** defined with respect to a fixed reference point or axis.
- physical quantities include forces, masses, and electric charge distributions
- If the quantity is not concentrated solely at a single point, the moment is the integral of that quantity's density over space.
- The definition of a reference point for a consolidated network is the centered connections with least plasticity; or in other words, most elastic point of the network.
- The 2nd moment ($n=2$) is sometimes called the quadrupole moment, especially in the context of electric charge distributions.
- While a single charge is a scalar quantity, and a dipole moment is a vector quantity, the quadrupole moment is a second order symmetric tensor.

Stress moment transfer

- The network/s with the highest kinetic content is/are the one/s with highest frequency, normally lead by an activated network in the frontal lobe.
- Moment of stress force: When a force is applied to a neural network, it tends to bend it fibers around each other. The amount of the moment is directly proportional to the magnitude of the force and an assumed perpendicular transferring line distance.   If a transferring force package into a network substrate has no resultant moment, i.e. $\sum \tau = 0$, the network remains *twistically in equilibrium*. Because of energy transfer preference for the least lost and time taking, the highest possibility of the energy transfer is between two neural network that the strained condition of the sender have got the most similar connectivity configuration with the reciever.
- moment of inertia: *Moment of inertia is a measure of a neural network resistance to changes in its straining frequency rate. Moment of inertia* is a measure of the of the neural network connectivity plasticity strength distribution. The moment of inertia for the small world and global networks is a summation of the integrating local networks.
- polar moment of inertia *is a property of a network related to its resistance to torsion*
- Magnetic moment is a measure of the strength of a magnetic field source of synchronized firing.
- First moment of area is a property of an object related to its resistance to shear stress from the adjacent networks.

- Second moment of area is a property of an object related to its resistance to bending forces.
- Image moment is a statistical property of an image, connected to the cloud shape of the synchronized firings.

Substrates and Formation of a Curvature

Consider a two-dimensional substrate section and energy pocket. This is not an actual situation and is shown to demonstrate the idea in its simplest way. Followings are typical curves to demonstrate the basic of kind of interaction in a substrate.

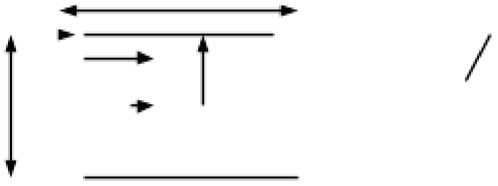


Figure 009: substrate deformation under stress.

A substrate before, when entering and after passing of an energy pocket

A substrate configuration while an energy pattern (moving fish) is entering in the substrate

An entering energy pattern (a moving fish) into a substrate

An energy pocket substrate, when a locally travelling energy pocket had passed through it

Interaction between built energy pocket and its substrate consists of three stages:

I) Stress inducing curve by energy pocket on substrate: When energy pocket is being built in a substrate, it imposes stress forces on it, tending to change its configuration.

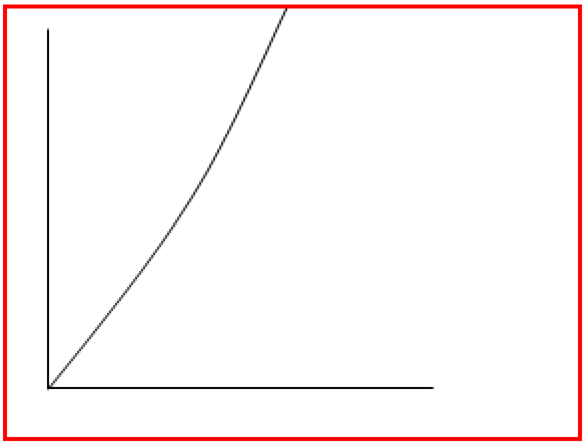


Figure 010: Stress increases in substrate

II) Stress balance state between energy pocket and substrate before energy pocket transfers:

Before desorption of energy pocket from substrate, energy pocket configuration and substrate structure have reached a partial balance.

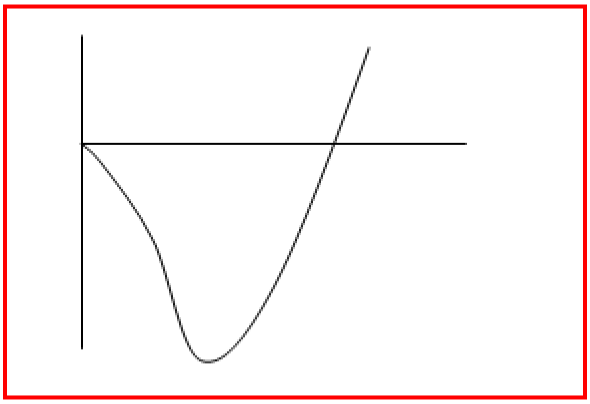


Figure 011: stress balance in a substrate before transmitting an energy pocket

III) Stress relieve curve on substrate when energy pocket dispatches:

When the energy pocket desorbs from substrate, substrate is released from most of imposed stresses.

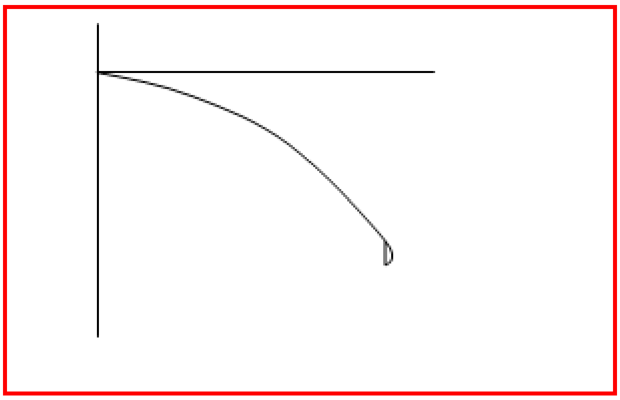


Figure 012: Stress decrease in substrate by transfer of an energy pocket

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All three stages in one coordination frame, if sequence of functions was not considered are shown in below figure, showing all three stages of absorption, interaction and desorption of energy pocket to and from substrate.

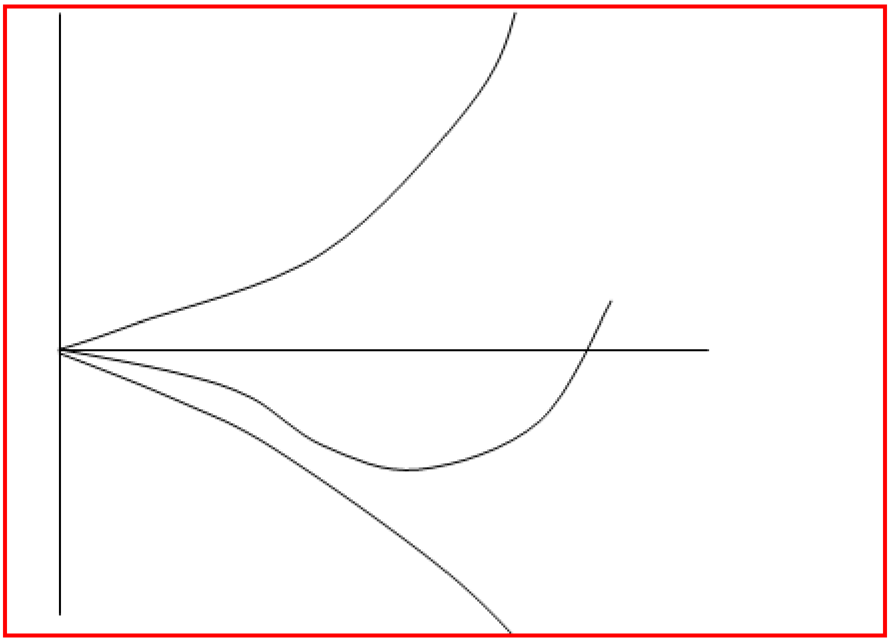

Figure 013: Three different stages of absorbing, balancing and desorbing energy in a substrate, ignoring time lags

Curvature topology as a result of imposed stresses on the substrate:

If three stages with consideration of frame-time for each sequence stage would be given in coordination, the stress fluctuation and therefore strain and temporary deformation on layer for two entering and leaving subsequent energy pockets, stress changes can be shown as follows.

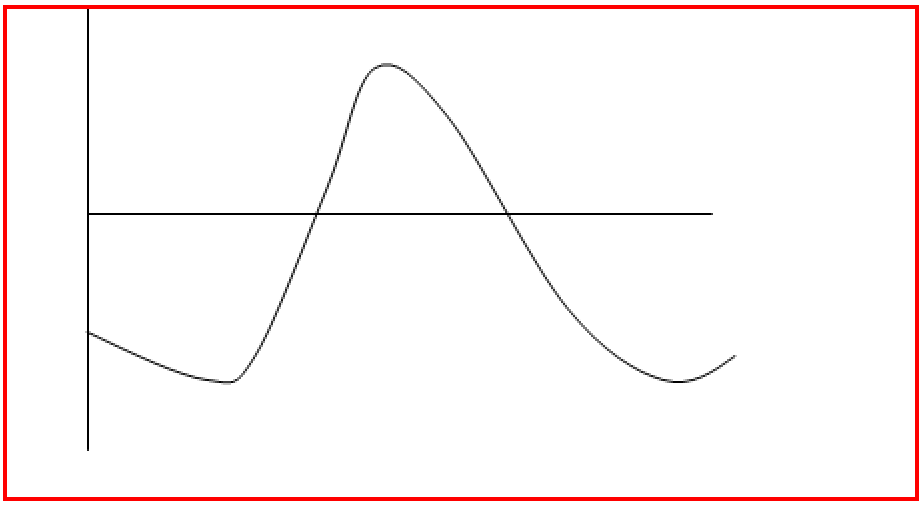

Figure 014: Three different stages of absorbing, balancing and desorbing energy in a substrate, considering sequences

Waving the curvature demonstrates the dynamic fluctuation of the substrate geometric by time.

During the time that energy pocket is being built by current of inputs in a substrate, stretch of fiber mesh creates a pre-shear condition which the substrate tends to absorb by temporary behavior, therefore stress forces drop from point A to a minimum level. Following that, since substrate as elastic material tend to retain original shape, therefore a part of energy should be sent out, which follows increase of stress to point B and this latter stress, changes energy pocket configuration to be discharged. This is incipient point for releasing the new energy pocket product. Therefore, the typical two dimensional as shown above can be demonstrated with more realistic curve as follows.

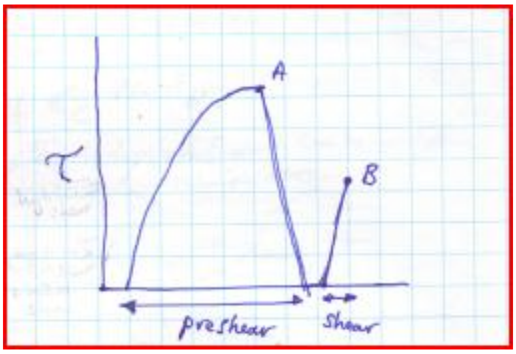

Figure 015: Shear stress changes in a substrate during absorbing, balancing and desorbing energy pocket

Stress Transfers between Substrates or Absorbed by Substrate Components

The shear stress gradient in following excited substrates makes a pattern of potential streams of stress ready to transfer.

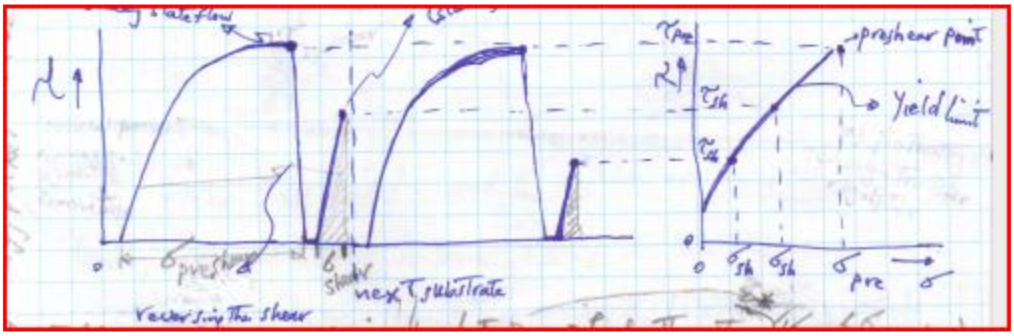

Figure 016: momentum gradient to flow between two next substrates

It was said that when the stress is removed, substrate configuration will not return back exactly to original position as a spring does. Remnant of strains in a substrate, due to confined energy is a drive for deep deformation in individual synapses within fiber bundles which are considered to be as fine curls in general curvature of fiber mesh in the substrate. The formed fine curls will save the memory of past stresses which happened to the substrate and create a similar pattern of firing when become active. This process is not gradual and happens intervallically in regeneration periods, which will be discussed in the next chapters.

Energy Types within a Substrate

There are two general types of energies: A) reacting energies, which follow the equilibrium line, and B) generating energies, which follow the operating line.

A) Reacting energies consist of:

1) Transferred energy by straight momentum transfer, which temporarily changes the firing intensity by impact on ion channels sizes and distribution.

2) Electromagnetic forces, induced by the neighboring substrate making the firings synchronized.

3) Far distance energy transferred by resonance. The source of this energy is an attractor. Attractors and receiving substrate should have the same or multiple frequencies.

4) The confined energy which is ready to be released on its point of incipient.

B) Generating energies is:

1) The absorbed energy which makes any kind of long term deformation.

2) Excess of ground energies which needs to be balanced periodically.

Generated energy is mainly the source of momentum transfer within the substrate from layer level to its component level and is generally a function and for the remains drive to random flows to retain geometrical balance again.

Reacting energies are the drive for momentum transfer from one substrate to the next one. Therefore, it is a function of substrate viscosity against energy flowing through and its time frame.

Stress Flow Function G(ε) and Flowability Drive Function R(ε)

Types of stresses working on a substrate, combination of them and elasticity limit of substrate enable us to predict how much related energy pocket is flowable.

1) Type of stresses working on a substrate is as following:

1.1) those stresses imposed by building up of energy pockets

1.2) stresses which are imposed by energy transfer from other substrates

1.3) those stresses which have already been absorbed by the substrate, but it is ready to relieve because of elasticity property (similar to a spring).

1.4) stresses imposed by resonance of far distance attractors with same or multiple-frequencies.

2) Maximum shear stress which acts as a tension or compression force on the substrate is the result of Mohr combination for all acting stresses on that substrate.

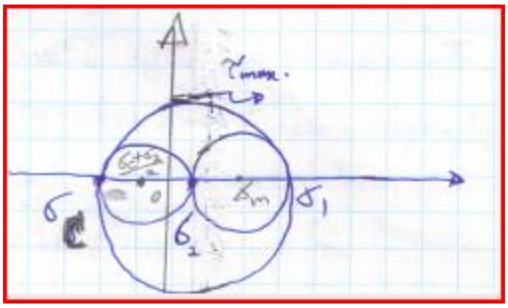

Figure 017: Combination of stresses in a substrate

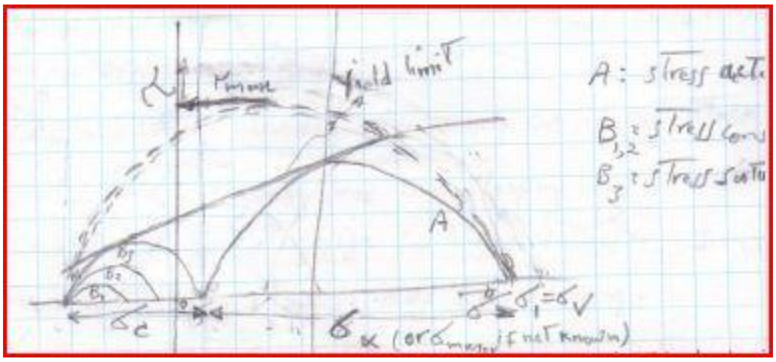

Figure 018: Maximum Shear Stress and Yield Limit in a substrate

3) Yield limit when approaches to full pre-shear stress is elastically limitation of the substrate.

4) Having above definitions, then stress flow function G(ε) and flowability drive function R(ε) are defined as below**:**

Maximum shear stress and related strain on a substrate, considering its elasticity limit, determine the flow function and time frame of the substrate. Because of the continuous changes in stress gradients over time, due to stress history on it, flow function varies in the process of time.

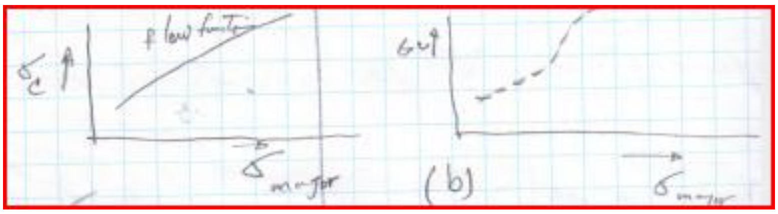

Figure 019: Flow Function Types

Flowability drive function is the ratio of maximum stress acting on the substrate dividing by the maximum stress which can be absorbed, considering elasticity limit. This ratio remains constant for a good range of stress-strain characteristic. Flowability can be categorized for:1) very inhibitory if ratio is high, 2) inhibitory if ratio is moderate, 3) easy flowing if ratio is low and 4) free flowing if ratio is very low.

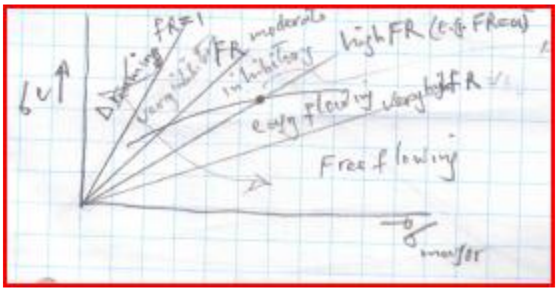

Figure 020: Flow Ability Characteristic

An intersection of flow function curve and flowability drive function gives a prediction of substrate condition and the way it functions in a definite time. Therefore, this operating point has a major role in energy flow through a pathway. Operating point degrades during a day and also for midlife afterwards.

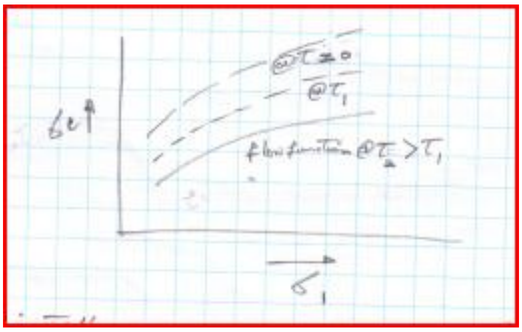

Figure 021: Variation of Flow Function over Time

Substrate as a Batch Reactor for Energy Pocket and Substrate interactions

The consequence of stress function in fiber mesh of a substrate is a strain tensor. A correlation between stress function and strain tensor in a substrate is same as R(ε), which can be called the operating line when ε indicates strain tensor. This function shows the strain-stress characteristic of the substrate and at present is to be approximately straight.

