

Chapter 8.2

Consciousness : Functional Models of Organisation and Multiplicity

Kirlian demonstration of an underlying template of form · Multiplicity in Unity · Morphic Resonance · Ukhtomsky & the Theory of Dominants · The expression and creation of a Dominant · Multiplexing and Packet Management · General notes on multiplicity · Complexity & systems Theory Interrupted Biological Processes · Conversation Theory

Look Down
Hands, arms fingers
moving freely
writhing
under my own control
is it my own?

Look Down
Legs, feet
one, and then the other
only pieces
of me.

I am fragmented
random pieces floating
in the air
connected
to what?

My reflection is deceiving
it tells me
that I am whole
that I am one
that I am.

But what is the mirror
to know what I am
to tell me that I am
whole?

... and you held me in your arms so
close
and you made me feel
that this could be real

Lyrics from "Real" by Vic Allen
(The Missing Piece)

There is some confusion in modern science between causality and process, when it comes to looking at form. The principle of “*Form follows Function, Function follows Form*” has been in Osteopathic thought from the early days when AT Still was first putting together his way of approaching the body as – we would now think of – an ecosystem. The phrase is an acknowledgement of the relationship between the physical shape and characteristics of a part of the body and its function in everyday life. So - to take a simple example - one can look at the shape of an orchid and the shape of the proboscis of its symbiotic bird or insect, and recognise that the form is exactly married to the function.

Exactly where that idea first arose is harder to pin down. Certainly it was a trend in late 19th century architecture, where the Arts and Crafts movement was attempting to reconcile functionality with beauty – or some might say, re-invent the wheel once again. One can look at a Ming dynasty vase in the British Museum; or a bronze age sword or axe head or piece of ancient Greek armour; or a 16th century Polynesian canoe – and see that beauty and functionality is a combination of properties of human-crafted objects that has been sought for millennia. It is no doubt a copy of the grace of line of a deer or seal, or bird, or flower petal, or of the line of muscle and bone that makes a tones and athletic human limb.

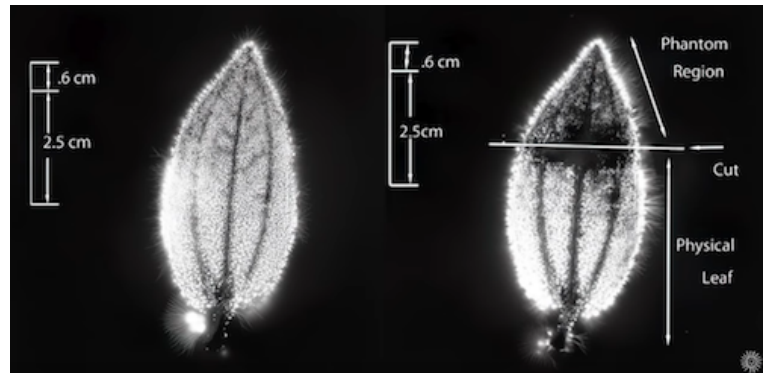


The modern way of looking at natural autopoietic form is to say that it is created by the unfolding of DNA and subsequent processes. Which is rather like saying that – if I wear a suit to go to work every day it is the suit that causes me to go to work. But we all know it is the opposite – it is the intention to go to work and the demands of the work environment that cause me to put on the suit. Intention in natural form is evident in the way that a dog’s or chimpanzee’s face begins at birth looking almost human, but develops and grows forwards as a representation of the use of the nose to sense and the teeth to fight and to use as as major tools. It is usually impossible to measure intention – or any non-physical template of form that might organise the physical processes. So the default position is to think that form is purely a matter of organisation through physical means¹. However, Kirlian photography (or *corona discharge imaging*) – a means of detecting the way that organic objects organise electrical charge when placed within a field of several thousand kV/cm – is one useful demonstration of the presence² of such a non-physical template. A typical Kirlian image (of an apple) is show above.

It might appear as if the Kirlian image is showing the physical structure of the apple, but this is not completely the case. It is possible to take any living thing – be it an apple or a leaf – and cut part of it away. If the Kirlian discharge were purely showing an electro-physical property of the object, then the discharge image would only show what is physically present after part had been removed. However, that’s not what

happens.

The image below shows what takes place when a leaf is cut. The missing end of the leaf is still visible in the discharge image, even down to the detail of the veining ... indicating that what is controlling the electrical discharge on the photographic plate is not necessarily related to the physical object. In one experiment, of just over 100 leaves that were cut, about 95% showed a “ghost” or “phantom” of the missing part – rather like a person who has had a limb amputated might feel the missing limb as if it were still present. The effect with the leaves diminishes over time, as the general discharge effect diminishes as the object dies. A leaf removed from a plant will only live for so long - so another aspect of these images is that they capture something related to the “life force” of what is being photographed, one of the purposes for which these discharge images have been used.



Given that the missing part of the leaf is still visible in the discharge corona, veins and all, something non-physical (i.e. not associated with the physical presence of leaf-matter) is directing the flow of electricity. This is presumably some kind of ordered field arising in the remaining part of the leaf. One question is perhaps – exactly what are we detecting here? Another important question might be – how does it behave? i.e. how closely is it bound or coupled to the physical form, and how much is it able to have some kind of independent presence with a reduced connection to the physical form it is associated with? There are several “energetic” layers that lie parallel to the physical human body, and which are capable of de-coupling in various ways. To take just one example, John Upledger described³ a “Vector” system – something like a matchstick man – underlying the skeletal framework, that could be displaced from its proper position. If it were purely “energetic” that might have no observable effect other than to a Kirlian photographic plate, perhaps. However, the “Vector” system (well actually there are at least two of them that have slightly different forms of behaviour) is tied into the proprioceptive sense – such that the proprioceptive position of a limb is far more closely tied to the Vector position than to the physical limb position (with its proprioceptive nerve endings). It is perhaps not surprising that the English language includes phrases that say describe somebody as being “beside themselves” or feeling “disjointed”.

Multiplicity in Unity

The subject of *Multiplicity in Unity* has already been introduced in several quite different contexts. In Chapter 2 (mechanisms associated with Life's resilience) we saw how fragmentation is in fact a useful and commonly used survival strategy. It has associations with kin selection (the identification of self-and-other) and apoptosis (sacrificial self-destruction of cells in a multicellular organism). Fragmentation may occur in several ways. One example on a very physical level might be the diaspora of egg-laying queen insects to form new colonies. Another example on an organisational level is the way that conscious attention does not have to be involved in all physical movements, even though those movements are carried out by so-called voluntary muscles.

