

Simon Says Trauma Gone:

Cognitive Neurophysics and the Principles of Change

Part II

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In my last paper (Furman, Nov. 1999), we discussed some of the fundamental building blocks necessary to clearly understand how intervention influences *change* in the human brain. Comparing the four, top, brief therapies of the world today, we distilled the fundamental mechanism by which these interventions facilitate change and clearly identified that which is changing. This is the first brick in the foundation of cognitive neurophysics and the construction of a unified theory of intervention. The purpose of a unified theory of intervention is to provide guidance to the practitioner of any school of therapeutic intervention, notwithstanding the limitations inherent within their arsenal of existing tools. By understanding what is changing when an intervention is selected and applied, and by understanding the natural course of the change process, the scientist, practitioner or student of human behavior, is poised in a position to be able to more deeply understand, more accurately predict, and more precisely influence human behavior. Before we go on to answer the plethora of questions that the last article generated, let's review some of the key principles of cognitive neurophysics.

Pattern: The Universal Language of Nature

Pattern is the universal language of nature. Pattern, both spatial and temporal, is the medium by which all *information* in nature is exchanged. In physics, pattern and information are one and the same. Regardless of what it is that you want to change within yourself or someone else, whether behavior, thought, emotion, belief, attitude or otherwise, the fundamental essence of what you are changing is a pattern. According to the Standard Theory of Pattern-Entropy Dynamics (Furman and Gallo, 2000), *pattern* (information) is engendered by the dynamic spatio-temporal configurations permitted as a result of the interaction between matter and energy.

Pattern Is Ubiquitous in Man and Nature

Our deeper understanding of physics, which has almost entirely emerged during the 20th century, has led us to understand that our old picture of the physical universe was incorrect. For nearly 2,500 years, since the time of Aristotle and Plato in ancient Greece, humans have been on a frenetic search for the fundamental building blocks of the material world. During the course of this search, we found that organisms are made up of organs, organs are aggregations of cells, those cells are agglomerations of molecules, the molecules are configurations of atoms, the atoms merely combinations of subatomic particles and those subatomic particles are configurations of still other subatomic particles. At each stage in the search, we discovered that what made up the physical world were patterns out of focus.

As we erected high-energy particle accelerators in order to bring the subatomic world into focus, and claim the holy grail, we were dealt the first crushing blow to our long-held world view. Every time we attempted to smash two particles together hoping to find their fundamental components, different particles emerged from the collisions. The mass and the properties of the particles that emerged changed with the amount of energy that was used to smash the original particles together. The rug of reality was pulled out from under us. No fundamental building blocks of matter actually existed. The new picture showed us that “things” do not have an absolute existence separate from “events”. This led to our current understanding that the “stuff” of material reality are “states of motion” dynamically interacting in an unbroken, interconnected, flowing, whole (Bohm, 1995). What remained consistent however, was the ever-presence of pattern. As we reconstructed our world-view back from bottom to top, a hidden principle emerged. Each “state of motion” permitted the development of one type of structure, while at the same time, preventing the development of all others.

The next crushing blow to our world-view was dealt by Einstein with his famous formula, $E=mc^2$. With a few simple letters, Einstein dissolved the duality between matter and energy by showing us that matter and energy were interconvertible into one another – that the material world which seemed so stable, was merely collections of transient patterns of highly concentrated energy in space and time. The hypothesis that bits of matter were made up of enormously concentrated quantities of energy, was regrettably proven by the tragic loss of untold numbers of human lives following the advent of the atomic bomb. Our long-held assumptions about the material world had been blown to bits. What remains is the exchange of information in the language of pattern.

Thermodynamics, Entropy and the Destabilization of Pattern

Now that we are clear that the target of any intervention is the alteration of a pattern, we must understand how patterns change. To do this, we must understand the most successful of all of the laws of physics – thermodynamics.

The first law of thermodynamics states simply that the amount of matter and energy is constant – that matter and energy can neither be created nor destroyed, but only changed in form.