A part of stresses are removed by energy pocket depart and a remained part will be consumed in substrate to make fine deformations which this remained part was shown by G(ε), and can be called equilibrium line.

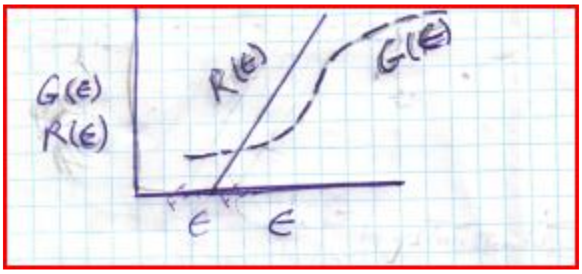

Figure 022: Deforming vs. Transferring Energies

Intersection of operating and equilibrium curves is the position that a substrate will reach regarding the amount of confining energy (to subsequently make a deformation) and amount of energy to transmit to the next substrates.

Operating curve changes with level of substrate activation energy, physical characteristic of layer and time.

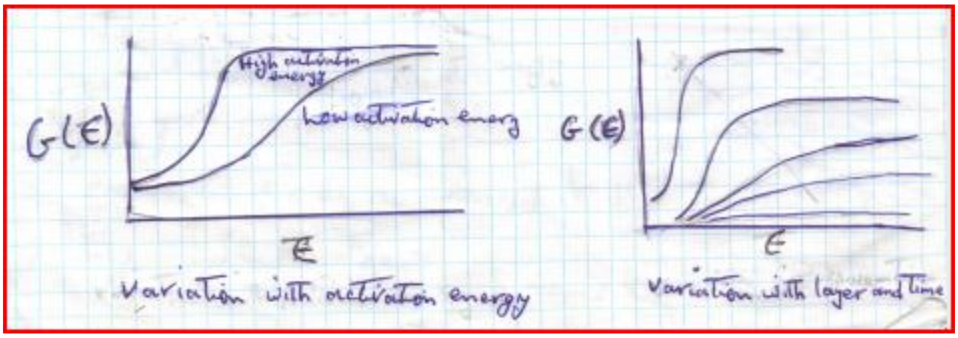

Figure 023: Transferring Function Vary With Substrate Activation Energy, Layer and Time

Attractors influencing the substrate state of confining energy which accumulates in a substrate.

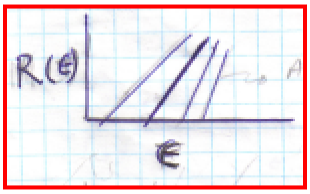

Figure 024: Variation of Deformation Function with Attraction Strength

Balance condition of transferring and confining energies highly depends on attractors influencing the substrate.

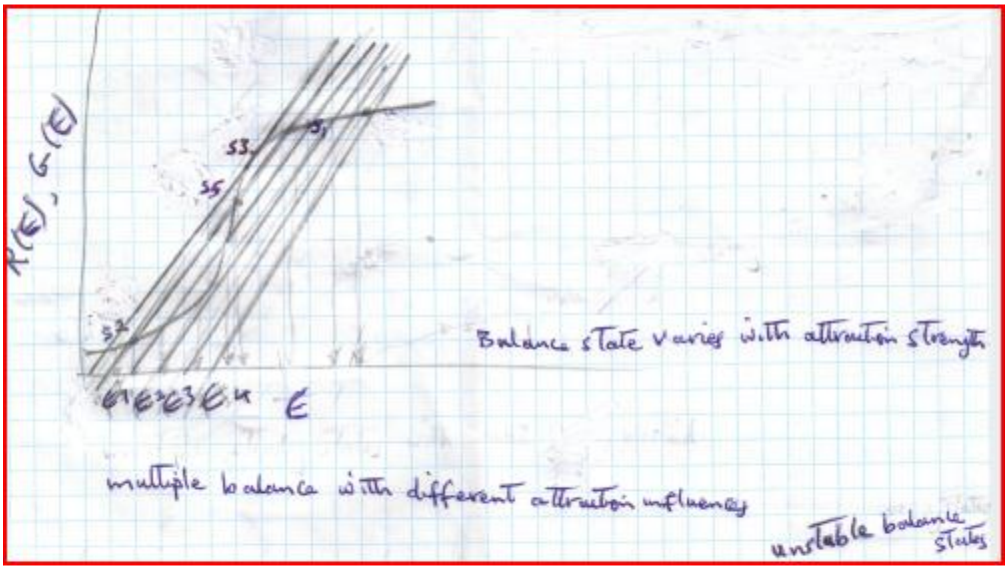

Figure 025: Balance Positions Varies by Changing Attractors

If deforming conditions can be shown for different influencing attractors, stable and unstable states of deformations can be predicted.

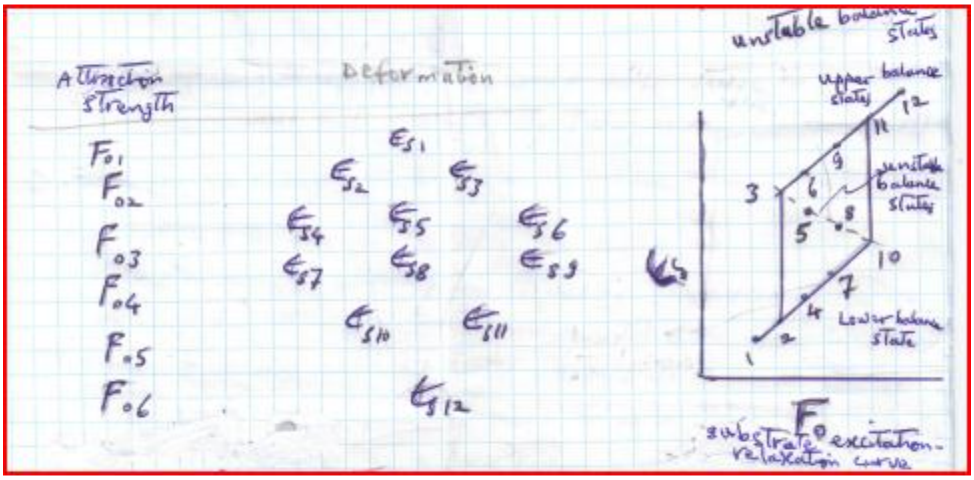

Fig.ure 026: Substrate Transferring-deforming Stability Ranges against Attraction Strength

Naturally, a substrate approaches stable condition; therefore, trend of split between transferring energy and confining energy can be traced.

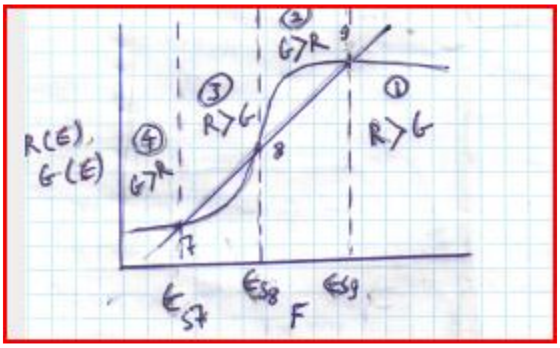

Figure 027: Variation of Transferring Energy against Consuming Energy to Make a Deformation in a Substrate

The above mythology is a good tool to trace changes that happen in different locations of the brain layers regarding specialty they find or the memories they save.

Substrate Energy Dispatch Mechanism

All the substrates in the process of interaction with an energy pocket experience increase in stress up to its yield limit of stress-strain characteristic curve. At this point, excess energy will find its final shape when a substrate is almost stress-free (pre-shear period). Then by having energy pocket configured according to the substrate structure, total stress increases in the substrate to a point called incipient point. At this point, energy pocket will be detached from the substrate.

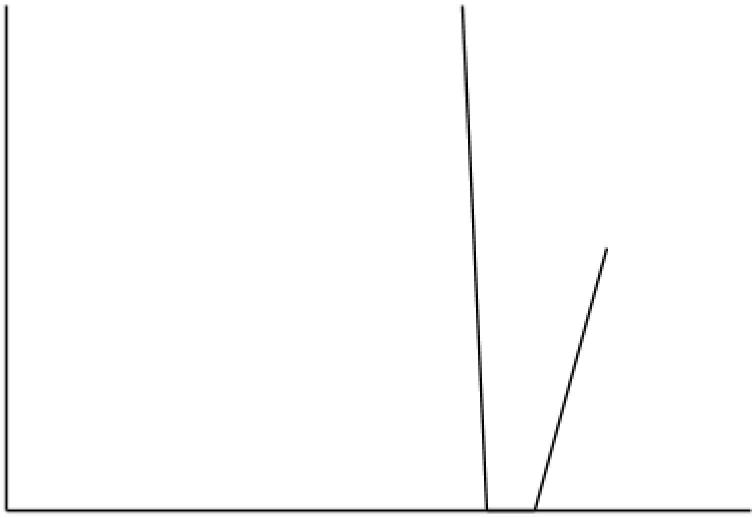

Figure 028: Stress Changes in a Substrate during a Period of Absorption to Detaching of Energy Pocket

The next substrate which receives the pocket undergoes the same steps, except that its incipient point is lower in stress content.

This difference reduces the transfer of energy to a point that the mentation terminates.

Up to now, influence of the ground energy on imposing stresses has not considered, assuming that the boosting of energy transfer by nutrition energy is the same along the transfer path.

During a day, confined energies in location will be accumulated. Therefore, incipient point also changes by time and location. When the location receives to a yield point in respect to elasticity character, its ground energy level increases and consequently the activation energy required for any input to enter, will highly increase. At this condition the location will be closed to inputs and regeneration period will be started to return back the layer to its fresh position again.

Activation energy of a receiving substrate is a threshold that dissipating energy pocket from previous substrate needs to overcome, otherwise energy remains as a trapped energy in the location, which if not released by far distance resonance can make feeling pain or in sever condition can cause injury in tissues. The corresponding energy in incipient point is the kinetic energy required to keep the flow going.

In summary, layer stress-strain characteristics summarize the relation between stress and strain data in the location. It is consisting of elastic portion which strain increases initially proportional and for higher stresses declining in slop and then layer shows plasticity property. Any further stress close to plasticity range directs the substrate in energy pocket dissipating process. The yield limit is the envelope for the energy flow. If the substrate remains close to plasticity range for a longer time, its components will be modified for a new structure and find a plastic functionality. In opposite, a plastic formed function may be unfolded by decay or new over load stresses. Finally, the curve becomes flatter and any minor increase in the imposed shear stress over tenses and damages tissues.

Energy flow and interacting rate in a substrate

For any interaction in a substrate; inputs' potential, substrate functionality and activation factor by attractor are the main parameters. These parameters can be correlated as follows:

E(Substrate energy flow) = k * (input energies)^a

Substrate energy flow indicates input and output energy changes.

k = A * e^(-AE*t/Ĩ), where AE is activation energy and Ĩ is the time frame of the substrate.

E = Overall energy changes in a substrate normally should be more than 1.6 joule

[=erge/(mm^3*ms)]

A and a are constants.

The Required Energy to Deform a Substrate

The power of the em-field induced by a string of input spike trains (firing rate) is about tens of microvolt per micron (say 60 as an average). On the other hand, the radius of the related field is 73-75 microns [Johnjoe McFadden; Synchronous firing and its influence on the brain's electromagnetic field].

We assume a substrate with free path length of 0.2 millimeters or 200 microns. Neurons and their synapses are distributed in different directions. As a typical figure, in outer layer, there are 10^9 synapses in a cubic millimeter volume. A driving force of 350 microvolt per substrate is also a reasonable suggestion for a flow across a substrate [Synchronous firing and its influence on the brain's elecromagnetic field, Johnjoe McFadden, 2002, Journal of Consciousness Studies,9, no.4].

In a time frame of 400 milliseconds, the ampere in an average forwarding direction can be calculated as follows:

Substrate volume based on a characteristic length of 0.2 mm: 2.14*10^9 cubic micron

Number of synapse per substrate: 2.14*10^9 (10^9 synapses pr cubic millimeter or one per cubic micron)

Amperage: I= 2.14*10^9/ 6.242*10^18=0.34*10^-9 (6.242*10^9 is the coulombs number)

Power=V*I= 350*0.34*10^-9=1.19*10^-7 erg per millisecond

I) A typical available energy density in a time frame of 400 seconds equals to 4.76*10^-8 ergs/cubic microns.

II) Considering that the natural strain of brain tissue is between -0.3<ε<0.2 [Mechanical properties of brain tissue in tension, Journal of Biomechanics, Volume 35, Issue 4, Page 483], and required stress to have a strain on a fiber that introduces injury, according to medical reports is about 3.5 KPascal [……………]. This magnitude of stress is equivalent to 3.5*10^-8 erg/cubic micron, which is far beyond the stress force required to have a natural strain. It can be concluded that the actual required power to do a deformation is available in a substrate, considering that the available power is multiplied by coupling with up to several far distance attractors reinforcements.

Substrate Characteristic Length

If the free energy difference in a substrate is shown as ΔF, then:

a) When energy flux is negative, the energy would be absorbed as confined energy.

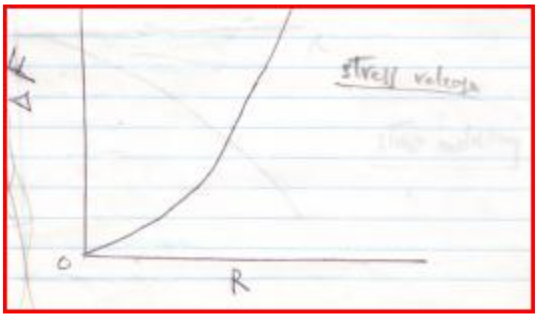

Figure 029: Negative Velocity Gradient and Accumulation of Energy in the Substrate

b) When energy flux is positive, the energy would be desorbed to transfer.

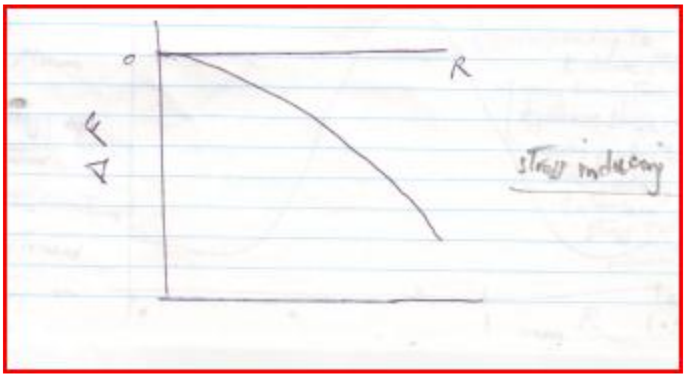

Figure 030: Positive Velocity Gradient and Transmitting Energy from Substrate

c) When energy flux is small but still positive, energy confining and transmitting states are in a balance position.

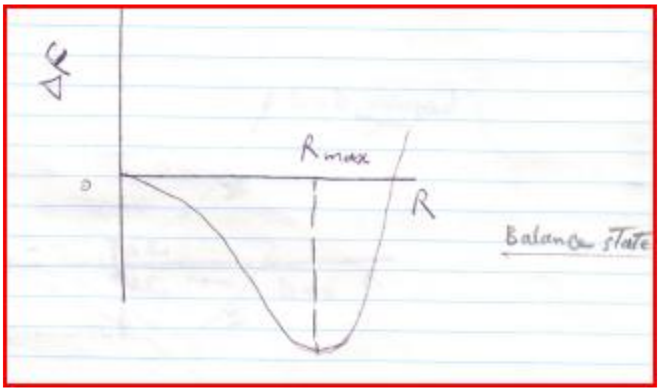

Figure 031: A Balance State between Accumulating and Dispatching Energy in a Substrate

Since the energy flow is going forward from backside of the outer layer to the front, the same direction should exist within each individual substrate. It means that the direction of energy flow in building substrates is the same as direction in the pathway.

The total energy exchange starting from a non-equilibrium position (when energy enters in) up to the position that they reach to an equilibrium position (when energy starts to transfer from a substrate) can be reviewed, as discussed before, by looking on reacting and generating energies. The amplitude in any periodic phase of energy absorption-desorption gives the characteristic length for each substrate. A substrate passes several states of absorption-desorption combinations, approaching the equilibrium condition (i.e. $R(\varepsilon)=G(\varepsilon)$). Excess of potential energy at this point compared to potential energy before excitation is the resulting confined energy in substrate, either to be released in the same periodic phase or to be consolidated in sleep. In case of release, the incipient point is the state that energy pocket will dispatch to motivate the next substrate. At this point, ΔF starts to become positive to release excess energy to the next substrate and this point is the end of substrate characteristic length. Rmax indicates the point that the substrate has received to it yield point and the substrate stress starts to decrease a minimum. Then, transferring energy pocket will be configured to transmit in the incipient point. The frame time is the duration from energy entering to the substrate up to the time that reacting function R(ε) equals to generating function G(ε). The substrate average frequency is equal to reverse of the frame time. A simple two dimensional curvature change, which is occurred as result of this interaction in any phase, is shown typically as below. In a three dimensional coordination it should be a saddle shape and real changes can be shown considering space and time multidimensions.

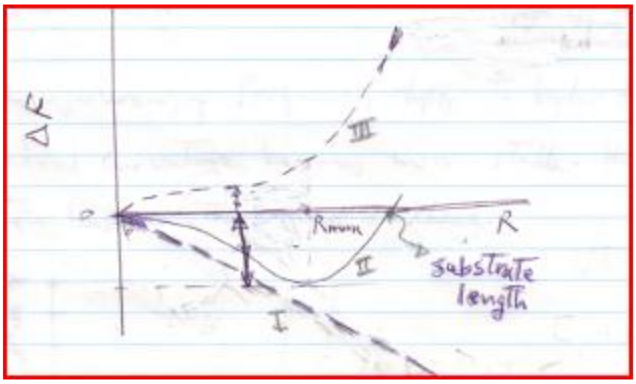

Figure 032: A Typical Reacting-generating Curves to Determine a Substrate Characteristic Curve

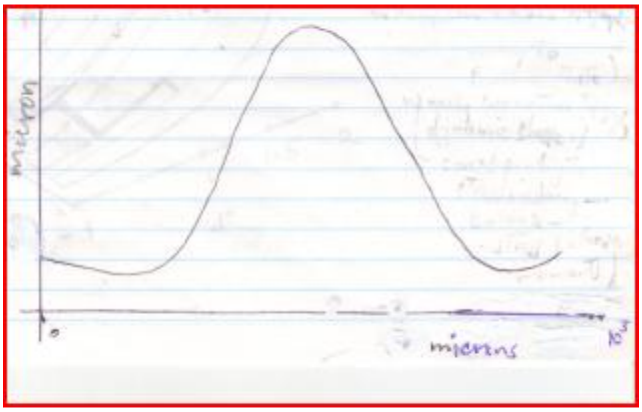

Figure 033: A Simple Strained Substrate in a Periodic Phase

Characteristic length, frame time and activation energy are parameters that determine a substrate stability.