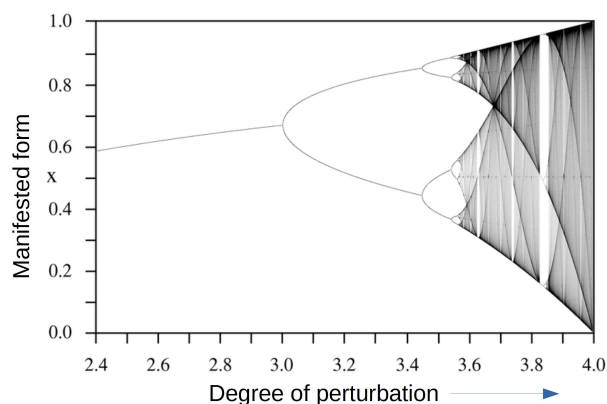
This kind of internal organisation fragmentation controlling the boundary between spheres of conscious/non-conscious influence - can possibly be thought of as an expedient and temporary quasi-reversal of the integration that binds a single cell or multicellular organism together. However, despite the apparent loss of integration that comes with it, what we are seeing is an extension of the chaotic nature of life, and life making use of its chaotic nature to increase its range of adaptation - by deliberately shifting between different qualitative organisational states and different degrees of coherent integration. In Chapter 3 (Wellness), "Loose Coupling" was described as an elegant means by which organisms deal with multiple demands. The chaotic balancing act that is homeostasis allows for the seamless separation and re-integration that defines these temporary manifestations of fragmentation. Chapter 5 (Meaning) very briefly outlined how the power of the human central nervous system is based on a lack of integration between the two hemispheres of the brain (q.v. McGilchrist) – and how it is the separation as much as the connectivity that creates the human capacity for inventiveness, language, abstraction and conceptualisation.

Goethe's principle of subjective participatory observation in Chapter 6 (Philosophical aspects) provides an alternate way to understand multiple systems – that goes beyond the usual reductionist investigation of subsystems followed by re-construction-from-parts way of thinking that dominates western culture. **Unity in Multiplicity** (UiM) is familiar to all people educated in the Western European and English speaking worlds as an abstracted way of analysis in which sameness is seen in many apparently discrete individual items that can be added together like bricks in a wall or cogs in a watch mechanism. So a UiM way of observing a tree would say that all leaves are near-enough equal to be abstractable to "leaf" - and are somehow separate/different from the trunk and roots. And indeed, with a UiM way of observing, all trees are sufficiently similar in the dendritic form of their branches and roots, and the presence of leaves to justify the noun-abstraction "tree", and for this to be used commonly with no need for qualification. Thus, objects are reduced to their lowest common denominator; and difference is discarded and seen as relatively unimportant, or just a

matter of random statistical variation. Thus statistical variation is thought of as “error” and “noise” more than representing intrinsically important qualitative properties. This degree of abstracted depersonalisation of each leaf is only possible if the leaves have no say in the matter – which is the position taken given a truly objective observer who is inherently separate from the object being observed. Given that there is an abstracted “perfect” leaf, all leaves are identified as less-than-perfect examples of that perfect ur-leaf, rather than being perfect (and of interest) in their own right.

On the other hand, Goethe pointed out that a participatory (deeply subjective) form of observation allowed for **Multiplicity in Unity**⁴ (MiU) to be identified. For instance, the form of each individual leaf becomes remarkable (and intimately and inextricably bound to the trunk and roots). In UiM there is a whole tree-forest-ecosystem-observer organism within which each leaf has a unique identity, and at the same time “leaves” can no longer be abstracted to a non-existent average that is separable from the whole. As the observer immerses him/herself more and more in the individuality of specific leaves, the transition between *specific examples* of leaf-ness and bud-ness and flower-ness starts to become apparent as a potential process – not separate as the reductionist observer might think of a leaf, bud, flower, but all expressions of a common pattern of expression. To paraphrase McGilchrist, the important information is encoded in how it is expressed much more than what is expressing it or where that occurs. This is also apparent in the chaotic bifurcation diagram introduced in Chapter 3, which is in turn an observer-object metaphor for the body-mind organism that is a human being.

In the case of leaves, a plant generates its own internal perturbation as a consequence of external perturbations (environmental pressures) that demand adaptation. Even an imperceptibly small shift in adaptive demand causes a shift in the ideal homeostatic balance of many interdependent mechanisms. First altering these within their normal adaptive range; and then, as the adaptive demand increases, moving beyond normal adaptive range into a more stressed emergency adaptive range. In more extreme states, mental-emotional responses, physiological mechanisms and DNA expression through methylation enters territory that is within its full capacity to adapt - but which it does not usually have to call upon. Repeated access to these states in turn creates epigenetic changes, which then can drive the evolutionary gesture of the organism through Lamarckian mechanisms - far faster than can occur by simple Darwinian selection. The baseline properties of the organism (in this case the leaf-ness of the ur-plant) make certain kinds of adaptive fragmentation more likely, and so the plant at some point adapts its leaf-form into a flower-form; its stem-form into a woody trunk-form; and so on.



The behaviour of the bifurcation diagram above perfectly reflects all levels of biological adaptation - because biological systems are in inherently chaotic, and are sensitive to very small perturbations through both internal adaptations and external environmental shifts. If they were not chaotic, and each leaf was “perfectly” like each other, then this could cause problems – such as certain wind speeds causing resonant beats that could rip the tree apart – whereas a “chaotic” distribution of leaf shape/size/form is inherently stable and also responsive to even the lightest breeze to optimise air mixing for evapotranspiration. And of course, internal organisational shifts are always to some degree down-expressions of external circumstance (the landscape, ecosystem, climate, human emotional state, physiological balance, etc) ; just as the behaviour of the single organism then up-affects landscape, ecosystem, and ultimately climate. Every creature, every rock, every blade of grass, every gust of wind, the largest and the smallest of planetary and ecosystem features, every part of every creatures metabolism – are mutual participants in a vast and unimaginably complex feedback loop that progresses end evolves through time. So although we view the totality as “chaotic” (and I described it so above), the reality is a collection of specifics whose interwoven-ness is also specific and each interweaving imbued with meaning. Each leaf, each grain of sand, each cell, has a unique and specific identity and interrelatedness that is not of itself chaotic. Culturally we choose to create an abstraction of the collective, a “Mr Average”, but we all know of humans that “Mr Average” with 2.3 children does not exist. What does exist is a totality that is so complex that – when perceived logically in **impersonally** – can only be called chaotic and random. The artificial order we give to it through abstracted agglomerations (“a tree”, “a leaf”) that implied chaos and randomness - is ignorant of the underlying self-generated and constantly renewed implicit (personal) order.