The second law of thermodynamics referred to as entropy, states that this transformation occurs in only one direction. Matter and energy are transformed from a usable state to an unusable state. Or, said another way, matter and energy are transformed from an “ordered” (patterned) state to a “disordered” (entropy) state. All living and nonliving forms continue to “exist” by virtue of their ability to continue to transform matter and energy from an ordered to a disordered state of motion. When the matter and energy of any system (form) reach a state of maximum entropy or disorder, it ceases to “exist”. This state of maximum entropy is referred to as thermodynamic equilibrium—“heat death” (Rifkin, 1980).

In an interconnected system of elements, whether human brain or the earth’s biosphere, “work” can only be done when there is a difference in energy concentration

between parts of the system. In other words, when a system reaches thermodynamic *equilibrium* (no difference in energy concentration), no more work can be done. We call this state “death”. The laws of thermodynamics clearly show us that for any pattern to continue to exist, it must maintain a delicate, dynamic state of *disequilibrium*. The laws also show us that even a slight change in this disequilibrium state will give rise to an equally profound change in the information engendered by the pattern. Remember that all “structures” in the material world, whether brain, mind, behaviors, emotions or thoughts, are in essence, patterns with varying degrees of stability. The stability of any pattern, therefore, is dependent upon the substrate which engenders it and the phase or state of that substrate.

The Stability of a Pattern is the Stability of its Substrate

Recall the example of H₂O used in the previous article. When pebbles are thrown into a pond of water in its liquid state, the water encodes the pattern made by the pebbles for only a short time. In a human time scale, the pattern is highly transient and unstable. However, if we were to be able to instantly freeze the pond at the moment that the pebbles made impact, the pattern that remained would be much more stable. This is an example of pattern stability that is based on a state or phase change of a substrate. In this case the substrate is H₂O and the phase is changed from liquid to solid. Remember, that a change in phase or state at the atomic level is simply a change in the substrate’s “state of motion”. Atomic motion that permits the development of a liquid state has a relatively higher energy level than the atomic motion that gives rise to a solid of state.

Information (pattern) can also become more stable by moving from one substrate to another. If the pond of water was very shallow, and the pebbles landed in the mud below with sufficient impact, or created a state of motion in the water that permitted the development of a pattern in the mud, the *exchange* of information from the water to the mud would have effectively stabilized the information. The human brain operates fundamentally in much the same way, notwithstanding its enormous complexity, it creates “memory” by moving information (pattern) from one substrate to another—from a *less* stable one to a *more* stable one. One way this is done is by exchanging information between first, second and third level messenger molecules.

For example, while experiencing a particular event, traumatic or otherwise, the neurons and neural networks of the visual system (substrate), would sample information available within the context of that event, and then convert different wave lengths of electromagnetic radiation (color) into a transient pattern of electromagnetic impulses. This pattern of impulses would quickly be transformed into biochemical patterns of the first messenger molecule system, made up of neurotransmitters and neuromodulators. These neurotransmitters and neuromodulators of the first messenger molecule system would, in turn, adjust the sensitivity of the nerve cells involved in encoding the information so that the pattern can be more easily replicated (remembered) by the neural network, at a later time. If the pattern is intense enough or replicated enough times, the information will be moved to a second messenger molecule system that acts within the nerve cells. These messenger molecules further increase the stability of the pattern by creating internal structural changes to the cell. If the information is necessary for still

longer periods of time (indicated by frequent replication or great intensity), it will be exchanged with the third messenger molecule system, which acts deep within the nucleus of the nerve cells, altering gene expression at the level of our DNA. In this way, patterns incorporated from the environment are stabilized throughout the brain's encoding substrates in varying degrees. Again, these patterns could be behaviors, emotions, thoughts, attitudes, beliefs, etc. And, the example above is just one way in which stability of a pattern is modified by the brain. This example should help to explain why some patterns are harder to change than others.

Why are Some Patterns Harder to Change than Others?