Energy Pockets and Related Substrates

Formation of an energy pocket is based on local elasticity and viscosity against deformation and in other words, on substrate viscoelasticity. Energy pockets transmitting on layer level and in the front lobe are most stable. All others, which are being carried with components of substrates, are less stable. Similarly, outer, middle and inner brain layers are energy currents are less stable in sequence. This is because of the decrease in viscoelasticity property of media in the same order.

1) Those which are stable are being carried in layer level and advanced layers rather than in substrates or their component levels, as well as in middle or inner layers.

2) Those with semi-stability condition are being carried by substrates with intermediate elasticity property.

3) Those which are not stable and take part as very fast reactants locate in the most elastic ranges of the fiber and its components.

4) The solid stored information, as genetic and instinct data, is shaped on molecular plastic ranges.

In short, substrates structures that host working and short term memories are located on the higher elasticity range in sequence. Substrates that host long term memories are located close to plasticity range and those maintaining basic derives are located on the plasticity range.

The viscoelasticity property of substrates change by time in daily and life time scales as well. During waking time, the substrate gradually would be shifted to less elasticity range, so that it shows more rigidity to accepting new stress and its consequence strain and finally approaches to a point close-to plasticity condition. In such a condition, the threshold of activation potential and layer rigidity is so high that input pocket energies are not capable to enter in and the brain stops to accept any external input afterwards. At this condition, the brain is degraded for its viscoelasticity property to a semi-solid material. Therefore, the brain becomes like an isolated system and the sign of entropy production rate would change to negative, which is actually the sleep stage characteristic.

During different stages of sleep the brain will be regenerated for viscoelasticity property by: 1) consolidation of fine curls so that elasticity would be recovered and 2) equalization of configuration energy all over the layers. Sleep is essential for these two regeneration steps to bring back the brain to normal efficient awaking time to start inputs taking in again.

Geometry and Natural Frequency of Substrates

Frequency of oscillation recorded in distant electrodes shows firing frequency,but for synchronized firings over a substrate is an indication of the substrate functioning, energy or field pocket fluctuations and in general, any parameter resulting from firings circuit dynamics, as well as spot firing frequency.

It can be assumed that there is a straight relation between a local neuroelectric and biomagnetic signals and the oscillation frequency corresponds to a total phase synchrony with low deviation and within a practicing time frame of +/-200 msec[2]. this is very close to measures which are described for substrates' frame time in this book.

When in the outer layer, the packets of synchronized beta or gamma firings are linked by by the alpha frequencies field packets, they travel with a transferring velocity of 4-10 meters per

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2

second [Paul L Nunez PhD; Emeritus Professor, Tulane University, New Orleans, LA; **Brain** Rhythms, Anatomy, and the Emergence of Consciousness presentation May 3-4, 2008]. This confirms a velocity of the energy pockets transfer about the same figure. The packets connected by alpha frequencies communicate with attractors in the lower level with theta frequencythrough the long fibers; and by these communications their strength will be increased by reinforcing amplitude.

All these energy pockets transmissions and communications are made of distributed firing clouds with varying energy densities. The ratio of attracting connections[3] to location-continued transfers is about 27 times [Paul L Nunez PhD; Emeritus Professor, Tulane University, New Orleans, LA; **Brain** Rhythms, Anatomy, and the Emergence of Consciousness presentation May 3-4, 2008].

The gradient of the energy flow in different directions impose a distribution of shear forces on pathway substrates, which appears as local curvature fluctuations.

Neural network substrates and their corresponding energy packets in different levels are expected to show more regular waves connected to the size and density of the networks.

[3] attractors are the networks in far and connected by the long fibers

Delta waves are the slowest oscillating waves (.5-3cycles per second) which is expected to correspond to substrates in the inner levels of the brain. Theta waves which oscillate 4-7 cycles per second and Alpha waves which oscillate in a range of 8-13 cycles per second correspond to coupling frequencies between layers and Beta waves which oscillate 14-30 cycles per second should correspond to the networks in higher levels, and finally Gamma waves which oscillate more than 35 correspond to sensory input-output zones and most upper levels. Probably high oscillation rates of 70 to 140 correspond mostly to activities in frontal lobe, interacting all other waves. These are expected from physical property of layers and size of energy packets that travel through. Obviously, they are subject to experience to be approved.

The practical activity in the brain shows a coupling and a phase-locking of different bands, which covers the involved networks in different parts of the brain.

Phase-locking happens between different locations with separate frequencies, only if one is a multiple of frequency of the other one, indicating the general connectivity configurations are the same. This is one of the requirements for locking the different frequencies to attract each other. The attraction is highly sensitive to the **geometrical and physical parameters** of the substrate and in particular to its' frequency and time-frame. A pathway in the outer layer may have several phase-locked interactions with attractors. **Phase-locking has to produce enough combined power within a reasonable time-frame to override the required potential to impose strains on the fibers in the substrate. Then the substrate is activated and will be considered as an element of a pathway.** When attractors and inputs on a substrate are coupled, the consequence field is sufficient for imposing a force to deform the connectivity in the substrate curvature.

A mentation consists of many substrates, in the chains coupled by certain frequencies. The substrate in chains are coupled by the progressive em-fields interactions. Therefore, the frequency of synchronized firings of the following substrates in the pathway fluctuates through the pathway. In other words, synchronization process proceeds through the pathway within a definite bond.

Oscillation and Connectivity Deformation in a Substrate

Fibers and substrates oscillate in their positions vibration by frequent internal sliding for connections within their wrapping tissues. The oscillation occurs in the elastic range of the layer. An oscillating stress wave has two components of the standing part (stationary pattern) and moving part (moment transfer).

Stationary pattern is related to absorbed strains in the shape of confined energy and will be consolidated periodically by short term or long term connecting deformation around synapses.

Connectivity deformation in fibers occurs by the two following processes:

1) Moving and sliding of fibers over or around each other: dendrites around axons; axons in substrates and fibers around glial cells.
2) Fibers within molecular and cells.

The required condition, for the connectivity deformation in addition to local energy transfer, is far distance attractors to resonance with them. By that phenomenon; stress forces within the substrate will increase to a sufficient limit to deform connectivity within the substrate. All the energies added by imposing forces are initially stored as confined energy and as a secondary process, the confined energy will be consumed to deform connectivity.

Such a change is not expected to be a straight process, but it is an exchange of moment between levels toward more simpler networks, cells and molecular level. Therefore, direction of induced forces is downward from networks toward axons and synapses. The detail of this exchanging can be described as follows:

With the repitition of the same oscillations, the sliding of fibers inside their wraps, due to bindings by stronger plasticized synapses, is in the shape of helical move. The helical moves would not return back to origin positions after a while; which indicates a change in the local elasticity limits. These changes would be added by time and finally appear as a rigid form of connectivity, presenting the substrate specialty. The found speciality make the local curvatures (connectivity distribution) that in the size of ion channels, their distribution, and the firing rate in the substrate would be less flexible and mostly remains the same, except by very strong stress initiations.

In ultimate conditions, molecular changes by strain condition occurs because of the change in the local chemical environment and under stress forces, either in the shape of mutation or long term consolidation.

Synchronization Degree in a Substrate

Although a pocket of energy which is associated with a substrate, should have all the related firings synchronized and phase-locked, but the state of absolute synchronizing of all firings is ideal and practically the probability for synchronization should be considered. The probability of the condition that an energy pocket is synchronized for firings on a substrate is an integration of synchronization probability along its characteristic length.

Probability of the individual neuron firing in any time in outer layer is a function of time to power of -3/2 [Reptation theory of ion channel gating Glenn L. Milihauser, Department of Chemistry, University of California, Santa Cruz, California 95064]. The power for the front lobe should be higher, probably -5/4 and for middle and inner layers less than -3/2.

By integration of the probability function within a substrate??? (integ ($\oint_0 t^{-3/2} dt$)), it can be concluded that shorter substrate time frame creates higher probability of synchronization.

Type of Interactions in a Substrate

There are four major categories of interactions when energy is absorbed or transferred to the next substrate:

1) Decomposition: Transferred energy pockets interacting with a neural network decompose to components based on the connectivity differences. The substrate will introduce possibility of a branching in the pathway.

2) Composition: Transferred energy pockets while interacting with a neural network will be added and synthesized together, if the network is more integrative. The substrate connects two branches in the pathway.

3) Isomerization: Configuration of energy pockets, interacting with a neural network may disconnect two or more similar connectivity within the energy packet.

4) Polymerization: Energy pockets, interacting with a neural network may make a heavy long and branched chain of similar combined pockets.

The above functions, when an energy packet is activating a neural network, occurs in the shape of clouds of synchronized firings and strings of them, linking successive substrates together; or separating them.

Substrate Components Catalytic Property

Active sites in a substrate are cellular or molecular structures which may work as a catalyst to accelerate joining or separation of the neural networks which appear as the active substrates. They promote a related pathway by reducing the required activation energy or in opposite, may work as an inhibitor by increasing the required activation energy through it. They accelerate a substrate to have a chain output or to stop continuing to chain.

Rate of interaction in a substrate is a function of catalytic property and amount of active sites in it. Catalytic property is referred to the activity in molecular scale of network and kind of chemical reactions in those sites facilitated. Turbulent mixing process inside the substrate means a rapid fluctuation of firing frequencies to ensure all the sub-networks and neurons activated. such an accelerated frequency change is important as well as catalytic property for the the output energy packet from the substrate. the distribution of the interaction rates is an indicator that reflects the connection of the mixing parameter as well as catalytic sites distribution. The narrower interaction rate distribution, the higher the mixing property or site catalytic property would be. In other hand sufficient time frame is essential for mixing effect.

As an example the decomposition interaction which may happen within a substrate with its network structure, considering its activation sites, the interaction types can be shown as follows:

Activation: A + S ----------------→ A* + S

Degradation: A* -------------------→ [output]

Partial Deactivation: A* -------------------→ A + A*

Deactivation: A* + S--------------→ A + S*

Cross Activation: A* + [output] ---------→ A + [output] *

Cross Activation: A + [output]* ----------→ A* + [output]

A* and [output]* are active energy packets intermediates. If output would be two or more, branching will happen from the substrate. S is catalytic sites in substrate. Substrate which is deformed in connectivity by an energy packet stream is indicated by S*.

Because a high active intermediate reacts as fast as it is formed, the net rate of formation of an active intermediate is zero.

Therefore, if rate of formations for any of intermediate in above reactions (according to section "Energy flow and interacting rate in a substrate") are added together, and considered as zero, few equations will be found. By solving the equations together, unknown information regarding rate constants in the interactions can be found which helps to determine the substrate main functionality as well as the mean pathway for individual substrates along a pathway.

Substrates, when interacting, are the action sites; and when initiates or approaches its equilibrium condition, demonstrates objects and characters. They develop a pathway within their activation energies range. Attractors which reinforce in the reactions on the substrate adjust the required activation energy. By their influence they make the direction of a pathway by increasing the activation energy of the interaction participants.

After calculating rates and constants as above, the intermediate interactions can be ignored and overall rate of interaction for the whole substrate can be concluded.

Overall conversion of input A (the indicator) to mentation product P (an imagination element)

(two pages missing compared to the book)

$$A \xrightarrow{K} P$$

1) Activation: $A + M \xrightarrow{K1} A^* + M$ $\quad r_{1A^*} = k1\, a_A \cdot a_M$

2) Deactivation: $A^* + M \xrightarrow{K2} A + M$ $\quad r_{2A^*} = -k2\, a_{A^*} \cdot a_M$

3) Decomposition: $A^* \xrightarrow{K3} P$ $\quad r_{3A^*} = -k3\, a_{A^*}$

$$r_{A^*} = r1_{A^*} + r2_{A^*} + r3_{A^*} = 0$$

$$r_{A^*} = k1\, a_A \cdot a_M - k2\, a_{A^*} \cdot a_M - k3\, a_{A^*} = 0$$

$$\alpha_{A^*} = k1 a_{A^*}\, a_M / (k2\, a_M + k3)$$

$$r_P = k3 \cdot a_{A^*}$$

$$r_P = -r_A = k3 \cdot k1 \cdot a_A \cdot a_M / (k2 \cdot a_M + k3)$$

α_M Is constant, because of its stability.

$-r_A = K\, a_A$ $\quad$ while $K = k3 \cdot k1\, a_M / (k2\, a_M + k3)$

K is a combination rates for decomposition interaction in a pathway.

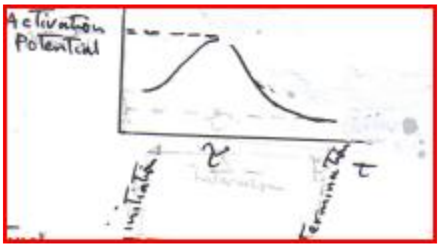


Figure 034: Potential energy change through a pathway

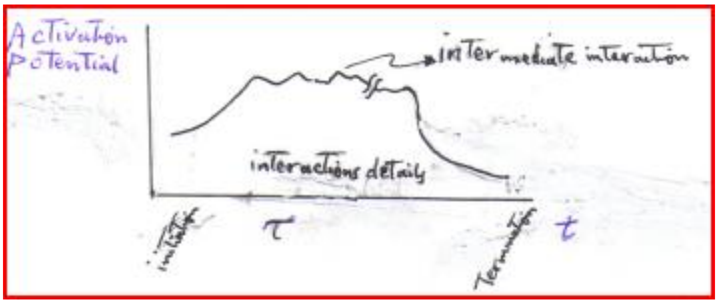


Figure 035: Detail of intermediate potential energy changes through a pathway

Types of Attractor Influencing a Substrate

1-Procedurals attractors: stimulates and put solid boundary limits to the pathway expansion by the saved functions, rules, procedures.

2-Declaratives attractors: stimulates and puts boundary limits to pathway expansion by saved memory of solid information about facts like names, numbers, symbols and events.

3-Short term memory generators: stimulates and puts boundary limits to guide a pathway pattern in pro or opposite direction.

4-Long term memory generators: stimulates and puts boundary limits to direct severely a pathway in pro or opposite direction.

5-Genetic and instincts stimulus, in molecular structures or more plasticized networks; which shape a pathway in a definite direction.

Chapter Two

Energy Transfer and Pathway

How a Pathway Works?

A pathway is made of several substrates which each of them is a well-mixing-batch-multi-reactor. The incoming energy pocket as a reactant reacts with structural energy of substrate and product is a reconfigured energy pocket in addition to byproduct of substrate deformation which slightly changes the functionality. The reaction is mostly catalytic by influencing energy coming from attractors which activate the substrate sites. Random velocity inside a substrate is very important for mixing purpose; while the transfer rate between substrates defines the traveling speed. Therefore, the type of dynamic is chaotic in substrate level but semi-regular or regular in substrate and layer levels. Different types of chain, parallel, decomposing or combining interactions can occur inside a substrate as reactor.

The transfer between substrates consist of desorption of energy pocket from previous substrate and adsorption of it in next substrate, including configuration interacting within substrate. In all the stages: configuration of energy pocket, structure of receiving substrate and direction of energy pattern variation are main influencing parameters. If substrate configuration is shown by S, S reacts with incoming energy pocket structure A, producing A*(which means activated A) and then by approaching a balance configuration between entered energy pocket and substrate, A* reacts with more A as A+A*, producing [A* + intermediate output]. Then A* reacts with the deformed substrate structure (shown by s'), producing [A.s'+S]. A.s' is a remained confined energy and output leaves the substrate as an intermediate energy pocket, entering the next substrate. After consolidation, s' will be a new fine curl in the substrate and the substrate still has maintained its overall configuration of S.

the formula was shown in section of "Energy flow and interacting rate in a substrate" can be shown in more general way for rate of interaction between A (as entering energy) and B (as substrate) like $-r_A = k'_A a_A^{\alpha} a_B^{\beta}$, when $a_A = \gamma_A \cdot \epsilon_A$.

- is configuration energy activity, γ_A is activity efficiency and ϵ_A is energy content of entering energy pocket or substrate and k'_A is a function of the attractor influence strength in the substrate.

A substrate maintains a structure of firings cloud in orbits like electron layers in atoms. Similarly a pathway demonstrates combined layers of firing clouds like electron layers in molecules and bound substrates together.

The pathway for the mentioned interaction can be identified by mean path method which will be explained in the next sections.

Transfer Index

In the section of “Different mentations, different states of mind”, an index was referred which enables us to define mind states milestones. In this section a more explanation of this index will be given.

Stability degree over a saddle is related to kinetic to potential energy ratio which shows how much they are far from equilibrium conditions. A) When index is low, structural energy is more significant rather than interacting energies. Therefore, travelling energy pockets are clearly ordered in regular streams, making a distinguished pattern and high correlations between energy pockets. B) When index is higher, travelling energy pockets are scattered and correlation is very statistical. This is a transmittal range between regular and irregular states. C) When index is very high, travelling energy pockets are arranged randomly and very irregular. Termination output of each condition accordingly shows that energy pockets are: a) correlated in a deterministic way, 2) statistically related and 3) not related.

In scale substrate components, because of multidimensionality of structure and high random velocities, energy streams are irregular and chaotic. In scale of substrate, energy streams are statistically correlated and in the scale of layer, energy streams are normally regulated.

There are three different directions of energy flow in the brain:

1) As it was indicated in the previous sections, the inputs are entered in the level of substrate components, therefore in high chaotic way and the products are delivered in the layer level in high laminar way. This direction of energy flow is in sequence and contains time-orientation in itself.

2) In other side, instant inter-layers direction of energy flow contains spatial-orientation in itself:

   2.1) the attractors in inner and middle layers regulate the pathway in the outer layer and together in the front lobe by resonance energy transfer, reinforcing in sub-substrate level.

   2.2) In reverse direction to attracting way of energy transfer, any pathway pattern would be condensed in a substrate structure in the middle brain by resonance, saving a memory of it.

Two time and space-orientation energy flows, determine spatial and time dimensions for each mentation activity, which are used internally in brain and have weak relation with real and global space and time dimensions, especially for sleep related mentations.