To give a few up-down examples of the flow of order, energy and influence ... the smallest microorganisms create rocks and dissolve them. The albedo (reflectance) of plants alters the energy balance of the planet, as does the methane produced by herbivores. The amount of water passed locally through evapotranspiration by plants into the hydrologic cycle, and in turn this has an effect on the generation of electricity by lightning storms in the tropics. The roots of one plant stabilise the soil and may assist or restrict the growth of other plants. The bodies of fish and



dead whales falling deep into the abyssal plains of the oceans make life possible at even these depths. Each tiny variation interacts and reacts differently; and although there may be an average that can be estimated or even measured, that abstract average does not behave the same as the collective real whole composed of individual elements, each with their own unique individual experience. The fact that the whole is chaotic means that these individual variations are the engines that drive change just as much as are the general shifts in average that may more easily be calculated. The

statistical bell curve might graphically and conceptually express the possible range of experience, but its mathematics is based on variation of a single factor, and for living organisms in a natural integrated environment there are always a near infinite number of contributory factors.

So the principle of *Multiplicity in Unity* is not just a static way of describing leaves, or even a way of describing a static fractal pattern – but rather applies to dynamic systems such as ecology, evolution and homeostasis. I would like to introduce a small selection of very different models that apply to loose coupling, fragmentation and the temporary dynamic aspects of Multiplicity in Unity:

1. Rupert Sheldrake's "Morphic Resonance".
2. The Dominance Concept is a systems view of the structure of homeostasis in living organisms, developed by the 20th Century Russian philosopher and physiologist AA Ukhtomsky⁵.
3. Multiplexing and packet management (two techniques used in broadband data transmission)
4. Interrupted Biological Processes
5. The Conversation Theory of Gordon Pask

All of these provide slightly different views of a common theme – the means for organisation of a whole living organism.

Morphic Resonance

Sheldrake's Morphic Resonance⁶ is very similar to an Idea (Chapter 8.3) or archetype, and shows one way in which the Idea might transfer to living organisms and ecosystems – and crystals. Morphic Resonance constrains the possibilities of organic growth and behaviour in ways that go beyond mere DNA and genetics. The capacity for a squirrel to learn and embody a new skill can be equated to the capacity of a compound to assume a new crystalline form. Once one new crystal has been made, or one squirrel has found a way to get at a bird table in a different way – just once - then that behaviour becomes more and more prevalent regardless of where in the world one might be. Since an Idea or a prior example can leave a universal pattern of potentiality, there are ways that different organisms can find a universal gestural language beyond mere genetic inheritance. And an infinite number of other modes of expression are also possible. All that is needed is the first example, and some reason why that should be taken up elsewhere in preference to any other possibility.

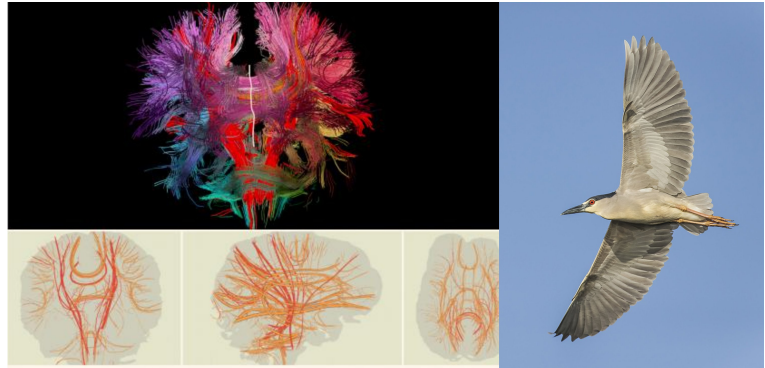
Although Sheldrake provides many practical examples of instances where this process of resonance has been observed, the idea (!) has met a lot of resistance in biology, possibly because it provides a mechanism whereby Lamarckian evolution might take place. It certainly explains the way that behaviour is inherited – birds migrate by navigating using the sun and stars along paths that might span half the globe. Or crouch in their nests at the appearance of a raptor's silhouette in the sky. At the moment we are so bedazzled by the double helix of DNA that it is assumed this knowledge must also be passed down chemically, to the extent that any other possibility (even if can be complementary rather than exclusive) appears preposterous.

Morphic resonance depends on a kind of consciousness that is discussed extensively in this book – namely a universal field of consciousness that is divisible but also pervasive, has the capacity to entrain, and to inform without an obvious direct means of communication – because its commonality by definition implies a “knowing” between anything that is connected through that field. A horse does not look like a goat because horse-consciousness and goat-consciousness are different, but they are nevertheless both part of vertebrate-consciousness and Gaia-consciousness. And the field of consciousness has the power to orchestrate DNA expression, and to modulate physiological processes. Some of the various means by which that takes effect are briefly described below.

Ukhtomsky & the Theory of Dominants

Although Sheldrake's Morphic Resonance has much wider implications than the internal organisation – or even the environmental symbiotic location – of an organism, it is not dissimilar to Ukhtomsky's idea of a dominant.