There are several reasons why some patterns are harder to change than others. I will mention just a few here. The first is the obvious one stated above – the more stable the encoding substrate, the more stable the pattern will be, and consequently, the more difficult it will be to change. One mistake made by many practitioners is the use of the correct intervention an insufficient number of times or with an insufficient intensity. Many practitioners have had the experience of helping a client to “eliminate” a traumatic memory or unwanted behavior, only to find that it reappears a short time later. The human brain and its activity give rise to the development of a morphogenetic field. Morphogenetic fields are capable of *regulation*, which means that if a significant part of the pattern remains in any of its substrates or subsystems, it is capable of regenerating the entire pattern.

Morphogenetic Fields

As practitioners of therapeutic intervention, we often make the mistake of thinking that we are “done” simply because the client can no longer feel bad feelings associated with the visual image of the trauma. Or, because the client has more difficulty even constructing the visual image of the trauma and that image had been significantly altered by our intervention. However, often the time scale that we use to measure our success is appropriate only for determining to what extent the pattern was disrupted in the first messenger molecule system. Remember that the first messenger molecule system is the least stable of the three – and the easiest to destabilize. If the trauma had occurred a significant period of time prior to your intervention, it is safe to assume that the information (pattern) was exchanged with the more stable, second and third molecular messenger systems of the brain and body. If we leave the client with the idea that the intervention has been successful, we will lose credibility and they will lose hope when the second or third molecular messenger systems move the information back to the first molecular messenger system, allowing the neocortex to recreate the memory of the traumatic experience. *NeuroPrint* (Furman and Gallo, 2000) is a simple modeling tool which allows us to measure the stability of any pattern relative to another and thus determine with great accuracy, how close we are to actually being “done” with a therapeutic intervention.

Pattern is Highly Distributed over Numerous Interconnected Systems

Another way that the effects of a morphogenetic field can come back to haunt us is if the pattern that we are trying to change is highly distributed over several interconnected systems. Let's take a simple example. The reason that Thought Field Therapy (TFT) as

a therapeutic intervention, emerged superior to NLP's Visual-Kinesthetic Disassociation (VKD), is that TFT's procedures more completely destabilized traumatic patterns by targeting visual, auditory, tactile, emotional, motor and proprioceptive encoding substrates, while VKD almost invariably targeted emotional or kinesthetic encoding substrates only. It is interesting to note here that when the VKD procedure was first developed it targeted and destabilized both visual and emotional/kinesthetic encoding substrates. However, as the algorithm was passed down to later generations of practitioners, visual pattern destabilization was dropped from the recipe.

Stated as a principle, *a pattern-disrupting intervention must target every pattern-encoding system which originally incorporated or is now internally representing (replicating) the traumatic sensate information from the environment.* If the intervention does not do this, any of the stable, encoding substrates left unperturbed (visual, auditory, emotional, motor, tactile, visceral, proprioceptive, etc.) could potentially exchange its information with the other interconnected systems, thus recreating the original pattern. How is this possible?

Hidden Structure of Morphogenetic Fields

Morphogenic fields are possible because *energy has shape* (Buckminster Fuller, 1975). Related event foci (energy vectors with direction and momentum) such as that which are generated by stimulation of the various sensory organs *simultaneously*, tend to return upon themselves, resulting in a self-stabilizing *structure*. In this way ephemeral energy patterns, each relatively *unstable* by themselves, are instantaneously transformed into a *self-stabilizing polyhedral* (a solid formed by plane surfaces) *bio-architecture* of communicating substrates—energy patterns with comparatively enormous *barrier height*. Once energy patterns become self-stabilizing they require perturbations (disturbances) of far greater magnitude in order to be disrupted. This is how one time learning experiences such as phobia formation and trauma are possible. They engender a “state of motion” within the matrix of the neurocognitive system that is *self-stabilizing*—no further stimulation from the outside is necessary in order to make them enduring.

The work of both Buckminster Fuller (1975) in synergetics and Calvin (1996) in neuroscience, suggest that the *minimal* number of related event foci (energy vectors) necessary to create a self-stabilizing pattern in nature or neurodynamics is *four*, and the self-stabilizing geometric form taken synergistically by the energy vectors is a *tetrahedron* (a solid formed by four “triangular” plane faces. A “phobic-traumatic structure” would by necessity remain self-stabilizing, by virtue of just four simultaneously activated encoding (incorporating) and/or internal representation (replicating) circuits (i.e. visual, auditory, external tactile, internal visceral, all converging contiguously within the association cortex). If olfactory, gustatory, proprioceptive, or motoric encoding or representation circuits were additionally involved, then the minimum requirement for the transformation of ephemeral energy patterns into self-stabilizing structure would be more than satisfied. Quite often with phobias and traumas this is in fact the case, and such energy landscapes become immediately apparent when *NeuroPrint* is used to model cognitive neurodynamics.