Physical characteristic of the layers accommodate different sizes and different combination of layer, substrates and substrate components energy pockets in their substrates which establishes different types of mentations: a) because of single-pathway mentations in inner layer, almost immediate responses; b) because of few-pathways mentations in middle layer, very rapid feeling; c) because of several-pathways mentations in outer layer, fast automatic thoughts; and d) because of multi-pathways mentations in front lobe, very gentle analyzing and synthesizing indicate types of energy flows in the brain.

Pathway Determination I

Outer layer as a media with following characteristics has a continuous fluctuations of natural strains and sudden deformation which consolidates daily accumulated stresses, to retain previous day balance of the structure:

1) Electro-firing transmitter media in varying directions,
2) Media for momentum transfer due to induced electro-magnetic fields,
3) over stress energy transfer due to resonance between frequencies,
4) Non-linear location and time-dependent deforming media because of fluctuating flow of stresses through it,

5) Accompanying strains to stresses which are appeared as helical-spring-moves of fibers inside their wrappings

Further to these changing parameters, the brain aging is a significant parameter, especially during early and latest years of life which makes integration of continuous and daily changes more complex, so that to have its highest functionality on the mode life and to start to degradation afterwards.

Free energy flowing and daily deformations are because of exchange and conversion of energy through their pathways from kinematic to potential states of energies and vice versa, flowing to confined and confined to flowing, in the shape of chains of interactions.

Numbers of substrates for energy exchanges are the number of steps between **operating line**, which shows kinematic characteristics and **equilibrium line**, which indicates potential characteristics of any i-substrate in the pathway.

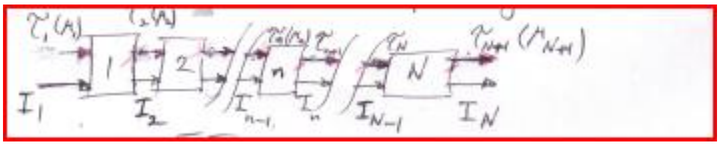


Figure 036: An ideal one-row chain of substrate in a pathway

“I” shows an input which initiates a current as long as it is simulating a pathway; “I_2” and I_i are intermediates flowing energy pockets through and I_N is the product,

“Ĩ” is the shear stress influencing the pathway in the process of transfer; “$\tilde{I}_2$”, “$\tilde{I}_i$”, ”$\tilde{I}_{N+1}$” are the acting shear stresses on the mentioned substrates.

The general formula for any stress transfer is as follows:

Strain = (stress gradient) / (deformation viscosity),

Strain = velocity / length,

Stress = force / area

Therefore: force / area = (viscosity) * (velocity / length)

And in general:

Stress = function (viscosity, strain)

For a viscoelastic media like brain, shear stress can be as complicated as:

$$\tau(x,t) = -\int_{-\infty}^{t} G_1(t-t')\,\dot{\Gamma}'\,dt' - \frac{1}{2}\int_{-\infty}^{t}\int_{-\infty}^{t} G_{11}(t-t', t-t'')\left[\dot{\Gamma}'\cdot\dot{\Gamma}'' + \dot{\Gamma}''\cdot\dot{\Gamma}'\right] dt''\,dt' \ldots$$

Where $G_1, G_{11}, G_{111}, \ldots$ are substrates strains in any time which they are influenced by each other. G is a matrix. $\Gamma', \Gamma'', \ldots$ are viscosities of different sections of the pathway in different regions and viscosity per energy density in each location is defined as momentum transfer coefficient of the location.

Each deformation is because of three types of tension, compression normal stresses and adjacent or far distance shear stresses which induce momentum forces in normal and angular shapes. Obviously, because of importance of far distance attractor inducing forces, shear stress is more significant than normal stress.

Although synchronization velocity, which proceeds along a pathway, is almost constant but it is variable in random directions. The time-average velocity in different coordination is as follows:

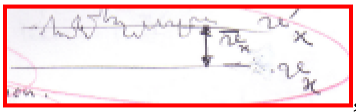
$$\bar{v}_x = \frac{1}{\tau}\int_0^{\tau} v_x \, d\tau \; ; \; \bar{v}_y = \frac{1}{\tau}\int_0^{\tau} v_y \, d\tau \; ; \; \bar{v}_z = \frac{1}{\tau}\int_0^{\tau} v_z \, d\tau$$

Now, the actual velocity of each energy pocket can be described in terms of average and random velocities:

$$v_x = \bar{v}_x + v'_x$$
$$v_y = \bar{v}_y + v'_y$$
$$v_z = \bar{v}_z + v'_z$$

v'_x, v'_y and v'_z are the fluctuating velocities around the mean velocities.

Mean values for these parameters, because of their minus and plus value summaries in different directions eliminate each other, are practically zero. $\overline{v'_x} \cong 0 ; \overline{v'_y} \cong 0 ; \overline{v'_z} \cong 0$

, but the mean value of their products are not zero.

$\overline{v'_x v'_y} \neq 0 ; \overline{v'_x v'_x} \neq 0$ and shear stresses are related to the product of random velocities.

Momentum Eddy flux indicates rates of stress production and as already shown are a function of strains and viscosity in the substrates. Each eddy moves a distance called mixing length or characteristic length before it loses its identity. Therefore, characteristic length is the distance that a small energy pocket which is carried by a substrate, maintains its identity while travelling that entire length. Afterwards it loses its identity by being absorbed for a part of kinetic energy as would be confined in the substrate for other part.

Correspondently, when eddies produced by differentiation of random velocities they create a drag pattern which proceeds forward in a pathway and terminates when all kinetic energy are absorbed in the pathway substrates as confined energies. In this condition, sectional drag forces, as a result of eddy random velocity products, which roll over each other, per lost kinetic energy equals to the shear stress per deformation energy.

If specific volume of each eddy particle is defined as reverse of its characteristic length and volume fraction of fiber networks in each location is known, then a pathway volume can be checked for its correlation with these parameters as:

Pathway volume = k * (fibers networks volume fraction) / (energy pockets average characteristic length)

Pathway Determination II

Mentation channel is the mood which directs the mentation pathways and is a function of 1) combined rates of interactions; 2) rates variance; 3) rates skewness, 4) frame time distribution function.

1) **Combination of rates** for a simple interaction like decomposition (as an example) was given in section "Substrate Components Catalytic Property". An example of decomposition interaction is the process of analyzing of an input in a mentation.

2) **Mean duration time** for a pathway is:

$$\tau_m = \frac{\int_0^\infty \tau E(\tau)\,d\tau}{\int_0^\infty E(\tau)\,d\tau}$$

3) Substrates **time frame variance** (square of the standard deviation) indicates that how much the substrates distribution is spread. It indicates that a distribution is skewed in one direction or another with reference to the mean.

$$\sigma^2 = \int_0^\infty (\tau - \tau_m)^2 E(\tau)\,d\tau$$

4) Substrates interacting **Frame Time Distribution** function help to study different pathway types with consideration of interaction rates in a definite pathway channel.

Whenever there is a clearer pathway, its ‘Frame Time Distribution’ function would be normal:

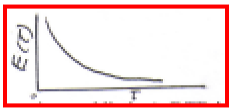


Figure 037: Frame time distribution for a simple pathway

Whenever the pathway divides into branches (e.g. when there is an addiction), Frame Time Distribution function would be irregular:

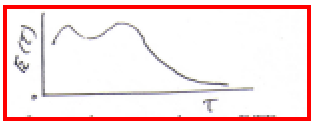


Figure 038: Frame time distribution for a branching pathway

Wherever the pathway is focused or a mass of output reaction with environment recycling is involved, Frame Time Distribution function has a peak:

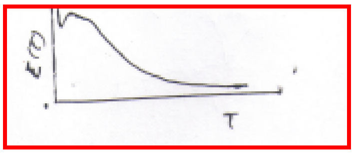


Figure 039: Frame time pathway for a circulating pathway in a mentation

Momentum Balance

In addition to the change of inputs from environment through sensory channels, due to their deficiencies, major error in the brain projecting outputs come from physical nature of cortex as the processing media. The brain is a viscoelastic media with time and location dependence properties. Therefore, the reflection of the input and map of processing products over it depends on the pathway which inputs will be treated through and time of processing. The generated patterns on the outer layer are the product in the shape of: stable, semi-stable or non-stable fibers curvatures changing. If efficiency factor of any of these functional elements would be known, then the correctness of interpreted facts was measurable.

A general mechanism description of how inputs are reflected on the brain and how the reflected inputs are mapped over there after processing was given in volume I and were repeated in different previous sections of this volume and will be summarized as follows:

Outside information as stress inputs enter into the brain from sensory channels. Strings of synchronized firings initiated by inputs, work as electrical currents. Transferring currents in the fibers (bundle of synapses and axons) which change directions create tiny electromagnetic fields, while the created fields impose forces on active fibers in the same time. Fibers are connected by synapses in the networks. Individual fibers absorb the imposed forces by sliding and spring-like move of fibers inside their wraps. Therefore, any moves of individual fiber between two connecting nodes carry an amount of energy and is called em-field energy particle. A definite network of fibers in a segment of layer also will carry a combination of forces between nodes in the network and is called an energy pocket.

Because absorption capability of fibers between nodes and a definite network of fibers is limited, depending on amount of input energy which enters and amount of nutrition energy which boosts active fibers, energy will spread and flow up over a pathway to a point that all travelling energies would be absorbed on it. The magnitude of travelling velocity of energy pockets along the pathway in x-direction can be considered constant (about few meters per second as discussed before), but this velocity is an average of many random individual eddy velocities of fibers and their network segments. For example, if v is the average velocity of energy pockets in a pathway and its pictures on 3-dimensions are v_x; v_y and v_z, then $d\,v_x/dx$, $d\,v_x/dy$, $d\,v_x/dz$ and $d\,v_x/dt$; $d\,v_y/dx$, $d\,v_y/dy$, $d\,v_y/dz$ and $d\,v_y/dt$; $d\,v_z/dx$, $d\,v_z/dy$, $d\,v_z/dz$ and $d\,v_z/dt$ are different parameters that vary in each location relating to em-field particles and create network of energy pockets flow.

The type of particles and pockets flow in a pathway is chaotic and turbulent. Therefore, although the study of flow is not very easy, but a momentum balance would be very helpful to summarize and determine what happens within a substrate and in a pathway.

Lump Eddy and Drag Eddy

An energy pocket is a drag eddy consisting of several lump eddies of em-field units. A drag eddy is an energy particle which is carried by a network of fibers, while a lump eddy is carried by individual fibers between two nodes of connection in the fiber network. Each energy pocket preserves its identity for a distance in a pathway which is called energy pocket characteristic length before losing its geometrical and kinematic properties. A lump eddy characteristic radius is a distance that an individual electromagnetic field, which imposes momentum, keeps almost its general pattern while fluctuating inside a substrate. An energy pocket characteristic length does not depend on individual lump eddy characteristic length, but depends on the integration of all lump-eddies characteristic length within a substrate. Generally, after such distance, both field pocket and energy pocket lose their identity by being absorbed for a part or whole energy. Fluctuating velocity is the velocity of a lump eddy within a substrate and does not change the integration pocket energy velocity individually. At the end of the characteristic length, the lump eddy has a different mean velocity from the adjacent lump eddy. To distinguish between lump eddy particles and drag eddy particles, one can imagine the difference between arrangement of electrons in an atom and arrangement of atoms in polymer molecules. Therefore, the study of lump eddy circles within a substrate will be a future study, but regarding drag eddy (energy pocket) fluid dynamic method of study can be adopted.

Stress Production of Eddy Particles and Energy Pocket by their Velocity Differentiation

Energy pockets (drag eddies) move through a pathway similar to the move of molecules in a channel.

The shear stress, which is produced due to velocity changes of drag eddies between x and y directions, is equal to product of location energy density (erg/mm^3) and eddy velocities in different directions.

On other hand, change of energy pockets velocity in different directions imposes drag forces on a substrate. The amount of these drag forces per unit area are called shear stress which are acting on different directions of a substrate [for example: Ĩ=µ* dvy/dx in x direction]. These stresses all together make a turbulent condition of moving eddies in a substrate, which increases mixing efficiency by turbulence intensity.

Different Terms of Viscosity Property of the Brain

As explained in previous section, spring-like moves of fibers inside their wraps is because of imposing mostly shear stresses and shear stress is correlated to local viscosity against these moves.

For a viscoelastic material like the brain, time function of viscosity (µt), in addition to indication of the brain physical property, reflects histories of strains which were happened in a substrate.

Time function (µt) consists of three terms:

1) A term that is the result of integration of strain changes in long term on synapses level,

2) A term which correlates happening of strain at a specific time which affects strain response at another specific time, in short term, which reflects fiber net level changes.

3) Other terms which correlate working stresses on the layer scale.

Therefore, it can be concluded that different kind of deformation as working, short term and long term are the consequences of the brain physical properties. Later, it will be described that these variety types of deformation maintain patterns which are referred to as working, short term and long term memories.

Pathway as a combination of substrates in series and parallel

Application of stress analysis by infinitive element method may help to calculate the substrate and pathway configurations in the future.

With increase in the number of attractors, activation energy (a), is replaced by a(t) and da(t)/dt is activation time gradient. While activation changes is smooth in the layer scale, its changes is more rapid in the substrate scale and much sensitive in fibers scale. Therefore, large a(t)'s in lower levels can have small changes in higher level, which makes it easy to have different history of the same activated energy pockets at the same time.

There are three directions of momentum transfer: 1) same layer pathway directions (x and y), with dominancy of forwarding direction from backside of the outer layer or middle brain toward front. 2) Two-way attractors' pathway is in the direction of fiber tree from inner brain to the outer layer and vice versa.

Figure 040: A pathway with substrates in parallel and in series

Momentum transfer a) with different directions of layer to substrate components and vice versa, b) with average forwarding direction, c) in addition to momentum transfer from the inner brain to the outer layer and vice versa make the combination very difficult. In any way, the combination of forces in three directions make eddies; drag forces and curvatures build substrates and pathways. The transfer rate can be summarized in simple following forms within a substrate and through a pathway, which is more adopted for energy pockets interactions than it was described in section "Energy flow and interacting rate in a substrate".

Substrate energy transfer rate: $R_1(t)=k*(\text{input energy})^a$ and $R_i(t)=k*[R_i+\Gamma(t)]^a$

Pathway energy transfer rate: $r(t) = \int R(t)d\Gamma$., where Γ is the characteristic length parameter.

"k" [equal to A*e^(-E*t/Ĩ)] is the attractor influence factor on the outer layer pathway.

According to the already explained directions, it can be claimed that combination of momentum transfers in substrates with wider historical memory properties, provide a higher conscious pattern. Therefore, highest consciousness is for pathways extending to the front lobe and lowest for pathways remain in the inner brain and different constants used in above rate formulas can be expected accordingly:

When a = 1, then it is applicable to normal conscious and correspond to normal waking state.

When a<<1, then it is very inhibitory and conscious and is applicable to front lobe..

When a >> 1, then it is very emotional and excitory and applicable for lower brain.

"a" is an indicator of influencing accelerator or attractor strength. Positive magnitudes of "a" represent excitory initiators and negative magnitudes of "a" represent inhibitory influences.

"A" is a factor representing the inner to the outer layers energy interchanges or history factor.

"E" is the substrate activation energy.

Pathway Input Duration and its Frame Time Ratio

A pathway can be considered as integration of infinitive substrates, each of which works as a tiny batch reactor, enjoying input, output, absorption and accumulation terms. All these terms are subject to change with time. In addition, substrates contain two arrangements spatial~~ly~~ (from substrate components level to outer level) and longitudinal (from inner brain to outer layer and generally toward frontal lobe). Taking the said directions into consideration, the entire pathway can be assumed as a network with substrates which are configured in parallel and in series. A pathway product is a parallel-combination of individual substrates and their intermediate products; and a serial-combination of substrates and their by products in series. In its simplest case, k and Ĩ can be assumed, equal for all substrates throughout a pathway. As it was described in section of “Energy Interaction Rate”:

Rate of energy change in a substrate equals k * (input pocket configuration energy)^α

Where: k interaction coefficient and equals = A * e^(-E* t/Ĩ); ‘t’ is the duration of interact and Ĩ is the time frame of a substrate.

“a” can be one or smaller (functioning as inhibitory) or higher than one (functioning as excitory) and very high (for attractors like instincts).

If time frame, A and E were remained the same in all in-series substrates, then energy formula for n*th* substrate could be related to energy pocket initiating the pathway as follows:

Energy input in n*th*-substrate in series = (energy input in initiated substrate)/(1+ Ĩ*k)^n

The term “Ĩ*k” is the rate of input energy interaction in initial substrate (e.g. a sensory substrate). Because of region structures and related frame times, it is expected to be higher than 1 for middle brain substrates and much lower than 1 for the front lobe substrates. However, generally it is around one for outer substrates. Applying such estimations and their counter check with experiments measurements can guide us to know more about pathways and their differences in different regions.

Determination of a Pathway by Static Measurements

As explained before, statistical measurements can also be employed to determine a pathway.

A pathway consists of several substrates and it works as an operator to combine interaction rates in all involved substrates; rates variance; rates skewness, time-frames distribution and cumulative energy distribution functions.

Mean frame time for a mentation activity is integration of individual substrate interaction duration for substrate divided by the total mentation time.

Rates variance is the square of the standard deviation which indicates the spread of the distribution.

Rates skewness shows the extent to which a distribution is skewed in one direction or another with reference to the mean.

Time frame and **Cumulative Distribution** functions help to study different mentation types, which may occur in a definite pathway, considering the mentation rates characteristics.

Whenever there is a clearer pathway, time frame distribution is normal.

Whenever there is more branching, time frame distribution is irregular.

Wherever the time-frame distribution has a sharp pick, mentation pathway is a closed loop and it starts and restarts again.

In the future, such measurements can be checked against the experimental data such and if successful, can be used as a procedure for mapping the activity predictions on the outer layer.

Mentation and Number of Involved Substrates

In this section, a summary of different mechanisms in brain which have been reviewed up to now, is repeated as following and in end the momentum measurements as a function of momentum diffusivity coefficient and energy flux gradient will be discussed.

Brain layers are an electro-firing transmitter with variable directions of synapses, axons and nerves.

Tissues and fibers, as media for momentum transfer, oscillates by absorbing and discharging of energies related to induced electro-magnetic field forces. If it is assumed that strains fluctuations are straightly related to oscillation, then a phase of oscillation would have two parts of: 1- substrate absorption of energy in the form of slight moves of fibers against tissues and 2-substrate transfer of excess of energy into next substrates within pathway.

Slight spring-like moves of fibers inside their wraps is not prefect and any move does not return to origin point. Therefore there would be a continuous gradual increase in layer curvatures, which layer digests them by consolidating fine curls in it to maintain its general shape.