A. A. Ukhtomsky⁷ was a Russian physiologist who investigated the mechanisms behind integrated actions in living organisms. As he clearly argued (and has since been demonstrated), simple action potentials measured outside the context of time and more general (higher order) integrative communications – cannot account for the extraordinarily efficient and responsive **unstable equilibrium** that is found in the brain and in all



other homeostatic mechanisms at all scales. Whilst his work was primarily focussed on very small scale (control via action potentials in neurons), the patterns of communication-response that he identified appear to be universal from a molecular level up to whole-organism, and maybe beyond (into societal and ecosystem dynamics), and are not constrained to the nervous system and brain. Ukhtomsky deviates significantly from the fashion in western European science, because he specifically focusses on the time-variance required for organic life to function, and therefore focusses on the process (verbs). His investigative approach therefore points towards Goethe's holographic Multiplicity in Unity. On the other hand, Western neurology tends to still focus on location and attempts to locate the specific parts of the nervous system that perform certain tasks – and so is preoccupied with descriptive nouns and a reality constructed from building blocks – Unity in Multiplicity – leading to the very beautiful but static images of neural connectivity (see image)⁸. It should be clear that a static model of connectivity, such as a “wiring diagram” of the brain, cannot possibly describe the dynamic process of Life. Just as a photograph of a bird in flight – no matter how beautiful - cannot capture its behaviour or place in the web of the ecosystem, or the sensory-motor integration of awareness and movement, or the exercise of wilful purpose as the bird flies. If there is no awareness of the dynamics of time and response, it becomes possible to average out a rhythm and assume that this average is its reality, or to ignore the microvariations that maintain equilibrium and consider them to be “only noise”.

Ukhtomsky also pointed out that every organism attempts to anticipate the world in which it moves. **Anticipation** is a fundamental task that determines the sensory organisation of every organism (no matter how large or small) and every internal

metabolic (homeostatic) process. A bacterium cannot move towards food unless it anticipates eating; a person cannot catch a ball (or a sparrowhawk catch a sparrow) unless they can anticipate its future position based on its past behaviour. And a homeostatic process cannot respond to any form of stress unless it anticipates how that stress will affect it – based, at least initially, on previous experiences.

Thus, *Meaning* is intimately tied into the question :

“That happened then ... so what happens next?”

In this sense, *anticipation* is not just a forward-looking gesture, but also constantly refers back to memory and previous experience. There are many reasons for this Janus-like position of staring at past and future from the present being central to metabolism, one of them being the fact that nothing has meaning unless it is already known (Chapter 5), and both the present and possible future are always related to the accumulated weight of experience. It does not matter that there is no direct experience in this life, because the Morphic Resonant response provides a fallback that (in its lack of physicality – being an “Idea”) permeates every atom, molecule and organelle. The biological momentum behind this anticipation is so powerful that it takes a particular and extraordinary human capacity to step outside its constraints and imagine the apparently impossible. Since anticipation is an inbuilt reference to past and future, *one particular part* of the effort required to escape it and find a different response is to return wholeheartedly and with full conscious attention to the nexus of *Now*⁹.

Of particular interest to Ukhomsky was the fact that – once a task has been started - any organism can and does prioritise that over other later distractions, even if their input is temporarily far greater than the communication that maintains the original task. This is *one of* the means by which actions are sustained over any length of time¹⁰. Homeostasis is not a fixed process, but rather, one in which there is a substantial flow of information in between different internal (almost always rhythmic) elements, and to and from the “external” environment¹¹. Homeostasis itself, along with the biological structures that embody it, is not something that has arisen out of nothing. Rather, it has grown during the stages of embryological and post-natal development out of a continuously evolving dynamic homeostatic equilibrium that has also passed through several critical stages of re-working, in which old physical and temporal (rhythmic) interrelationships are replaced by new ones. Adolescence is becoming more recognised as a time when emotional regulation is difficult due to very substantial changes in organisation of the brain. And the many reorganisations necessary after birth – turning on lung function, increasing heart circulation, orienting to feeding through the mouth instead of the umbilicus (including a reversal of flow in major sections of the vascular system), recognising socialised eye contact, etc. etc. – precipitate a period of about two months in which the infant’s whole organic impetus is focussed on adapting to these changes.

Although it is possible to think of homeostasis as being something relatively static, in fact it is an expression of holographic dynamic activity – rather than any simple transition from one homeostatic state to another. In exactly the same way that a stationary unicyclist is constantly adjusting by means of rapid micromovements to impossibly small changes in balance and orientation, but when s/he moves the first act is one of loss of control and literally falling in that direction. The fall – which appears to be more significant than stasis – requires less control and is less universally adaptive, because the control to produce it was already initiated from stasis. So from a biological and homeostatic point of view, of all possible macro-activities *stillness* requires the greatest degree of internal self-regulatory micro-activity. And the balanced state of (apparent) stillness embodies the greatest potential (energy) for adaptation and response (**lability**). Technically speaking, all macro-states of change incur a penalty of inertia, and are therefore inevitably less adaptive. This seemingly topsy-turvy arrangement is a direct analogy to social immobilisation or the startle response, in which the immobilisation might appear externally calm and neutral, but in fact the homeostatic mechanisms underpinning it are more active and potentiated and are open to a wider range of possibility than in any other state. Simply, a living organism that has temporarily stopped moving and entered any form of stillness is asking the question

“... What now...?”

with every atom of its being.

Immobilisation is so survival-critical for a mammal that *when healthy and awake* it cannot be a static disinterest – but rather consists of constant high level of communication, both internally and between the socialising individuals via subtle tells in eye contact, body language etc. It is the micro-adjustments over millisecond intervals that embody meaning and maintain control through self-regulatory feedback loops. The sensitive feedback loops that maintain this homeostatic state (whether immobilisation, or constant body temperature, any other state) from a locus around which the entire organism’s activity temporarily pivots, are fundamentally integrative in nature, and are always contingent ...

Normal physiological operation of any given organ or tissue is not a statically determined value but a reflection of the current functional condition...¹²

The constant communication within a distributed holographic intelligent network that is required for any kind of life (including a single cell!) to maintain homeostasis cannot be explained by centralised or linear or organ-centred model.

As Rusinov stressed – the various cortical elements in a polarizational dominant react as a unitary functionally organized ensemble or system with long-term effects after the current is switched off. This cannot be explained by shifted membrane potentials, which return to their initial levels almost immediately after the current is turned off, and which from the perspective of the

polarizational model represent only the first and preliminary effect of forming a dominant physiological system. The dominant focus, according to Rusinov, entails widely integrated structural and biochemical changes occurring under electrotonic effects¹³.