This knowledge of the minimal “state of motion” (or pattern of forces) necessary for the development of a self-stabilizing energy structure in the brain (neuro-cognitive system), is the keystone to effective, lasting intervention. One way this could be applied is to be able to deduce the existence of *hidden attractors* (caused by previously encoded sensory information) or *hidden stimuli* within the information field, in the same way that Einstein deduced the existence of hidden planetoids by the variance in the phase path of existing planets (the variation is caused by the gravitational force exerted by the unseen planetoids). In other words, if you find that a traumatic event is being consciously represented by the subject, in only one or two representational systems, you are not done looking. Effective intervention could only be accomplished by the location of *and* perturbation of the minimum number of attractors (event foci) necessary for the development and maintenance of a self-stabilizing energy structure.

Inappropriate Match Between Intervention Tool and Presenting Problem

Many practitioners make the mistake of learning one effective “change technique” erroneously assuming that it can be used for everything. Armed with their VKD anti-trauma/phobia weapon, they attempt to change obsessive compulsive behaviors, habits, beliefs, and a whole host of other resistant targets. This is the sad result of producing a trail of intervention tools without a guiding theoretical model for their appropriate application. One hundred years of such misguided psychotherapeutic intervention within the psychological sciences, was reason enough to warrant the development of NeuroPrint and The Standard Theory of Pattern-Entropy Dynamics (Furman and Gallo, 2000). The theory and resulting application model clearly show how intervention tools from *any* school of psychotherapeutic intervention can be classified and organized by their scope, behavior and entropy effect so as to be able to match a tool of intervention appropriately with the task at hand. While there are several other reasons why some patterns are harder to change than others, I will mention just two more of critical importance.

All Dressed Up and No Place to Go

Information patterns do not exist in isolation in the brain. They exist in highly *distributed* and elaborately *interconnected* substrate environments such as the neural-net, sub-neural cytoskeletal net, and the first, second and third molecular messenger systems. Patterns do not always necessarily have to be completely obliterated in order to produce lasting change. Patterns must merely be destabilized *relative to other existing choices* (phase paths) within the neurocognitive system. To put it another way, our brain is born with an untold number of possible choices, commonly referred to as “degrees of freedom” (states of motion). As information (pattern) is continually incorporated by the brain throughout life, energy barriers are formed (with varying barrier heights) continually restricting the neurocognitive system’s potential *degrees of freedom* (states of motion). **In the branch of science we refer to as cognitive neurophysics, intervention is defined as any procedure which results in a qualitative, *stable* change in the state of motion of the neurocognitive system in an intended direction.**

When a pattern is treated as though it existed in isolation, and it is effectively destabilized relative only to its *own* previous level of stability, we have failed to take into account the relative stability of other interconnected patterns (event foci) and their

effects. In other words, if you destabilize a pattern relative only to its previous value, but not relative to other adjoining patterns that must be selected by the neurocognitive system for change to occur, then change will not occur. With no stable place to go *instead*, the state vector of the neurocognitive system will remain where it is and quickly restabilize the unwanted pattern. In other words, if a new *phase path* is not stabilized with an intended attractor destination in mind, the temporarily weakened energy pattern will regain strength via the self-stabilization process. Not only will the pattern recover from perturbation and regain its stability, but since it is the only stable choice relative to other available patterns, it will continue to be replicated (reactivated) and thus quickly become *more stable* than it ever was prior to your intervention.