Brain aging is another parameter which turns the increase of curvatures into a more complex phenomenon through which some of curvatures degrade and it seems that the brain has the highest efficiency during the mid-life, because of the most perfect combinations. Free energy flows with each momentum transfer which is accompanying a mentation. There is a chain of continuous exchange of energy, passing through the substrates. Energy exchanges happen by means of conversion from kinematic to potential which is absorbed through the way.

Number of substrates in each mentation is the number of steps between operating line of kinematic energy and equilibrium line of potential conversions along a pathway.

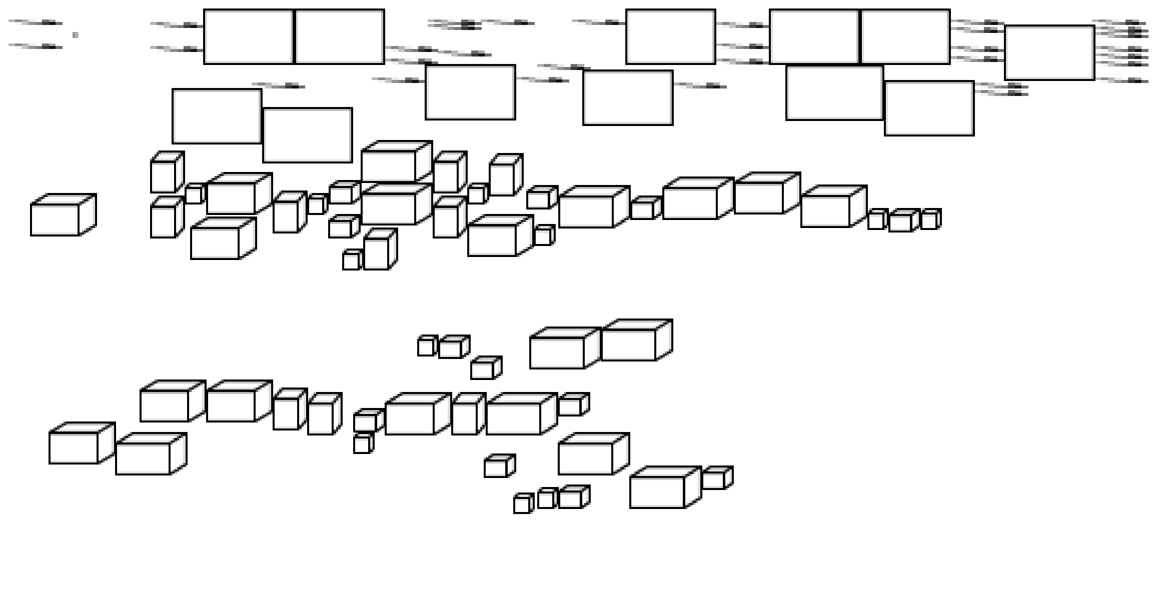


Figure 041: Substrates arrangement in converging and diverging pathways

Rate of momentum transfer generally equals the driving force for the transfer per resistance against the transfer.

For viscoelastic materials, there is a function of viscosity changes through the pathway. Initial condition of strain forces and time and the related properties have matrix values.

Forces have three types: tension, compression and shear. The tension and compression parts as normal shear forces are considered in momentum transfer and shear forces as the source of deformation on the substrates.

Synchronization proceeding velocity and therefore momentum forces rate are assumed constant along the pathway but variable in random directions. In other words, the average velocity is the velocity along the pathway, with many fluctuations around it. In complex systems like brain, the fluctuating velocities, due to chaotic nature of flow, are initially very high in substrates components scale, but slow in layer level. However, the random velocities nullify each other in forwarding axis. The mean value is almost zero in spatial direction, while the average forwarding velocity remains almost the same and very slow. In fact, the difference between these fluctuating velocities produce eddies and vortices. The product of these eddies introduces drag forces on the substrates. Eddy drag force per unit area is the shear stress acting on a substrate and that can be integrated for the whole pathway to calculate total energy which is consumed for a mentation. Eddies and energy density move through outer layer in a manner similar to the molecules in a gas or liquid.

With transfer, depending on Positions, viscosity and energy density are considered as matrixes and their ratio (ratio of viscosity per density) is called momentum diffusivity coefficient on the pathway. A momentum pocket moves a distance called the mixing length before it loses its identity. Therefore, "L", as a distance a small pocket of energy related to substrate which was exposed to momentum pocket, retains its identity while travelling the entire length of "L".

Eddy is a lump energy particle, while a combination of eddies create a drag (an energy pocket) and drags create a wake (a pathway) which is initiated by a rippling input.

A drag symbolizes a substrate and presents a pocket of energy. Instead, a wake follows a pathway related to a mentation and has two parts of standing and travelling. It is a fractal-like pattern which symbolizes a concept to be stored as memory or conveyed.

If ῡx is the velocity of a drag or a pocket of energy for a small length of a substrate, we can then assume that fluctuating drag velocity ῦx@(y)/ L equals (ῡx@(y+l) - ῡx@(y))/Δy or ῦx@y= L * dῡx/dy. Therefore, within a substrate, functioning frequency is approximately the same and average product of velocities of two different coordination is proportional to (-

L^2)*(magnitude of dῡx/dy)* dῡx/dy. The term [- L^2*(magnitude of dῡx/dy)] is equal to momentum diffusivity coefficient (ε). Momentum diffusivity coefficient is in fact a ratio of energy eddy viscosity per energy density. It is almost constant for a substrate but variable through a pathway because of both variables viscosity and density.

Therefore, momentum transfer rate on a pathway is equal to the product of ε * d(ρ*ῡx) /dy. In general, momentum transfer rate is a function of momentum diffusivity coefficient (ε) and energy flux gradient in a mentation.

However, during a waking time (from sleep to sleep), which many mentation occur, velocity gradient changes because of accumulating of confined. In this general case, momentum transfer rate is an integration of momentum changes by time and over the whole layer..

If we can apply the general formula for momentum transfer rate in a media like brain, then it can be calculated by a term like ρd(ῡx*ρ)/dt – ε*d^2(ῡx*ρ)/dx^2, which is driven from an unsteady state balance around the momentum generation, absorption and transfer [Chistie J. Geankoplis, "Transport Processes ad Unit Operation", 3rd edition].

Experimental "drag coefficient" measuring may work to calculate the momentum transfer rate, if the traveling energy at the time can be calculated through measuring of frequency and power using methods like fMNR or similar alternatives. Drag coefficient (Cd) correlates pathway geometry with related momentum diffusion flux considering energy generating pattern (G(ε)) and operating pattern (R(ε)).

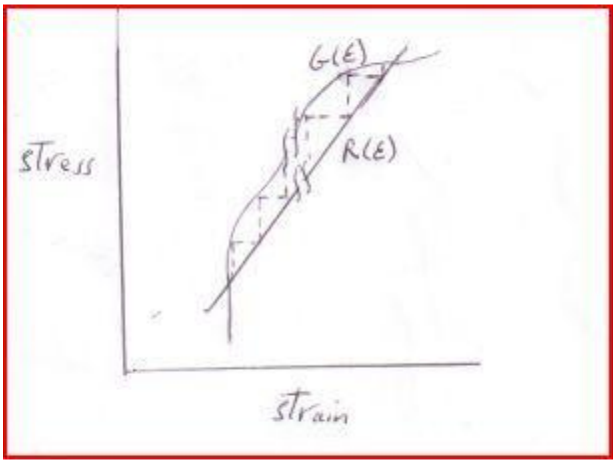


Figure 040: number of substrate in a pathway (equals number of steps between generating and equilibrium functions in a pathway)

Branching

Branching is considered to be ~~a~~ secondary flow, with transferring energy on two or more adjacent substrates. If the main stream and its branches is called wet area or mentation channel, both average velocity or time - smoothed stress travel (< $\overline{\upsilon}$ >) and branch expanding velocity ($\overline{\upsilon'^2}$)^(-1/2) are important parameters in shear transfer along a pathway. Their ratio $\frac{\sqrt{\overline{\upsilon'}^2}}{<\overline{\upsilon}>}$, as an index for shear transfer, is called intensity of chaotic behavior of transfer.

Branching associated stress can be integrated as follows:

Viscosity (μ), energy density ($\int_e$) and angular velocity (w), are wet area nonlinear properties which change based on location and time.

The branching has two different types 1) incoming, which perceptually questions the main stream (inhibiting or reinforcing the stream) or 2) outgoing, which perceptually confirms the main stream with conclusion.

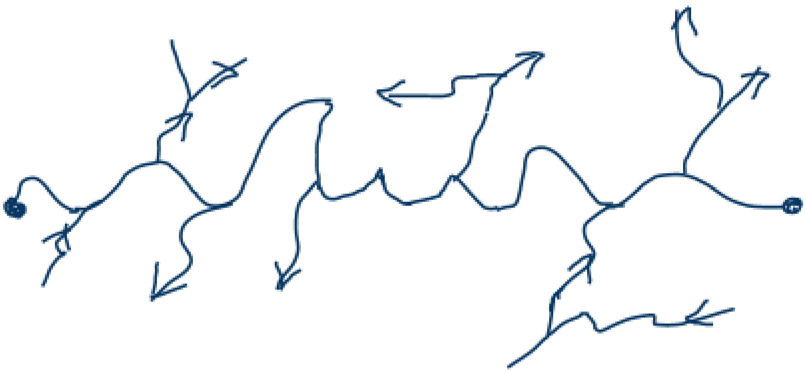


Figure 041: A branching pathway

A wet area can be:

1) **converging**: by decreasing in wet area width along proceeding direction.

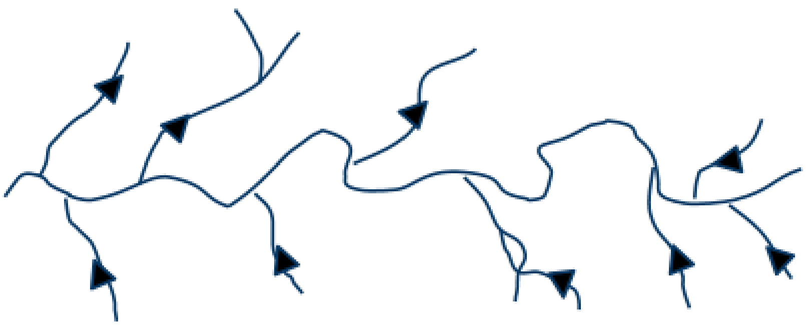


Figure 042: A converging pathway

2)diverging: by increasing in wet area width in proceeding direction.

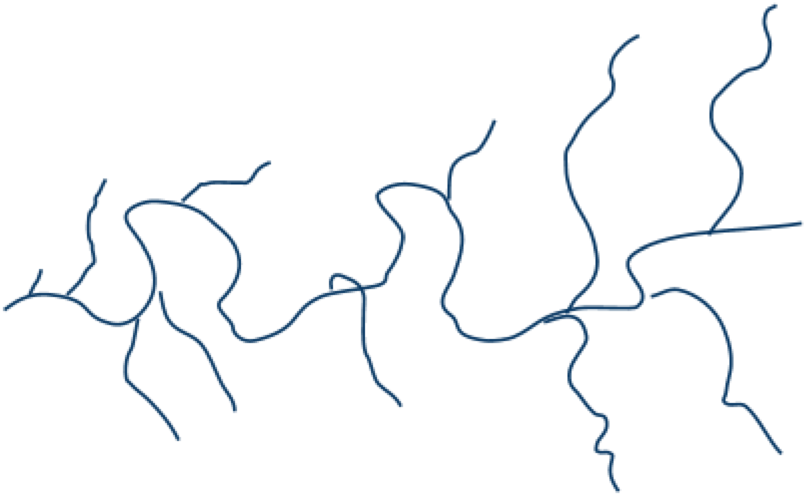


Figure 043: A diverging pathway

3) **Steady:** by having wet area width almost constant in proceeding direction.

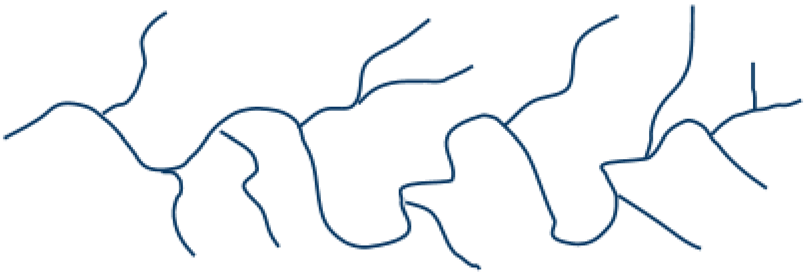


Figure 044: A steady pathway

Branch streams in parallel layers, may increase in local confined energy too. The flow which is slower in a layer works as relative resistance for adjacent layer stream. This is significant for upper layers next to brain surface. In long term, stresses caused by the resistance will increase in curvatures. One consequence of such phenomenon is momentum transfer angular velocity which will combine with normal velocity.

In short, a main stream can be expand as:

1) Branching out or decomposition: input decomposes to components and initiates separate sub-branches.

2) Collecting in or composition: inputs are synthesized in a substrate and a byproduct will born.

3) Jumping between different fractal configurations of synchronized firings or isomerization: arrangement of a present pathway reconfigures from one image to another one, resulting in a different products.

4) Proceeding by making longer chains of energy pockets or polymerization: a mass of energy pockets produces a heavier and long branched chain of pathway.

Temporary Decay in Pathway Substrates

Intermediate energy pocket, which enters in any substrate of a pathway, after having interaction with the substrate desorbs from it to be fed to a next substrate. This will happen for several substrates in the pathway, creating a temporary change in their energies and configurations. Some intermediates or product eddies will be absorbed within substrates as confined energy.

Therefore, substrate activity will change by time. Activity function shows how the activity changes throughout time. The efficiency of a substrate component, in a pathway is a function of the rate of substrate deformation and it is the function of the rate of activity that changes by time.

The rate of daily substrate decay is: A FORMULA

Deactivation of a substrate can be due to accumulation of confined energy pockets in substrate or its deformation, due to high stresses, shocks or ages.

Turn-over frequency of any substrate during the day is the number of energy pockets interacting with it and leaving it per unit of time.

Accordingly, pathways gradually spread over layers and lose their governing role on mentations during the day to the higher catalytic ones. It means that as the free flowing through substrates increases, concentration ability and consciousness will reduce during the day.

At the time that almost all active surfaces become deactivated, the required activation energy is so high that brain stops to receive input from the environment.

The confined energies and products which have deactivated substrates are to be consolidated or released in order to retain the elasticity property of the brain, known as regeneration process. This process include a wide spread transfer of energy all over the brain with complete lack of focus or any inhibitory. Attractors located on lower levels of brain will govern the pathways. Further to that, the process includes reconfiguration of layer by addition of small curls in fibers, axons and synapses to balance the layer for configuration energy.

Outer Layer Substrates in Connection with Middle Layer Regions

Any substrate that makes resonance with other substrates will be coupled with them. Resonance happens when synchronized firing oscillations of a substrate, is approximately equal or a factor of any other far distance substrate frequency and once happened, the amplitudes will be added. The coupling substrate is called attractor and if an attractor is a memory, then by coupling, it would be recalled by means of the momentum energy transfer with its specific pattern as already saved in the lattices of the hippocampus in the middle brain or elsewhere. Coupling can be reverse so as to save a memory of interactions into other substrates which was referred as condensation.

Standing part of a momentum transfer may be integrated within the lattice of hippocampus, where it makes the structure of related memories within the lattice more stable. Later, in a reconfiguration process, the transferred momentum in a pattern would be consolidated as a memory. The spot memories integrity would be increased in complexity and surrounding memories may be distorted to some extent and in worst cases, some may be erased in final reconfigurations. The configuration of spot substrates for the memories would be condensed and later the memories seem as if they are remote and old.

By synthesizing of memories in lattice structure of middle brain, when they are recalled in course of a mentation:

1) The memory complexity would increase,
2) The concentration would increase,
3) The judgments and decision making would be more prefect,
4) Extrapolation and forecasting would be more correct,
5) The planning and scheduling in relevant mentations would be more effective,
6) Modulation and creation of new symbols is possible.

Type of Saved Patterns

Saved patterns can be categorized on the basis of life span and range of plasticity-elasticity properties of the related substrates. They include:

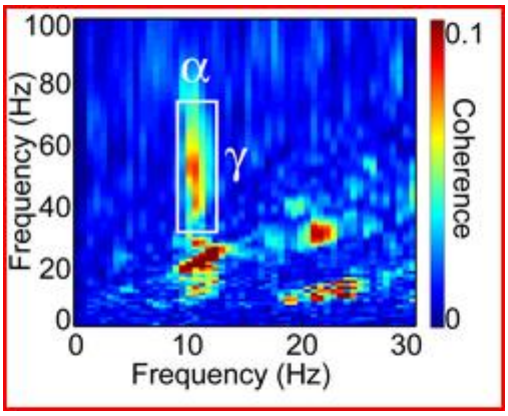
1) Active intermediates or flashing images which are not stable and take part in another interaction as fast as they are created. They are mostly located in highest elastic places like substrates or pathway curvatures.
2) Short term memories with semi-stability condition; configured on substrates with intermediate elasticity ranges.
3) Memories with higher stability condition sit on fine configurations of substrates' components, especially synapses curvatures.
4) Most solid information is stored in genetic pathway curvatures and instinct data shapes on molecular structures.

Bound of Frequency for a Pathway

A pathway is a stepwise synchronization progressing from substrate to substrate either in parallel or in series. However, connected substrates should couple together in any of transfer-activation or resonance-activation. Coupling happens when frequencies are either equal or are a multiple amount of one another. Different bounds of frequencies are known in the brain. In one hand, range of frequency depends on layer or region physical properties and on the other hand, substrates in one layer or region would be coupled with different frequency. In section "Substrate Components Catalytic Property", active sites with catalytic properties were discussed, which are cited in the sub-molecular level (especially genes) of a substrate. In the substrate definition also, it was said that a substrate is a group of fine potential hills and valley made by different electromagnetic fields, but there is a very smooth changes between them so that they retain almost a similar physical properties inside the substrate. Therefore, it can be concluded that transfer-activation in a region can be coupled by their component bonds of em-field and sub-molecular scales.

If two frequencies are coupled then their amplitudes will be added together, providing higher strength. A powerful pathway happens within a narrower bound of frequencies and similarly even a set of pathways in a mentation has a distinguished frequency bound, while an effective mentation should have a narrower bond of frequencies. Parallel mentations have distinguished frequency bounds and the dominant one is the one with higher strength.

Following coherences between different brain frequency bonds show coupling of different ranges of bonds as they are found experimentally [Gamma Power Is Phase-Locked to Posterior Alpha Activity, **Daria Osipova**[1*], **Dora Hermes**[2], **Ole Jensen**].