In other words, the relatively high voltage action potentials are synchronised within a much lower voltage background level of activity that serves to coordinate and maintain coherence and persistence well beyond each specific discharge and beyond each specific neuron, synapse or target organ/muscle. It is possible to (appear to) account for this background Dominant by thinking of it as being *emergent* from the total action potential activity. However, the implication of the Dominant theory is that the higher order coordination egg precedes the chicken of total emergent individual action potentials. This arrangement is (amongst other things) reminiscent of Valerie Hunt's high frequency EMG measurements (see notes on Multiplexing, below). Bones are particularly effective semiconductors (though all connective tissue is to some degree semiconducting and provides a non-neural layer of communication¹⁴), and are particularly likely candidates as a source of this electronic and low frequency radio activity. It is not surprising that they have recently been identified as being central to the fight-flight response¹⁵.

These inherent anticipatory responses (or more accurately *adaptive ranges of response-action*) are what Ukhtomsky called "Dominants". Each of them forms a recognisable *pattern in time* – which on a higher organisational level might be observed as a pattern of reactive or automatic behaviour, or personality, or habit (or habituation). There are three fundamental characteristics whose change over time defines the three distinct phases of a Dominant response :

Lability is the capacity for constant change and **adaptation**. When considering the Window of Tolerance of the ANS (Chapter 7), Lability is at a maximum in the heart-centred range of ANS activation. In a heart-centred mental-emotional state, physiological efficiency and systemic coherence is optimised; and there is a maximised potential to adapt in any physiological, mental, emotional, sensory and behavioural direction. Lability with respect to action potentials is also associated with the generation of electrical charge. The body is electrical, and through the action of the whole-body electrical field, Lability is strongly associated with the capacity to maintain territory and defend body-space – and therefore to maintain psychological¹⁶, physical and relational identity/integrity. (see *Plasma and Charge Shells* in Chapter 8.2).

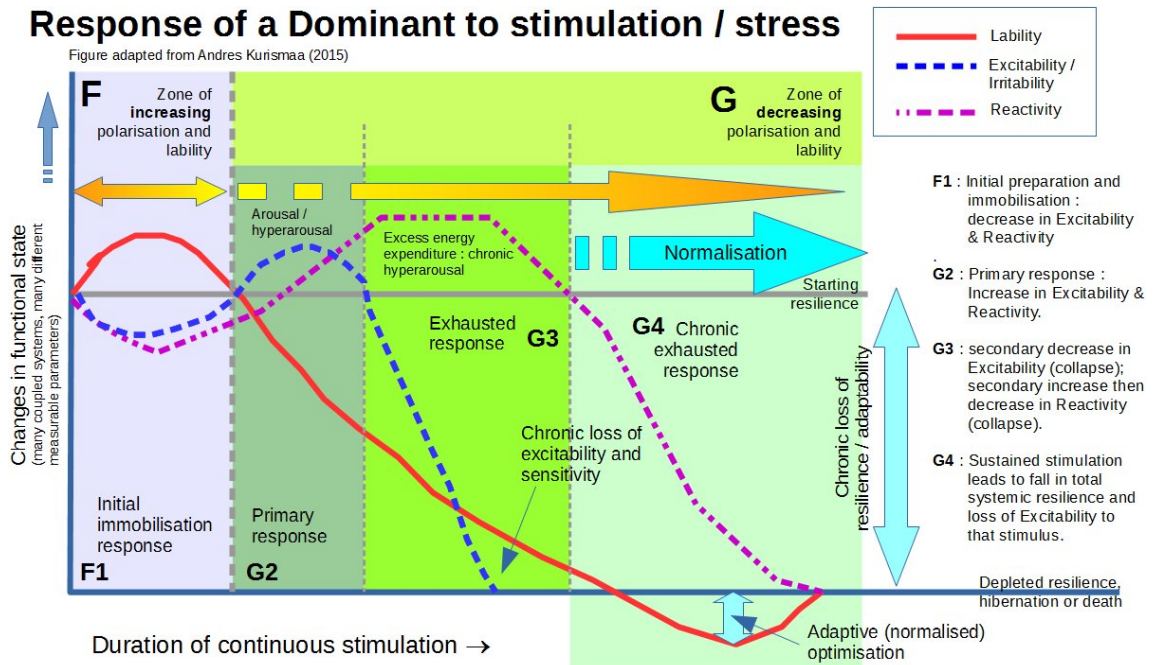
Excitability (or **Irritability**) is the capacity of a cell or tissue to generate or propagate (transfer) action potentials. On a more systemic or whole-body sense, it is the capacity to receive a stimulus (information) and then to respond through movement or other meaningful gestures. i.e. it is the ability to move within the **sense-response cycle**. In contrast, Lability is a measure of what kind of responses are possible and how much choice and mobility there is in

selecting those responses.

Whereas the previous two definitions are about *capacity* to respond, **Reactivity** is the *actual* response to stimulus. e.g. it describes the specific change in ANS balance that occurs when we meet a new situation.

The expression and creation of a Dominant

A basic Dominant response is shown in the figure below. As the graph moves to the right, it shows the changing effect if the same stimulus is applied constantly over an increasing period of time. The response of the two major zones and three sub-zones defined by Ukhtomsky can be understood simply with regard to the ANS, but *it should be remembered that the processes described are of the same generic form at all levels and modes of response by living systems, from sub-cellular up to societal.*



- **F1** : Initially there is a startle-immobilisation response. When we go still in order to create a space in which we can decide how to respond :
 - all sensory and physiological activity increases, but only focussed on the potential danger ... so *total* capacity to receive information (excitability) decreases