If you do not take the time to provide the neurocognitive system with additional choices (degrees of freedom) that are *directly accessible* from the escape trajectory of the destabilized pattern (attractor), the client will be inadvertently worse off than they were before you tried to help. The solution then, is that all other interconnecting choices of the neurocognitive system should be mapped or modeled prior to selecting the highest leverage point for the application of a destabilizing intervention. In addition to mapping their interconnectivity, the relative stabilities of each of the patterns (attractors) should be measured so that we may predict at what point the neurocognitive system will reliably change its state of motion (phase path), thus creating the desired change. Whenever destabilizing an unwanted pattern, we must always stabilize the desired alternative pattern or patterns relative to the unwanted pattern. In other words, we must give the system a place to go and influence it in that direction intentionally in order to build a predictable and stable change.

For those readers who asked whether it is possible to screw up something that is working while trying to repair something that is malfunctioning, the answer should be clear. Without a model of the system, and its interconnected patterns, it is highly probable to damage something that is working while repairing something that is not. In fact, the second law of thermodynamics demands just that. It states that for every increase in order that a system experiences, the order is paid for by an even greater amount of disorder (entropy) in its surrounding environment. This entropy must intentionally be directed by the practitioner to dissipate outside of the neurocognitive system, or it will automatically dissipate inside, wreaking great havoc and confusion. Mounting evidence suggests that this is one of the leading causes of learning disabilities such as ADD and ADHD, currently proliferating throughout student populations in our school systems world-wide.

Destabilizing the Destabilized

The last critical error of intervention that we will cover in this article is the mistake of using a destabilizing intervention on a problem that was caused by destabilization. For example, if a client is experiencing confusion and disorientation, feeling distant and out of focus with accompanying difficulties of memory, we would do even greater damage by applying the use of a destabilizing tool. Unfortunately, most of what the psychological community refers to as “brief therapy,” is nothing more than an agglomeration of tools that destabilize different areas of the neurocognitive system. Each of these have a different scope or range of the system upon which they act. The problem

here is that most any tool selected from these arsenals will do more long-term damage than if the problem were left alone. Applying a destabilizing intervention to a problem whose foundation is built upon already unstable interrelations, will prove devastating; the greater the scope of the destabilizing intervention, the greater the damage. Hypnosis and hypnotic intervention, the tool of choice amongst many psychotherapeutic practitioners world-wide, is one of the largest scope destabilizing interventions and consequently one of the most devastating when used on an already entropic neurocognitive system.

Two important things are needed here to make lasting change in the right direction. First, a psychotherapeutic practitioner must be able to *identify* those presenting problems that are built on a foundation of *stable pattern* and clearly separate them from those problems that arise from neurocognitive states of *high entropy* (lack of pattern or the presence of a high degree of disorganization). Second, practitioners of psychotherapeutic intervention must be able to *classify* and *organize* their existing intervention tools as stabilizing (pattern-increasing) or destabilizing (entropy-increasing) while also understanding the principles necessary to create new and effective interventions that lead the neurocognitive system in the right direction, whenever their ready-made “templates” do not match the problem at hand.

Epilogue

The information-energy environment assaulting the human brain today is both qualitatively and quantitatively different than that which influenced our brain’s structure, function and development just a decade or two ago. This information-energy environment continues to change at ever-increasing speeds, leaving in its wake a trail of mental disorders from learning disabilities to sudden personality change, the likes of which we have never before seen in earlier information-energy environments.

In a relatively short period of evolutionary time, human brains have had to adapt to radically different shaping forces, as human societies transitioned from hunter-gathering environments to agricultural ones, and then from agricultural information-energy environments to industrial ones, and finally from the industrial age to the information age. Each new information-energy environment forces the human brain into a condition of greater order, pattern and structure, creating greater specialization and progressively increasing its energy flow-through requirements, while decreasing the degrees of freedom (states of motion) available to the system. As the second law of thermodynamics predicts, each increase in order that the human brain has had to sustain comes with the inescapable price of the production of greater disorder (entropy). In the end nature must balance her books. We have only begun to see the labyrinth of new disorders that lurk in the shadows of the information age. As scientists and practitioners, we must learn how to decrease this problem – not add to it. When it comes to effective intervention, “*The Structure of Magic*” is the result when our interventions are in alignment with *the structure of energy*.

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