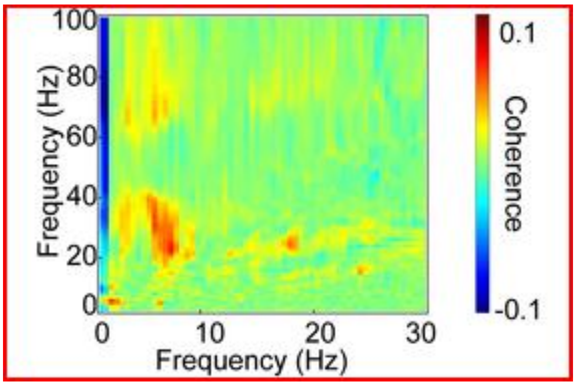


Figure 045: Cross Frequency Couplings for different Brain State

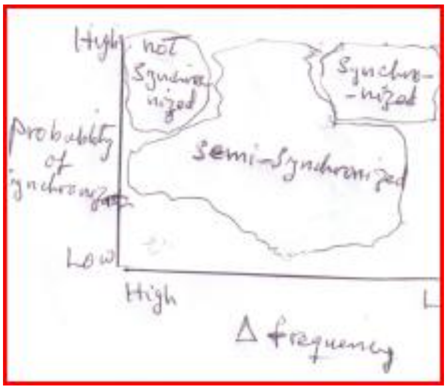


Figure 046: Degree of synchronization Probability vs. Frequency Spread

A plot of logarithm of probability of being synchronized against time changes also shows that synchronization intensity reduces in wider time frames.

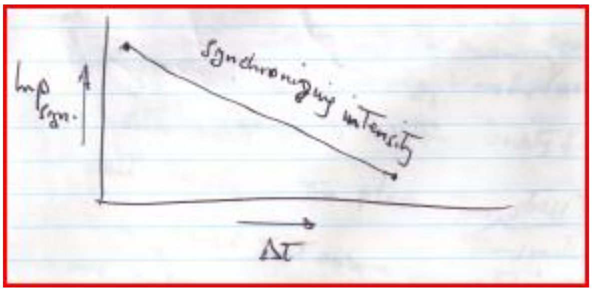


Figure 047: Synchronization Probability vs. Time Frame Changes

The plot of probability of being synchronized logarithm against frequency difference and time frame logarithm indicates that pathways have different narrow bounds of synchronization frequencies.

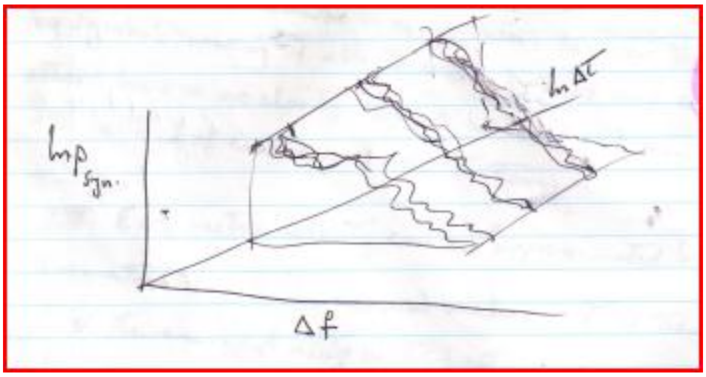


Figure 048: Frequency Bounds and Mentation Clarity

Each strip in the above figure shows a definite and clear mentation while between bounds energy pockets configurations are not distinguished and there is spread clouds of them.

In case the frequencies are a factor of each other, they reinforce each other by resonance phenomenon.

Chapter 4: Mentation

Mentation Process

Mentation process is a chain of interactions, consisting of:

1) Initiation: formation of an active intermediate energy pocket
2) Chain of excited substrates or intermediate products to transfer: interaction of an excited substrate as an active intermediate with coming energy pockets, produce another active intermediate within the pathway.
3) Termination: deactivation of the active intermediate to form product/s at external layer.

A substrate consists of a group of fibers related neuron firings which are synchronized within a defined time-frame and because of that, the substrate is segregated from other substrates.

Segregation is not absolute and degree of segregation defines how much they overlap each other. It is a strong function of the “variance of its fibers activity durations” and “variance of duration of the whole substrate synchronized firings”.

Mentation is recognized as the chain of substrates interactions that grow together all along a set of pathways with tiny time sequences.

The number of reacting substrates in one mentation process is mainly a function of the mentation’s mean activity time and standard deviation of its mean path”.

Mentation Stages:

A whole mentation is consisting of the following stages:

I) Sensory **inpu**ts as external stimuli or an internal attractor free stimuli (like: Visualizing and imagining; internal hearing; feelings of touching, tasting, smelling or heat content),

II) **Processing** by a transfer of stress in the shape of temporary deformation waving, consisting of:

1) Synchronizing current of firings in a pathway,

2) Electromagnetic forces on fibers (self-induction),

3) Transfer of shear stress followed by induced drag forces and combination of electromagnetic fields on substrate,

4) Waving of temporary curvatures in transferring pathway,

5) Modulation (Symbolization or conceptualization) as a combination of few or several of the above products,

6) Product sending out including: perception and emotion expression output motor commanding.

7) Periodical consolidation of absorbed energy during transferring.

Active input information or high confined substrates simulate a flow of energy pockets directed by attractors. They have interactions in the way with variety of location-continued and resonance-continued substrates in the pathway.

Through such a flow, mentation products develops for the static, dynamics and kinematical elements, considering their standing and moving parts with different interaction rates in the way, considering substrates’ time frames, catalytic properties and influences of attractors.

Simultaneous mentations

Chain of interactions in a layer can happen in the following types, when A is input and B, C, D, E and F are intermediates, mentation byproducts or products:

1) In series: $A \xrightarrow{K1} B \xrightarrow{K2} C \longrightarrow$

2) In parallel:

$$A \longrightarrow B$$
$$A \longrightarrow C$$

3) Complicated:

$$A + B \longrightarrow C + D$$

$$A + C \longrightarrow E$$

4) Independent:

$$A \xrightarrow{k1} B + C$$
$$D \xrightarrow{K2} E + F$$

Degree of Focus

Ground potential level is the total energy corresponding to each section of the layer and it is related to general fibers curvature.

Sensory input is limited by input channel fibers capability to receive and transfer to the brain input zone.

Degree of focus is proportional to the difference between input free energy and ground energy conducting to recirculation portion of intermediate products, which would be checked with environment.

If input strength is high or ground is low then recirculation of intermediate products is high and the person is focused.

In normal conditions of input strength and ground level and recirculation of intermediate product, the person would be semi-focused.

If input strength is low and ground level is high, recirculation of intermediate products is normally not sufficient in this case and the person would not be focused, and

If input strength is equal or lower than the ground, then it would not be qualified to enter.

Ground level slightly differs during the day with accumulation of confined energies and concentration would be more difficult, but will be reduced by relaxation and returns back to normal fresh condition after sleep regeneration.

When the mentation is focused, its pathways-substrates time frame distribution is wide enough for higher mixing and more efficient interactions, it shows that the recirculation of the intermediate products is good and mentation has a good attention factor.

Hyper-synchronization in outer layer

Because of difference in physical properties in different layers and areas, firing time probability distribution density is considered as t^(-5/4) for outer layer back side and t^(-3/2) for front lobe.

Time frame for each substrate is assumed about micro-second and time frame for a pathway in a range of milli-second.

From calculation given in Appendix III and following resulting curves, it would be concluding that:

1) difference of substrate time frame by 0.0001 causes: a) wide changes in frequency of Gamma 1 and Gamma 2; b) wide distribution of firings probability density
2) differences of substrate time frame by 0.00001causes: a) moderate changes in frequency ; b) moderate distribution spread but high distribution density

3) difference of substrate time frame by 0.000001: a) almost constant frequency; b) least spread distribution of firing probability function; c) very high firing density ; d) hyper synchronization in both gamma 1 and gamma 2

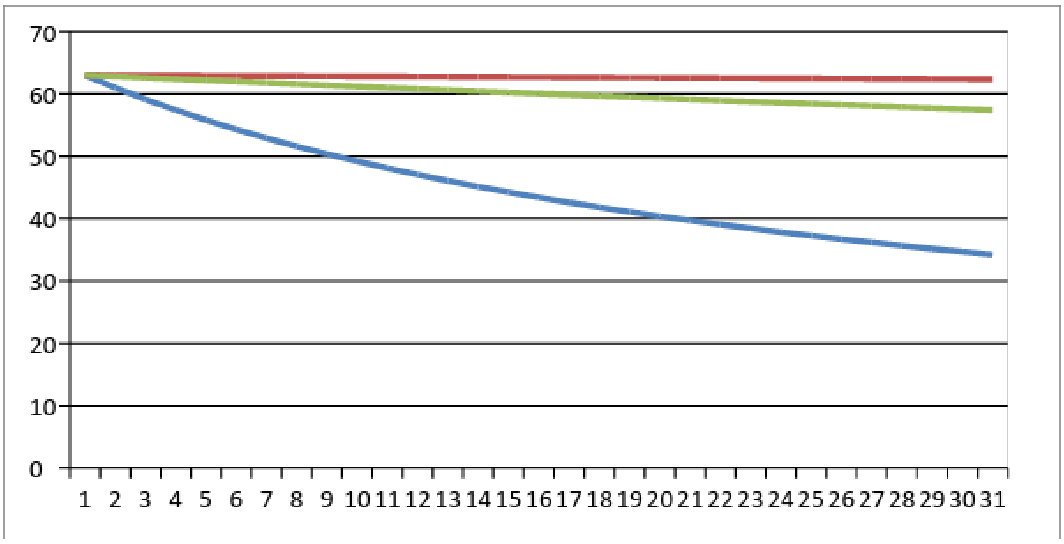


Figure 047: hyper synchronization for substrate time frames variation by .00001 in outer layer back side (series 2) results in easy couple ability with attractors in sensory area; therefore high capability to make multi-pathway thoughts. (X-axis shows the data number)

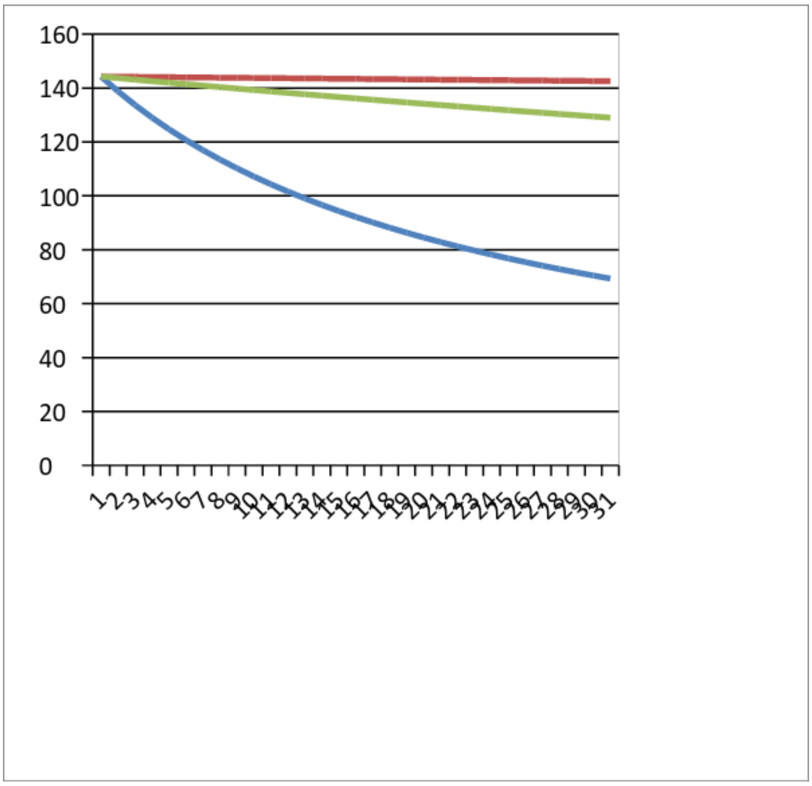


Figure 048: hyper synchronization state for substrates with time frame variation of 0.00001 (series 2) in front lobe causes a state that is very high energetic and easy couple able with attractors in sensory zones, therefore capable to make multi-pathways thinking. (X-axis shows the data number)

Hyper synchronized conditions in outer layer and especially in front lobe is available when the layer is fresh and regenerated and this condition decreases during the day. Further to that, higher uniformity in substrates turn over frequency (number of times that energy pockets enter or leave a substrate) is important factor to have more distributed stored confined energies over the region, making more uniform sizes of energy pockets.

In front lobe, because of hyper synchronization state and high frequency, energy pockets are most energetic to communicate with sensory zones and expression channels before sending signal to motor outputs for any action. Therefore, energy pockets build high-multi-pathways mentation as rational thinking against limited-pathways as automatic thoughts in middle brain and single-pathway for reflexive behaviors.

In outer layer backside, because of hyper synchronization state and high frequency, energy pockets are sufficient energetic to communicate with outside through expression channels before sending signal to motor outputs for any action. Therefore, they build multi-pathways mentation as rational thoughts against limited-pathways as automatic thoughts in middle brain and single-pathway as reflexive behaviors.

Mentation during Sleep:

During sleep, input and output input channels are blocked. Spread intermediates are activated by attractors of any kind.

Depending on the distribution of accumulated confined energy over the layers, such a flow-net of intermediates is formed to make an overall balance on the layer.

Such redistribution in psychological term is the satisfaction of overall emotion mood and in the physical term it brings fibers and tissues to normal range of elasticity by transmitting confined energies to balance ground level over the layer. However, such a flow-net is not sufficient for geometrical balancing of the whole layer and it goes under reconfiguration by retaining the overall configuration through creation of fine curvatures of synapses in the main curvatures of the fibers. In REM period, the flow-net of narratives releases layers from strains, bringing back substrates to origin positions. However, this will not retain geometrical equilibrium to the layer. During the NREM, recovering of the geometrical balance will be maintained by consolidation of extra fine curls in geometry that would save the relevant memories. Progress of balancing is regulated by the number of REM and NREM stages.

Therefore, sleep is a regeneration process to relax stresses by releasing confined energies and consolidating synapses with detailed configuration. Changes in synapses scale encode memories which sometimes may distort the previous memories.

By release of the accumulated strains on different locations, a flow of releasing energy pockets from spread locations on the layer starts, the pathways of releasing locations would be attracted with different memories, producing delights and “just-know” products as dreaming.

The difference of mentation activities during waking and sleeping time (as regeneration period) is summarized as below:

In sleep, there is no input from the environment. The path is wide spread and limited by none or less inhibitories. Therefore, any flow of images or concepts, in the shape of energy pockets compared with waking time would be cloudier and frame times for energy pocket would be much shorter. It means that due to the strong uncensored attractors, interaction rates are high and there is no recirculation of intermediate product, which due to the slow transfer rate through inlet and outlet channels decreases the rates very much.

Chapter 5: The Layer

Types of Substrates and their Specialty

Substantiates located in different layers have different specialty which are created by substrates active sites like genes as substrate molecular components and layer physical property. Procedural substrates are mostly located on the outer layer and advance types of them on the front lobe. Declarative information is saved on the middle brain, including attached emotions.

Working memories are intermediate energy pockets in terms of mentation durations in terms of seconds, while short term as well as long term memories are long term attractors for mentations and their integrations by fine consolidation curvatures shape higher level curvatures and gradually build the functional substrates in long term.

Memories, as already discussed in previous sections, are saved in structure configuration of a substrate and they are connected in the lattice of substrates in each layer. However, in the course of a mentation only some of them have chance to participate in a mentation, depending on the substrate required activation energy and inputs or attractors which have influence on interactions.

In summary, configuration of firing trains by means of spike channels sizes and distributions, when excited, recreate memory types as follows:

1-Procedural memories: Functions, rules and procedure and operators for actions are stored in these memories.

2-Declarative memories: Solid information about facts like names, numbers, symbols, etc are stored in these memories.

3-Short term memories (STM): They are semi-stabled with limitation for capacity and life span. It can contain few pieces of information which are shaped on the substrate level.

4-Long term memories (LTM): They are shaped close to plasticity range of tissue-fiber and their components level and may last for longer time.

5-Solidified genetic and instincts: Their structures on the brain are shaped beyond elasticity range and formed by plastic deformations in molecular structures.

Further to general categorization for specialty, origin procedural memories are formed mostly in the outer layer; origin declaratives in the middle brain, but short and long terms of any type as secondary or tertiary memories almost everywhere. Origin instincts structures are located in the inner brain. The main reason for that is the point that, the outer layer is made of higher flexibility and wider elasticity media, while it is more rigid in the middle brain and rigid in the inner brain. More rigid media is a proper place to fix structures and more elastic material for procedural which are capable to have quick changes in behavior from very static to very dynamic.

Channeling Pathway and the Mood

Input feeding duration, strength, frequency and pathway frame time are different parameters that define termination of a pathway as well as its occurrence as a mood. If the duration of input per pathway time frame is small and much smaller than one, then the pathway would be an accidental pathway. But if input parameters product per pathway frame time is high (close and higher than one), then pathway will work as a mood and creates channeling phenomenon which with the lower required activation energy for consisting substrates, direct variety of inputs to the same terminating conclusion.

A Model which can be adopted for Energy Transfer in a Channeling Pathway

One of the fluid dynamics models, which have some similarities with energy transfer process in a pathway, is fluidizing particles bed. In this model blowing of inert gases fluidizes the powder or pellets throughout the bed and the patterns of the cloud of these materials make a fractal of energy particles distribution through the bed. The type of flow is energy transfer accompanying particles. Similarly, in the outer layer, the type of flow is energy transfer between substrates locations. In both cases, variety of pattern fractals is made within clouds of energy pockets. In fluidizing bed, the media is a clean neutral gas, which can be refined (regenerated) and used again as a carrying media. In brain, the media is fiber and tissue, which needs to be regenerated periodically. Similarly, there are varieties of spot frequencies of energy particles inside the brain. There are varieties of vibrating particles inside fluidizing bed as well. In the fluidizing bed, the total drag force and its consequence momentum is a function of bed dimensions and particle physical properties. Similarly, within a pathway, the drag force and its consequence momentum is a function of the pathway width and the energy particle physical properties (like eddy viscosity and density).

In conclusion, application of fluidizing bed model can be successful to study energy transfer through a channeling pathway.

Elasticity Limit and Plasticity Property of the Brain Substrates

Typical stress- strain curve for three levels of regions over layers, the substrates and their component in the brain surfaces were discussed in section of “Fibers tissues stress-strain characteristics” in volume I. However, they are subjects for further studies.