- ii. the capacity for adaptation in creases because this Dominant – at least temporarily - takes highest priority, so there is no momentum from a currently active Dominant to be overcome. Note that a Dominant *always* suppresses all other activity within its sphere of influence - which in turn depends on its level of priority. If the priority level is high enough (such as a survival-critical event), all other potentially active Dominants are temporarily suppressed. This is sometimes described as “flooding”.
 - iii. functionally, the stillness suppresses reactions so that (a) it is harder to be seen or heard, and (b) so our senses are more acute and therefore can more easily gather and assimilate information.
- **G2** : Now we have decided how we should best respond for optimum effect, and begin to express that as activity (which on a macro-scale always implies movement). This movement decreases our potential for adaptation (Lability), because a Dominant has been set up, which embodies a certain degree of momentum and tends to suppress response to other stimuli. For instance, if I focus on the road when driving (so driving is the Dominant), I am less aware of the passengers conversation. But if I focus on a conversation in the car (so that listening becomes a high priority Dominant), then the driving Dominant is given second place, and although I may still be driving, there is less capacity (Excitability/Irritability) for conscious awareness-response of driving, though that Dominant may still be processing on less conscious levels, with the necessary excitation being withdrawn to some degree from the capacity for conscious intervention. Once a course of action has begun it takes a big effort to change or redirect it or to engage with another Dominant. But the movement/response also usually opens up a focussed ability to respond and to communicate and receive information (i.e. in the case of a social Dominant the Ventral Vagus nerve will be engaged in socialisation activity).
 - **G3** : But as the same stimulation continues, it becomes harder and harder to maintain the same level of response. The party becomes more and more tiring, the loud music might be initially pleasant, and then just becomes a background noise that brings its own stress and exhaustion, the constant conversations and exchanges might be enjoyable for a few hours, but then a desire for something else – silence, solitude, sleep – begins to set in. As the duration of stimulus increases, if the reactive Dominant demands attention for good reason (i.e. it’s not just a party – it might be a baby with colic that continues to scream unconsolably for several hours), it increasingly “dominates” the capacity to respond, excluding all other possible Dominants/responses. Information theory begins to take effect – in that a continuous noise becomes the norm and (almost) equal to no noise at all – except that it takes a lot of energy to filter it out so that we can be aware of anything else.

Meanwhile the “Excitability” (Irritability) increases for a while – so although the noise might become the norm, a hyperaroused response develops. Even though the level of noise (or pain) might not have gone up in reality, the sensory system ramps it up because of the feedback loop demanding our attention. One manifestation of Zone G3 is central sensitisation.

- **G4** : In the chronic state of stimulation, the sensory system disengages, becoming numb, and the entire mental-emotional-physical capacity to respond and adapt to anything (resilience) is decreased. This is stress-induced dissociation, which physiologically consists of an opiate-adrenal state. The bottom line of the graph is the chronic whole-body resting state with which the next stimulation is encountered and responded to. Note that in the final stages of normalisation the red line (Lability / capacity for adaptation / resilience) returns to a slightly higher level. This represents the body shifting to a different homeostatic balance by changing the way in which everything interacts to make the best of the presence of the new adaptive Dominant. This shift increases total resilience (energy efficiency) at the expense of losses in efficiency and adaptive capacity at lower metabolic levels. This is essentially a reduction in Wellness (Chapter 3). If the cumulative effect of Dominants is sufficiently large, there is nowhere left for the total body adaptive capacity to go when a new stressor is encountered – and at that point a “last straw that broke the camel’s back” effect can be seen. I regularly hear people coming to my clinic saying *“I just bent over to open a drawer and then my back gave way.”* The small normal everyday stress could not be accommodated by normal adaptive capacity because there was no adaptive capacity left.

The characteristic Dominant response shown in the above diagram is found in all biological, physiological, mental, emotional and societal responses regardless of their type; the difference being purely a matter of relative duration of each of the three zones, and the specific level of process one is observing. So this model applies equally well for whole-body ANS responses as it does for individual action potentials or for metabolic changes of any kind (whether immune or systemic or confined to an individual organ) to any kind of stressor. It applies to tranquilisation as much as excitation, as much as it also applies to inhibition, but each of these invoke a different proportion between the three/four zones.

The above graph should not be interpreted as having to be in any way traumatic or catastrophic (though, of course, it can be if the stressor is large enough). The magnitude of responses, of numbness, and loss of resilience that occur in response to a constant stimulus/stressor is determined by :

- i. the magnitude and type of stressor
- ii. the pre-existence of Dominants to deal with that stressor
- iii. the inherent adaptive resilience at the onset of stress/stimulation

If the stimulation is a low level of traffic noise, then provided there is not a pre-existing noise-affected Dominant, the person will first feel a little stressed, then will become slightly hypersensitive to the noise and find it annoying. But then the traffic noise will become normal background, will (unless attention is deliberately directed at it) become unnoticeable. The penalty for this normalisation is that a new Dominant (lets call it the “I’m going to ignore traffic noise Dominant”) is created, which

- i. creates response inertia and so reduces total resilience and adaptive capacity on a mental-emotional-physiological level
- ii. takes up metabolic room, and slightly displaces a series of sensory and metabolic processes, reducing their adaptive range
- iii. induces an inbuilt level of environmental numbness, which is accompanied by a loss of capacity to respond to the environment

All these might be so small as to be imperceptible, but they are still present, perceptible or not – as is shown by the fact that even caterpillars are stressed by traffic noise and have a higher resting heart rate! The presence of this “traffic noise Dominant” specifically predisposes the person to a higher level of reactivity and reduced capacity to adapt gracefully to future noise-related stressors; but generally reduces the capacity to adapt to any kind of stressor. Many of these imperceptible Dominants (a chemical toxicity, a disruptive neighbour, a mobile phone signal, a piece of bad news, job insecurity, etc etc etc) may be stacked on top of each other, and the net effect of multiple small environmental stimulants or stressors is that there are cumulatively large losses in systemic resilience, and similarly large losses in sensory engagement. i.e. there is an increase in systemic dissociation.

In fact, any Dominant created as a result of a constant stimulation almost inevitably leads to reduced resilience and an accompanying loss of sensory engagement – which most often manifests as a qualitative reduction in embodiment – i.e. dissociation. Having said that, life is a continuous adaptive compromise, and we are so universally adaptable that it is almost impossible to tell which particular environment humans are truly optimised for. And of course, Dominants may also be positive. Most people have strong dominants associated with activities that they enjoy, or which occupy all of their attention, and can often be heard to say “I was in pain, but when I got interested in X it seemed to go away”. Which Ukhtomsky elegantly explains as one Dominant taking the highest priority and so reducing perception of stimulation that is not relevant to that particular Dominant. The need to pee or defecate similarly removes interest from other possible actions, and makes concentration on other things far more difficult – another example of the action of a Dominant that is familiar in everyday life. Survival-critical Dominants (such as the need to pee) tend to flood and take over far more easily, so even though it is possible to focus through them to other layers of information, they still dominate the experience of that particular moment. Dominants are familiar in Trauma work as “alters” and “apparently normal parts” in Dissociative Identity Disorder – which are substantial and intense examples of

Dominants that can be set up and retained in lesser traumas (such as traffic noise).

The interesting thing is that small to mid-range Dominants can be neutralised and re-normalised with a return to previous levels of adaptation, resilience, coherence, integration, and sensory engagement. So although a Dominant is an embodied response-pattern, it is a programmable one, and can equally be de-programmed. The rules for how a dominant is set up in the first place provide some understanding of the process by which a *redundant* Dominant (i.e. one no longer adaptive to current circumstances) can also be de-prioritised (as a temporary solution); and – most importantly - how it can be re-normalised.

Multiplexing and Packet Management

Modern communications requires that vast quantities of information in many different separate streams is transmitted in parallel. To understand this it is largely necessary to forget the particular sources of information that go into these streams – they may be files of data in various formats, or images or video or music, or any other form of information that can be digitised. And it is also necessary to almost forget the many end users. Some streams of information just go to one person, whilst others (such as television and radio transmissions) may be broadcast to many millions of users. The issue is simply – how to get so much parallel information down a single wire or fibre-optic cable or radio-frequency transmission in a manner such that it can be retrieved at the other end and separated from everything else. There are several quite different ways in which this is done – which are used in combination. Data compression is not really relevant to this discussion, so I am going to focus on *packet management* and *multiplexing*.

Packets of information

The information is separated out into small **packets**, and these are transmitted one at a time. The packet begins with a marker that – amongst other things, such as an error checking code - tells the receiver which particular information stream the packet is from. If you are watching a video on broadband and also have an email program open, your computer sends only the video packets to the video program, and the email packets to the email program. The important thing is that the identity of the packet and its contents determines how it is then processed. If one packet is corrupted, then it can either just be discarded, or it can also be replaced by re-sending that packet. As an example, you might post a book to somebody by placing each page in its own envelope with a separate stamp. If a page was lost or damaged in the post, they would be able to tell because each page is numbered, and so they could ask for a replacement page to be sent. If a different page from another book was substituted into an envelope, then it might have a different size or texture of paper, or a different font, or the first sentence might not read properly when compared to the end of the

previous page.

With regard to signalling in living organisms, packets tend to be more physical – you might think of them perhaps as the particle aspect of information in the Quantum Mechanics wave-particle duality; and they apply particularly to DNA and RNA. One aspect of packets is that they are always without context – it is the sequence in which they occur and the context and the meaning ascribed to them by “higher” processes that determines their effect. Signalling molecules – proteins, hormones, peptides, etc. – are essentially packets. Consider a set of packets that are sequences two seconds long from a series of cowboy films, each showing a cowboy removing his gun from its holster. The intrinsic function of the gun and the act of removing it from a holster indicates that someone is probably going to be shot. But some of those film clips might actually show someone preparing to clean the gun, or hand it to someone else, or even throw it away. As a self-contained packet of information stripped of context, those nuances are lost. Everyone looking at the two-second film clip sees the gun being prepared for action. If they know the general plot of the film, then maybe they will guess the meaning of the short clip. Similarly, once released into the body, a hormone or protein begins to lose its context unless it is accompanied by a set of other changes that place it in context. Without the whole film – the whole body-mind context – the package meaning defaults to an un-nuanced fallback meaning. The gun is always going to shoot.

In fact, just as guns are taken out of holsters for many reasons other than a shoot-out, individual signalling chemicals in the body are used in many different contexts, and it is the whole context that determines the meaning. A stray molecular signal without context can only have its fallback meaning. As an example, cortisol is a stress marker that often accompanies adrenaline, and indicates that (a) a fight-flight response is in progress, and (b) infected injuries are likely to occur. Injecting cortisone into the body indicates to local tissues that the whole body is preparing for a fight-flight situation by manufacturing a cortisol precursor. The local immune response is therefore to enter a fight-flight mode, encapsulate current infections (to make them safe), and promote interstitial (lymphatic/serum) fluid loss from wounds so that they are flushed clean. There are many such loops that can lead to escalation. For instance, Osteocalcin is produced when bones are physically stressed (loaded), and also ties into testosterone and assists in the total stress response¹⁷, modulating heart rate, blood glucose and several other fight-flight adaptations.

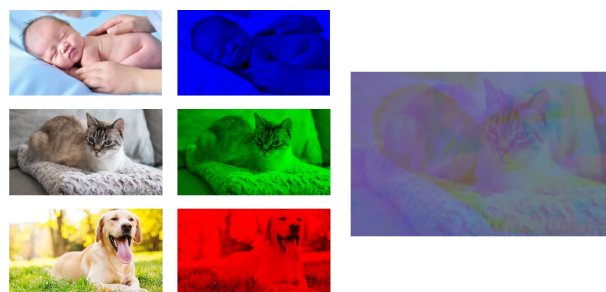
... This insight led the researchers to the unorthodox hypothesis that perhaps bones evolved, at least in part, to help animals escape from danger. If this idea was correct, then bones might also contribute to the flight-or-fight response.

Given that one local “loop” accepts a signal at face value (rather than in a whole body-mind-environment context), the storyline that it plays out (cowboy draws gun, *and therefore shoots*) is then taken up by the next loop downstream, and so on. Thus, whilst packets of information are a simple means by which the physical body

communicates internally, it provides a route by which the most fundamental levels of organisation can be operating on a very different reality and agenda from that being experienced and projected by the conscious mind. So far as body organisation is concerned, packets result in the potential for a bottom-up response cascade, which may be relevant to real current circumstances or may not. Somehow – that molecular – cellular cascade also has to be regulated by nuanced top-down responses to the environment. Optimised health lies at the nexus of this cross-flow of information.

Multiplexing

A second way that data is transmitted in the broadband reaching your home, and particularly multiple telephone calls made over the same line – is based on the principle of **multiplexing**. Here, the information is broadcast in a particular frequency band, which can be added to all the other signals that are also travelling down the cable in their own particular and unique/individual frequency bands. Each distinct signal is given its own frequency range. Hence by definition, “broadband” means there are many different multiplexed bands being transmitted simultaneously in parallel. So many different information streams and/or packets from one channel can also be sent at the same time along multiple frequency bands, meaning that the information reaches you much more quickly. The information in each specific bandwidth can then be filtered out at its destination from the information in other bands. Another way to explain this might be to think of an image projected in red, blue and green light. The three colours might contain very different images, and whilst the total image will probably appear to be a confused mess, if the different colours are separated again, the original images will re-appear.