Strains and relaxation are limited to the elasticity ranges. Different ranges of elasticity (corresponding to fibers, substrates and layer), host or connect to different types of drag eddies as substrates and therefore there would be beds for different category of mentations. The substrates configured by short term memory are located on the higher side of the elasticity range. Substrates which are configured with long-term memories are located close to of the plasticity range which is formed for instincts and other genetic behaviors. Referring to three levels of spatial configurations for sub-substrates, the substrates and the brain layers and having substrates and sub-substrates dominancy in mentations during sleep, dreams follow irregular pathways, being attracted by substrates and their components. Therefore mood (layer curvature) has less influence on them. Therefore, narratives of dreaming are full of subconscious memories. Besides, many instincts are embedded on them. Related substrates release their daily stored confined energies and recover their elasticity properties.

During waking time, the layer stress-strain curve will be gradually shifted to more flat shape, so that it shows more rigidity to strain and temporary tends to plasticity characteristics. In such a condition, the threshold of activation potential is so high that input information energy would not be sufficient to be fed in and the brain stops to accept any external information afterwards. It would be the case with sending out of the mentation products to the environment as well. The brain goes under rest and consequently, sign of entropy production rate changes to negative, which is sleep stage characteristics. During different stages of sleep: 1) consolidation of newly born memories of the daily events would occur and 2) balancing of ground energy over the layers by flow of energy excesses from high tensed points to the lower potential points would be processed.

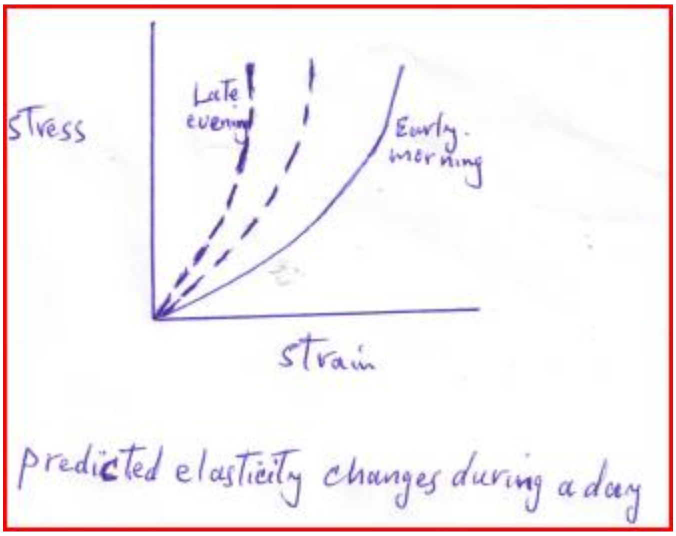


Figure 049: gradual change of stress-strain relation curve during waking time

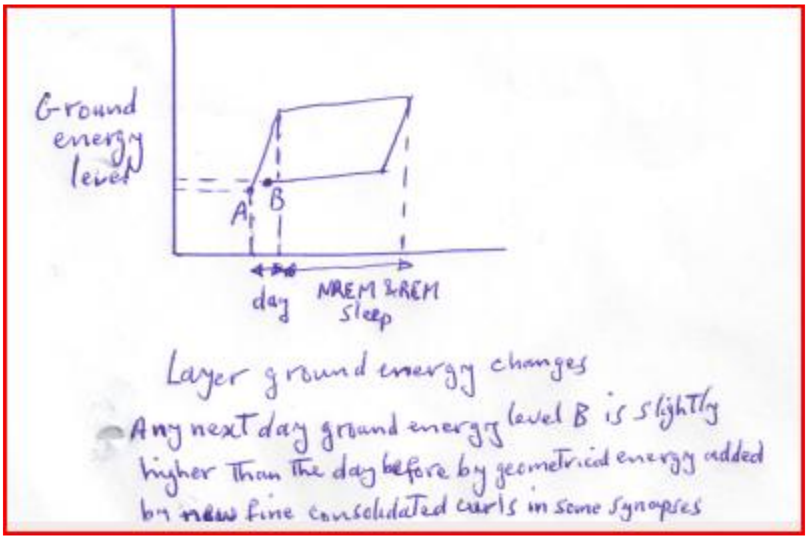


Figure 050: A schematic Pattern of Ground Energy Changes

Sleep is essential for these two regeneration processes to bring back the brain to normal efficient waking time.

Physical Property of the Middle and Outer Layers in the Brain

The periodic shear stress which is introduced in any cross section of middle and outer layers of the brain will maintain an oscillating motion with tiny amplitudes, according to its physical properties for the viscous and elastic responses to the shears.

Formula…………

For a media with complex viscosity like the brain, there are two components for the viscosity which both depend on frequency.

For mentation process with small-amplitude oscillatory shear flow, the following relations may exist for the viscosity behavior:

Silly Putty is a well-known material which may show similar behavior. One of the first studies in this subject is a detail study of the brain behavior to the internal cross section shears for similar magnitudes that function in the brain. Silly Putty is a linear viscoelastic which should cope to very rapid stress changes. In such situations, the material behaves as an elastic solid.

According to the Generalized Maxwell Model for such a material:

……………

The formula describes that the stress at time t depends on deforming speed gradient at all the past times t*. However, memories related to t* are closer to present or t is stronger than a memory related to a very remote t*. The G(t-t*) portion of the above formula is called the relaxation modulus.

The numbers of relaxation times, because of the linear viscoelastic property of the mentioned zones, are as frequent as the media degree of freedom [Transport Phenomena, 2nd edition, 2002, R.Byron Bird; Warden E, Stewart; Edwin N.].

Daily Decay in the Outer Layer

Energy pockets are produced, as intermediates, by the transfer of em-fields and attractor interactions. This continues for several substrates along the pathway, changing a bite in their energy contents as well as shapes. Some of fine pockets remain as standing wave, increasing the location potentials, while the others move forward.

Therefore, activity of any position, depending on the mechanical property of the location, especially its viscosity toward rotation shear forces changes over time. The rate of interaction in any location depends on the geometry of substrate as well as its on-time mechanical property. It is assumed that all kinds of potentials including chemical reactions are included in its geometry or configuration energy.

The rate of decay in the layer is due to the change in elasticity property by adding confined energy and approach to plasticity limit. In addition to these daily changes, decay can be caused by shocks or aging which deactivate any location. Turn-over frequency of any substrate during the day is defined as the number of the times the substrate has gone under stress during waking time.

Accordingly, the pathways distribution would be gradually changed over time, looking for higher efficiency in interaction and elastic routes. This would limit the focusing degree in specific mentations. When the layer generally becomes deactivated, the required activation energy is so high that almost input gates would be closed. Afterwards, the regeneration would be started to retain the elasticity range of the layer again as the day before. This process includes uniformities of the ground energy and recovering the same general configuration by adding new fine curls in deep level of the substrates all over the layers. With no recirculation of intermediate pathways' products, sleep related mentations lack in focus or any inhibitory influence. This makes the sleep mentation nature to be different from that of the waking states.

Change of Mentation State

Fine curvatures on the synapses work as roughness through mean pathway and introduce a kind of friction to conducting the flow of energy pockets, because of introducing more random velocities. Friction factor (f) is defined as how severe the roughness affects the flow of energy and a combination of pathway properties (average interaction rate; pathway width; energy density; reciprocal of viscosity) is summarized as an Index number. A curve of "Friction Factor vs. Index" gives very interesting information regarding the sequence of different states of mentation including: “Focused Waking”; “Semi-Active”; “Relaxation” and “Sleep”.

```
     !   Focused thinking
     !
     !                      Semi-active thoughts
  F  !
     !                                       Non-active mentations
     !
     !                                                           Dreaming
     !
     !
     !
________________________________________________________________________
```

Index (Patterns Rate*Channel Bandwidth*Energy Density/energy Pockets Viscosity)

Fig… Mentation Flow State

Mentation flow is a conduction of intermediate energy pockets through related pathways.

Mentation state changes from “focused active” to “sleep” by increasing the brain ground energy content. Falling in sleep happens by approaching the maximum possible stress absorption limit as confined energy on the layer. At sleeping stage, the input channels, because of increased ground energy, would be closed to the new entries.

Consolidation and excess entropy discharges start with changing entropy production rate sign to negative when input energy approaches zero. At the end of the regeneration period, when the activation threshold is reduced to normal, then a shift from sleep to awaking state happens.

There can be some delay in inputting free energy even when the ground energy reaches lower than the input channels limit and excess entropy would be discharged. It is due to the point that negative entropy production rate is still fluctuating between negative and positive. This delay- if sleep is not disturbed- would continue up to the point that entropy production rate approaches higher than zero. The inner brain is the center for providing attractors to the input-output zone substrates to change the state.

Conclusion

- There is a continuity between focused; semi-focused; not focused and sleep mentations. The difference is derived from the kinematical properties and pathway characteristics.
- In macro-scale, the mentation can be quantified for different parameters like interaction rate constants, interacted energy, mean consumed time and the number of pathways.
- A kinematical model can possibly be suitable to be the counter checked with the neuroscience studies for resolving many not discovered phenomena in the brain.

Several Patterns Configuration in Pathway to Reach an Equilibrium State

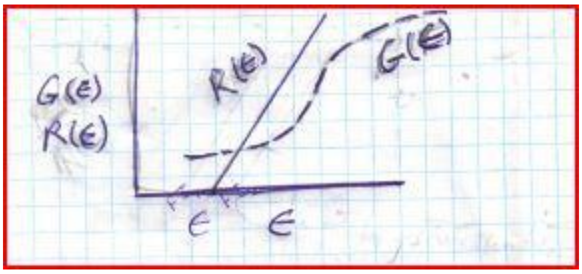
Configuration of hills and valleys, carrying energy pockets, build energy plan over the layers. Kinetic of hills and valleys fluctuation, in terms of stored energy changes in any kind of: chemical, electrochemical or electromagnetic field, approaches equilibrium geometry. Equivalence configuration is a common target for any interacting system and limits distribution spectrum of the varying parameters and considering our study, spreading stress over the brain layers is the state that random momentum diffusion velocities find a least dispersion condition. Configuration stability for the involving substrates structure or travelling energy shape is linked to the initial conditions, activation energies and influencing attractor's amplitudes.

During stress spread and interaction with substrates, two main functions are involved: (1) generation function to absorb kinetic energy as much as physical properties permit and (2) operating function to transmit excess kinetic energy to the next substrates. If m number of parameters define state I of interactions and n number of parameters define state J of interactions, then other than states of I and J with not complete interaction would be defined by general analytical mathematics formula of $A_n^k = n^k$, for those many states, the combination state function, as the possible number of states, is a function of transmitting energy pocket and present potential energy of substrate, that means: $\pi = \pi(E,x)$, where E indicates potential energy and x kinetic energy of combination. Entropy function for such a combination is logarithmically correlated to states function.

$$S = kln\pi,$$

Therefore, in order to have an interaction, the total entropy production in respect of potential and kinetic changes ($dln\pi = \frac{\delta ln\pi}{\delta E}dE + \frac{dln\pi}{dx}dx$) must be negative. A condition, that interaction (conversion between these two energies) happens, is the one that: $\frac{dln\pi}{dE}$ and $\frac{dln\pi}{dx}$ for any substrate and the related energy pocket eliminates each other.

Equilibrium condition is a state that generating and operating functions are equal.



Chapter 6: Overview of the Model

Bound Frequency of Energy Transferring Waves

The brain layers are highly made of different types of neurons. The nucleuses are connected in different directions. The connections are through synapses which are isolated or wrapped by other tissues. The construction of fiber connectors makes them to have a function similar to springs with definite elasticity coefficient which whenever excited, approach a new equilibrium position and when relax returns to its origin position. However, under continuous stress any fiber oscillates between two positions as a viscoelastic material. Although the equilibrium positions differ during the day by slight changes in their rigidity, however, they generally retain very origin position after sleep regeneration period. The connectors continually and finely oscillate around their local equilibrium positions by specific bonds of frequencies, depending on the brain region. The number of degree of freedom for each neuron depends on the number of connectors which connect that with other nucleus. Each nucleus is coupled with few to several connectors and are located in an electromagnetic field radius related to unique string of synchronized firings. Transmitting of oscillation from a substrate (a network of fibers, axon and synapses connectors with almost similar vibrations) to the other one can be considered as energy transfer phenomena. In general, the transfer velocity can be calculated by $v = \frac{d}{\delta\tau}$, when a cloud of energy pockets travels a distance of d in $\Delta\tau$.

1) Any instant position of an energy pocket in an excited pathway can be defined by general relations of $u = \alpha_0 cos(\omega t)$, where α_0 and ω change frequently in it. 'α_0' is the oscillation amplitude (characteristic length) of a substrate. Random direction of an energy pocket indicates the random direction of transfer which is pathway polarization (branching potential). In addition to the location-continued transfer, there is strong connectivity between layers and far-distance substrates as attractors through spatial tree of nerves from inner brain toward the outer layer. Accordingly, polarization happens in two types of (1) longitude because of normal stresses from adjacent substrates or (2) latitude because of sheer stress imposed from adjacent substrates or far-distance attractors. Furthermore, elasticity coefficient is not homogenous and therefore transfer velocity and polarization are different in different directions. Resonance and multiplication of the power of coupled energy pockets regulate the pathway as neutrons determine the electron orbits or more correctly as attractors configure fractal. Resonance phenomena happens when frequency of oscillations in a position (fiber nodes, substrate, region, area) are equal or are a multiple of other position which is not its local continuation. Consequently, the random velocity distribution follows a function which is strongly tied not only with initial stimulated position fluctuating (input strength) but with influence of attractors.

If plotting of a dispersion diagram of energy pockets moves in a pathway or related pathways in a mentation was possible, the resulting plan would consist of dynamic curvatures with a different degree of freedom. Each curvature had a dynamic function of $z = \rho e^{ie(\tau)}$

, where $e^{ie(\tau)}$ indicates the transfer vector of the substrate fluctuating around its ground energy level and φ(t) is its rotation change, when "i" shows energy pocket direction and "l" is substrate characteristic length. In mentation termination, when equilibrium condition is approached, the relevant state can be formulated as $z = w^n$ and $w = f(z)$ would be a complex function, indicating a complex plane which shows fluctuation of n substrates around equilibrium positions with amplitude of characteristic length. Solving this general formula results in $\square_{\square} = \sqrt[\square]{\square\square}$ for each substrate by k=0,1,2,3... Geometrically n corresponding position of w_k are located on a special orbit of radius l which is called substrate characteristic length. Each orbit is the same-energy level position and in overall a complex of orbits indicates an energy pocket in a substrate and the combination of them is a fractal of kinetic energy in a pathway and further in a set of pathways in a mentation. These configured energy layers are continuums which correlate the involving substrates and the pathways taking part in mentation.

2) When energy layers are not in equilibrium and are transferring, the plans would not be clearly shaped and seem like clouds which approach an equilibrium condition as a solid final configuration which will be the conclusion of the whole process of energy transfer in a pathway.

A pathway, considering general mode curvature, is the shortest route of energy transfer from initiation to termination point over general sectional curvature of a layer. In general, velocity distribution can be formulized as following:

$$u_n = a_0 e^{J(\omega T - 2n\theta)} \qquad \theta = \theta_0 + K\pi$$

$$\theta_0 = \mathrm{Arc}\sin\left(\pm \frac{\omega}{2}\left(\frac{m}{K}\right)^{1/2}\right)$$

When u_n is individual energy pocket transfer rate; ω is frequency, Θ is phase delay; m and k are media characteristic properties and 'a' would be the amplitude. In case of an energy pocket wave in a pathway over the brain layer, m is replaced with its equivalent length characteristics of related substrate and K is replaced by $\frac{1}{C}$ as the substrate electromagnetic field integration.

3) Phase velocity v is considered as average velocity of the bulk of energy pockets in the pathway. The required energy to oscillate a substrate is maintained either by transmitted energy from the adjacent substrates or by resonance from the attractors. There is a delay between energy pockets random velocity and average energy pockets bulk velocity. This phase difference due to the random moves of energy pockets depends on polarization property. The velocity of a group of substrates energy waves by travelling through a pathway, is $v_g = \frac{\int f}{\int k}$ where $\int$ is a symbol for combination of frequencies and the elasticity coefficients would be.

The phase velocity of a bulk of energy pocket, travelling through a pathway, is $v_e = \frac{f_o}{K_o}$, where f_o and K_o indicates equivalent value of the combined frequency and the elasticity coefficient of a pathway.

When all of wave groups (energy pockets) find similar frequency, then: $v_g \simeq \frac{\delta f}{\delta k} = v_e$. It means that wave groups velocity approaches energy transfer velocity and random velocity of energy pockets can be ignored. If ω is the frequency and α_n is the combined amplitudes for

an energy pocket , then any substrate kinetic energy is $E_n = \frac{1}{2} m \omega^2 |\alpha_n|^2$ and the

pathway waves up to the time that sensory input or auto-simulating input maintain a power of

$W = \frac{\partial E}{\partial \tau} = \frac{E_\nu}{\delta \tau} = E_n \frac{v_e}{\alpha}$

4) Therefore, the transmitting energy equals: $v_e = v = \frac{\alpha}{\varepsilon_n} W$.

Natural frequency for a mentation can be defined as a combination of discrete natural frequencies of integrant pathways and natural frequency for a pathway can be defined as a combination of discrete natural frequency of substrates in it.

As it was defined in volume I, the pathway is made by stepwise progress of synchronization from substrate to substrate. Therefore, an average velocity of a bulk energy pockets is the rate of changes in the frequency through substrates: $v_e = \frac{\partial f}{\partial (1/\lambda)} = \frac{\partial f}{\partial K}$. consequently, the pathway is capable of transmitting a range of frequencies without significant loss of their energy and the brain is a good conductive media for a definite range of frequencies between beta and gammas. Natural frequency of a formed pattern in a pathway is indicative of the pathway output product and the pathway memory which will be saved by consolidation process in place and in parallel by resonance and consolidation in the other layer.

Amplitude, frequency, phase and polarizations of a pathway are elements for modularization of a product. By modularization, the pathway will be assigned by a symbol and will be enabled to convey its message. In short, a developing firing synchronization in the brain is converted to a module of an image or the concept or the complex mentation. Through such a process, an energy transfer in the brain is modulated as a complex of a multi-frequencies wave product, combining a spectrum of frequency bounds and energy wave groups.

The brain is more than a transferring media and absorbs a portion of transmitting energy, which later structurally consolidates that as memory saving. In fact, natural frequency of a substrate, a pathway or pathways in a mentation represents its integrity. Modulation phenomena in the brain enable it to handle two transmitting waves with different frequencies. For example, a lower frequency wave as auditory wave, and a higher frequency wave as visual wave in a very distinguished bounds in the same time are normally going together. There are prohibited bonds between the allowed frequency bonds which the brain physical properties determine them. Generally, connectivity for transmitting transversal oscillation is weaker than longitudinal oscillations. Therefore, for similar amplitude, transversal frequencies are less than longitudinal wave frequencies. However the same or multiple frequencies make a resonance and make amplitudes be added together and reinforce a substrate activity as attraction.

Mentation Media for Communication

Sound, symbolic moves, facial configurations, smells, touches, pictorial, and wording patterns are the main kind of modulation of mentations in the brain. If some of them are expressed simultaneously, then there should be agreement between all of them as far as their part of speech is concerned. Pictorial expression has been evoluted to wording during human being life, while the pictorial expression has variety used types but with different degree of meaning content.

In sleep, the driving force for dreaming is the negative rate of entropy production which happens with lack of information input from the environment. Following that, the highest deviated substrates structures with confined energy from the relax positions and the highest deviated layer curvatures from equilibrium condition of configuration energy initiates free network energy period and geometry configuration recovery. To release the stress, strain on surfaces should be removed either by discharge of those remained as entropy or by reshaping of curvatures through consolidation process of new memories.

Release of the scattered confined energies on the layer introduces a flow. Since access to the environment gates is blocked during the sleep output zone substrates with all saved memories or attracted by memories on other zones and layers, are virtual environment for flow products. More powerful visional zone provides pictorial products, while other output centers can also provide wording or even some motor signals to move the body parts. This might be the reason for major pictorial nature of mentation during dreaming.

Appendixes

Appendix I: Comparison between Descriptive Modeling in this Book and Larry Abbott's **Computerized Modeling:**

Larry Model Parameter	Equivalent concept in this model
Red connectors between the brain circuits	Momentum transfer and motor response trough the fibers
Genetic reservoir	Attractors, if inhibitory work as Buttery Limit to the pathway; if excitory work as input.
Motor response	Moving part of oscillating fiber with high regularity pattern.
	Standing part will be sensed and added to the reservoir as a memory for future attractor.
Internal activity of the brain	Synchronized firings within a Substrate, considering its geometry and consequence em-field shear forces impact on the substrate, producing tiny deformations on the substrate up until the force is removed.

Appendix II: **Energy Pockets Viscosity Estimation:**

A pathway can be defined by stream function and stream lines in terms of fluid dynamics. However, these terms, due to complexity of the patterns are not so easy to be studied using the same method. In addition, the computational method may be used to substitute the stream function methodology of study in future.

[SS1] Shear stress is proportional to second order of stream function differential. The proportional factor in the relation is the eddy viscosity which is a strong function of location and time.

[SS] On the other hand, the shear stress is calculated based on stream function differentials in the related diverse directions.

[Conclusion] By comparing the two functions, the eddy viscosity can be guessed (pages 173,185 Transport processes and Unit operations).

Appendix III: Hyper synchronized frequency in outer layer table

firing time probablity distribution density(t^-5/4)			substrate time-frame of .0001:.000001 &.00001)			firing time probablity distribution density(t^-3/2)		
2364	2364	2364	0.002	0.002	0.002	11180	11180	11180
2224	2363	2350	0.0021	0.002001	0.00201	10391	11172	11097
2099	2361	2335	0.0022	0.002002	0.00202	9691	11164	11015
1985	2360	2321	0.0023	0.002003	0.00203	9066	11155	10933
1883	2358	2307	0.0024	0.002004	0.00204	8505	11147	10853
1789	2357	2292	0.0025	0.002005	0.00205	8000	11139	10774
1703	2356	2279	0.0026	0.002006	0.00206	7543	11130	10695
1625	2354	2265	0.0027	0.002007	0.00207	7128	11122	10618
1553	2353	2251	0.0028	0.002008	0.00208	6749	11114	10542

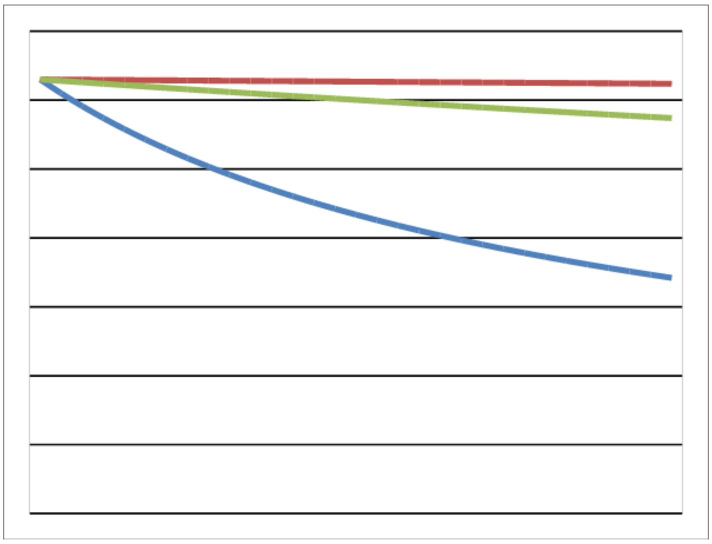
1486	2351	2238	0.0029	0.002009	0.00209	6403	11105	10466
1424	2350	2224	0.003	0.00201	0.0021	6086	11097	10391
1367	2348	2211	0.0031	0.002011	0.00211	5794	11089	10318
1314	2347	2198	0.0032	0.002012	0.00212	5524	11080	10245
1264	2345	2185	0.0033	0.002013	0.00213	5275	11072	10173
1218	2344	2173	0.0034	0.002014	0.00214	5044	11064	10101
1175	2342	2160	0.0035	0.002015	0.00215	4829	11056	10031
1134	2341	2147	0.0036	0.002016	0.00216	4630	11048	9961
1096	2339	2135	0.0037	0.002017	0.00217	4443	11039	9893
1060	2338	2123	0.0038	0.002018	0.00218	4269	11031	9825
1026	2337	2111	0.0039	0.002019	0.00219	4106	11023	9757
994.1	2335	2099	0.004	0.00202	0.0022	3953	11015	9691
963.9	2334	2087	0.0041	0.002021	0.00221	3809	11007	9625
935.3	2332	2075	0.0042	0.002022	0.00222	3674	10998	9560
908.2	2331	2064	0.0043	0.002023	0.00223	3546	10990	9496

858	2328	2041	0.0045	0.002025	0.00225	3313	10974	9370
834.7	2326	2029	0.0046	0.002026	0.00226	3205	10966	9308
812.6	2325	2018	0.0047	0.002027	0.00227	3104	10958	9246
791.5	2324	2007	0.0048	0.002028	0.00228	3007	10950	9185
771.4	2322	1996	0.0049	0.002029	0.00229	2915	10942	9125
752.1	2321	1985	0.005	0.00203	0.0023	2828	10933	9066

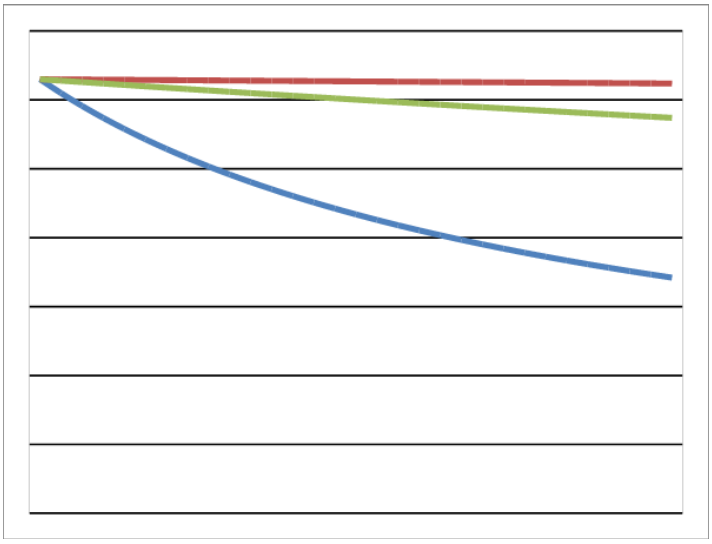
frequency in outer level(gamma1)			frequency in outer level(gamma2)		
63	63	63	144.27	144.27	144.27
60.98	62.98	62.79	138.75	144.212	143.7
59.12	62.95	62.58	133.68	144.155	143.13
57.39	62.93	62.37	129.01	144.097	142.56
55.79	62.91	62.17	124.69	144.04	142
54.29	62.89	[illegible]	120.68	143.982	141.45

52.89	62.87	61.77	116.96	143.925	140.9
51.57	62.85	61.57	113.48	143.867	140.35
50.34	62.83	61.37	110.22	143.81	139.81
49.17	62.81	61.17	107.17	143.753	139.28
48.07	62.79	60.98	104.3	143.695	138.75
47.04	62.77	60.79	101.6	143.638	138.22
46.05	62.75	60.6	99.056	143.581	137.7
45.12	62.72	60.41	96.647	143.524	137.18
44.23	62.7	60.22	94.366	143.467	136.67
43.38	62.68	60.03	92.203	143.41	136.16
42.57	62.66	59.85	90.148	143.353	135.66
41.8	62.64	59.66	88.194	143.296	135.16
41.07	62.62	59.48	86.332	143.24	134.66
40.36	62.6	59.3	84.557	143.183	134.17
39.69	62.58	59.12	82.861	143.126	133.68
39.04	62.56	58.94	81.241	143.069	133.19

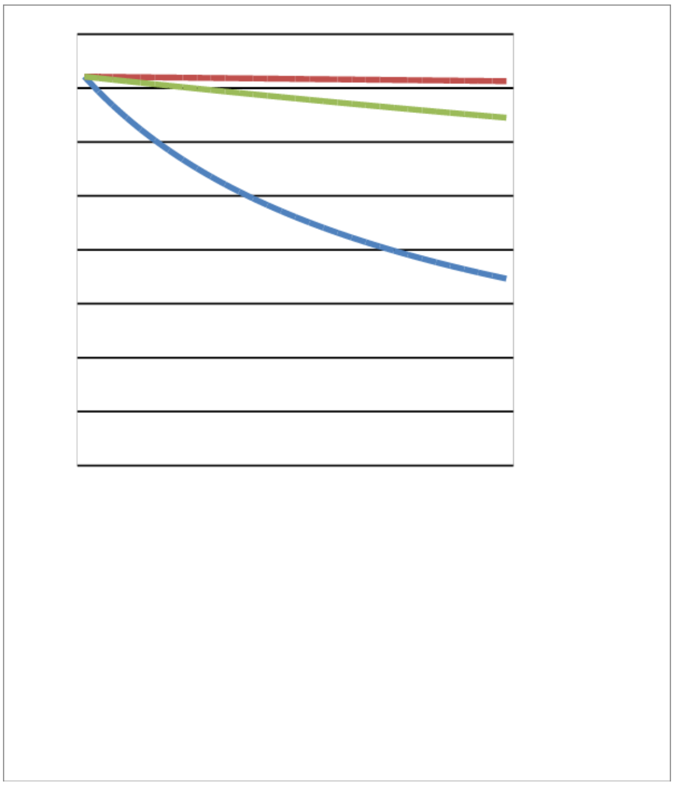
38.41	62.54	58.76	79.689	143.013	132.71
37.82	62.52	58.59	78.203	142.956	132.24
37.24	62.5	58.41	76.778	142.9	131.77
36.69	62.48	58.24	75.41	142.843	131.3
36.15	62.46	58.07	74.096	142.787	130.83
35.64	62.44	57.9	72.832	142.731	130.37
35.14	62.41	57.73	71.615	142.674	129.91
34.66	62.39	57.56	70.444	142.618	129.46
34.2	62.37	57.39	69.314	142.562	129.01



Frequencies of the range 36-63



Frequencies of the range 36-63



Frequencies of the range 70-144

Appendix IV: Data used as Reference

The average speed of a mentation in general is a function of activities of consisting substrates. It is said that the average velocity is in a range of 4-10 meters per second [Paul L Nunez PhD; Emeritus Professor, Tulane University, New Orleans, LA; **Brain** Rhythms, Anatomy, and the Emergence of Consciousness presentation May 3-4, 2008].

The natural strain of brain tissue is $-0.3<\varepsilon<0.2$

[Mechanical properties of brain tissue in tension, Journal of Biomechanics, Volume 35, Issue 4, Page 483]

Number of axons per square centimeters	>	2000000	
Time frame for synchronized firing=time frame for a substrate		0.004	sec
Average energy per axon		50	10^6 J s^1-cm^-2
Assumed average substrate surface		4	cm^2
Overall energy changes in a substrate	>	1.6	joule
Consumption time for a mentation	>	1	sec
Average number of substrates per pathway		250	

Assumed blood energy to brain	0.2			
Assumed efficiency of absorption by brain	0.8			
Assumed total calorie based on food per day	3000	cal		
Consumed energy for mentations during a day			480	cal
Consumed energy per mentation	400	joul	0.096	cal
Average number of mentations per day	5000			
Average input energy through sensory inputs per day			19.26471	cal
Average input energy through internal inputs from middle brain attractors per day			30.82353	cal
Average output energy to middle brain (save memories)or through expresion or output motors			69.35294	cal
Total average energy consumption during waking time			119.4412	
Total energy absorbed as confined during a day(waking hours)			107.4971	
Total release and consolidation energy during a day(sleeping hours)			224.55	
Focused mentation(partial feedback):				
Average hours per day	2.5	hours		

			14.7058			
	Daily average percentage		8			
			456.604	182.641		
	Consumed energy		5	8	cal/hr	
Semi-focused mentation (partial feedback):						
	Average hours per day	>	4	hours		
			23.5294			
	Daily average percentage	>	1			
	Consumed energy		324.88	81.22	cal/hr	
Automatic						
thoughts						
	Average hours per day	<	9	hours		
	Daily average percentage(full feedback):			<		52.94118
			346.764	38.5294		
	Consumed energy		7	1	cal/hr	
Dreaming			6.5	hours		
	Average hours per day		8.82352			

	9		
Daily average percentage(full feedback):			0.270833
	12.6825		
Consumed energy	9	1.43736	
Absorbing	0.27291		
constant	7		
	0.25927		
Releasing constant	1		
	0.46781		
Consolidating constant	3		

Substrate energy flow = k * (input energy)^a   k = A * e^(-E*t/Ĩ)   E = j11=>1.6 joul

erge/(mm^3*ms)

t = time frame of a mentation

Ĩ = duration of an input

Ĩ /t >>1 cycled

Ĩ /t == 1 cycled

Ĩ /t <<1 straight

mentation types(multi-pathways):

each type is a combination of left column and right column

1) narrow	a) open pathway
2) widened, but ending in one point	b) cycled pathway
3) widened, but ending in multiple points	c) coupled pathway

Terminology

Geometrical energy = structural energy = Configurational energy: are synonyms for potential energy. If same elements change in configuration their geometry or structural energies will be changed.

Deformation: change in structure by the following time consuming processes:

1) Moving and sliding of internals around each other: synapses around axons; tissues in a fiber and fibers in a substrate. All these occur within everything other than neurons, specifically glial cells.
2) Molecular and molecular components changes.

Oscillation: Position vibration in the outer layer, ignoring any internal detail deformation. It occurs in elastic range of the fibers.

Stress Waving: Disregarding the individual mentations in any time, there are continuous varying oscillations in any location due to new mentations which is referred to as stress waving.

1) **Connectivity:** Synchronized firings The denser the connectivity, the more clear the firing clouds would be. This will result in more effective processing. Connectivity is related to synapses density in the location.

2) **Curvature:** The brain connecting routs in a mentation, as established in synapses distribution, tissues, fibers and finally folds.

3) **Mentation**: Any brain activity in shape of feeling; run of current or flow of automatic thoughts;

4) **Direction of the mentation flow**: It is normally from outer layer back side toward the front. The energy pockets configuration increases in complexity in the same direction and a mentation takes a format of complete statement by going toward front section. The mentation, in elements and as a whole, should be symbolized and translated in the language zone, by communicating its total potential energy and final energy density distribution, indicating the configuration.

5) **Input-output zone:** The sensual input and motor output zones are connecting routes between the physical states in the environment and simulation activities in the brain dynamic networks.

6) **Route**: orbits layers and proceeding network substrates that have a synchronized firings event over it.

7) **Initialization**: start of a firing storm due to an accidental or selected input, either from environment or a recalled input from another mentation process.

The recall links, in crossing nodes, which have shared substrates of different running mentations, continuously happen. However, their effectiveness depends on the interaction between the shared substrates.

8) **Acknowledge-ending**: This is the steady state destiny for any mentation. However, it may be none, one or several, depending on final pattern configuration of energy levels, if any.

9**) Ending of a mentation:** Jumping between final energy level configurations, as conclusions, happens frequently. It depends on stability of general pattern and physical condition of substrates.

*10) **Creativity**: The ratio of newly formed fractals per recalled ones.*

11) **Conscious and subconscious recalls:** Recalled subconscious energy pockets are the main mass of feelings and current of thoughts, while intended recalls are those internal inputs requested by a pattern during approaching of an equilibrium state.

12) **Conscious degree or awareness**: Ratio of requested inputs or intended recalls per mass of subconscious recalls.

13) **Unconscious**: Automatic run and flow of unsynchronized firing clouds,settling in a steady synchronized state.

14)

15) **Attractors complexity:** Orbits configurations in middle layer (Limbic system) are formed around attractors in inner layer. similarly attractors in outer layer are formed around attractors both in middle and inner as well as outer layer itself. **They increase in complication from inner brain to outer layer.**

16) Evolution of attractors: Attractors are getting evolved and complex in higher layers.

17)

18) **Environment inputs**: demanded energy pockets to settle in an energy level.

19) **Output**: energy pocket send-outs.

20) **Emotion**: release of viscous energy to remain in a definite energy level

21) **Energy level**: Orbit energy levels are definite and not continuous. Channels potential thresholds determine the levels.

22) **Runaway process**: When absorbed stresses are not smoothed by the overall mood direction.

23) **Virtual stimuli:** is an internal input against environmental (sensual input), which needs a free flowing or recalling process.

24) **Mood overall control system**: is made based on brain's overall distributed stress-strain properties over the sections. The tissues stress-strain behavior and orbits changing energy

levels are the two sides of the interactions; they define the limitations for type and complexity of orbits and brain disorders with time.

25) **Fractal**: A current of energy pockets which are configured as a sensual or conceptual statement. Orbit, too, has the same meaning as pathway configuration but through the text.

Patterns are sub orbits which correspond to substrates on the pathway, rather to provide a complete sensual scenario or conceptual statement. They pronounce the alphabet and words for a statement or show elements of a scenario.

26) **Attractors:** are facilitators for speeding up or down of firing synchronized eddy density, viscosity and curvature (fractal or orbit) by changing chemical reaction conditions on the substrates. They are located on lower level for any other level patterns.