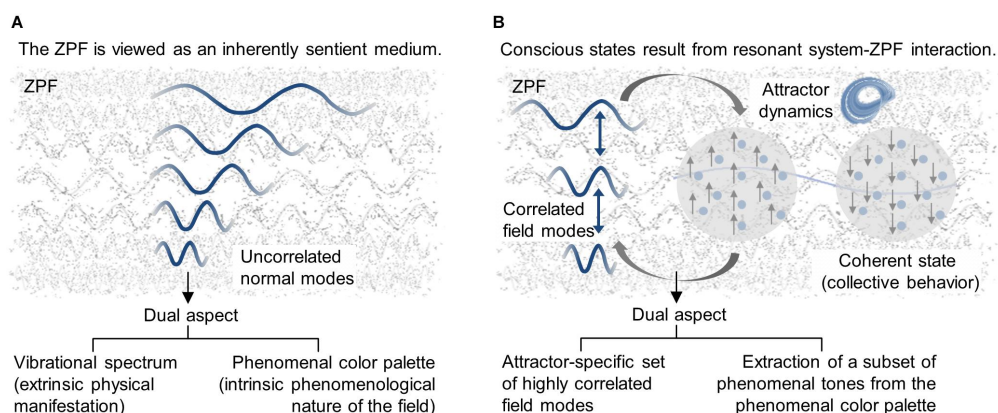


Multiplexing is an important concept for understanding how different organs and tissues in the body can retain their own identity and function as a coherent organ. It is also particularly relevant to Ukhtomsky’s theory of Dominants, in that it provides a mechanism whereby several dominants may exist in parallel. One of the foremost researchers on Consciousness – David Chalmers – considers consciousness to be a matter of coherent vibration¹⁸ – a concept that *also* allows for de-coherence, resonance, and multiple bandwidths.

Electromyogram (EMG) signals measure the electrical activity associated with connective tissue and muscles. They are usually discarded above about 3000 Hz using a low-pass filter¹⁹ on the measuring equipment, because this high frequency information is considered to be just noise – useless static²⁰. Valerie Hunt²¹ carried out research into high frequency EMG signals (up to about 250,000 Hz) and found that these carry a lot of information, with the higher bandwidths being related to mental-emotional activity, and lower bandwidths being related to the health and activity of

physical organs and metabolic systems. She also found that the activity of these high frequency EM signals correlated remarkably well with colours observed by accurate medical clairvoyants (e.g. see Carolyn Myss²²). In all, Hunt’s observations demonstrate a clear example of multiplexing, with information being passed throughout the whole body and beyond – into what is termed the biofield – by means of a quasi-hierarchical arrangement of frequencies arranged according to metabolic level. More basic (let’s say primitive and cellular) metabolic activity occupying lower frequencies, and more whole-organism and integrative functions occupying higher frequencies. In process control it is well recognised that higher frequency signals are required to interrupt and control lower frequency processes²³.

The idea of multiplexing also ties into the electromagnetic theory of consciousness²⁴ in which consciousness is a fundamental attribute of the “zero point field” (ZPF). Or even that the ZPF and Consciousness have some degree of equivalence. The figure below from Keppler (2021) shows how this might work. A ZPF model requires that dissociation exists as a phenomenon in its own right because otherwise we would be like a radio set unable to tune into a single frequency – but rather untuned and simultaneously receptive to every broadcast on every radio frequency.

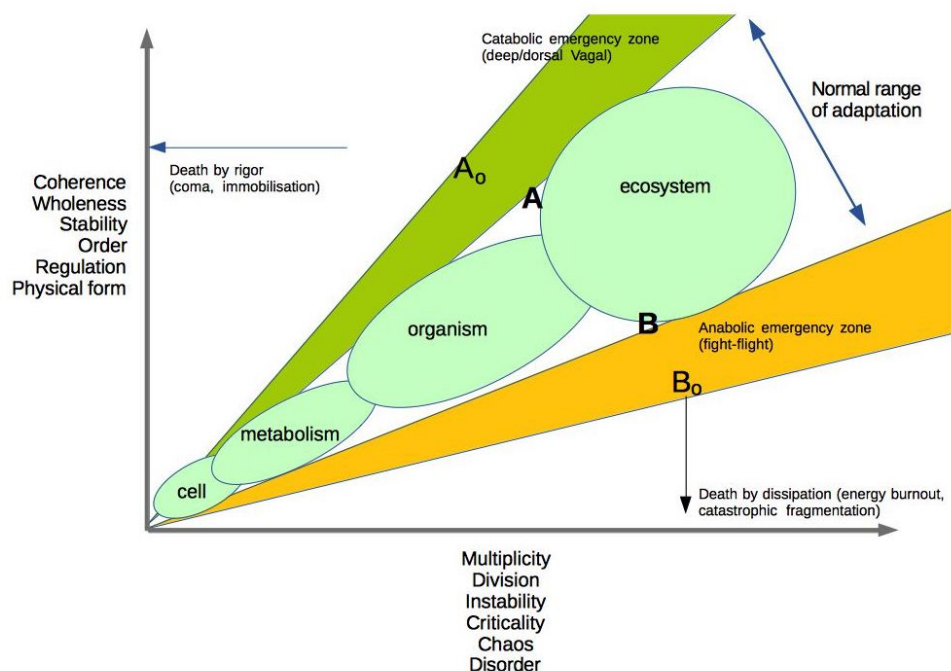


It is necessary that your liver can have a communication within itself that does not intrude on your cognitive thoughts, so compartmentalisation and the ability to *not* listen is a pre-requisite requirement of any source of consciousness in complex living systems. Communication is, after all, only meaningful when a simple meaningful message can be abstracted from everything else. Your senses – particularly the external senses – are managed by application of gestalts that filter and assume meaning according to a set of pre-determined templates (see Chapter 5). This model not only provides for necessary separation – but also allows for other apparent boundaries to be transcended. So we exist in a landscape of living organisms and have the capacity to both tune out (and be isolated individuals) or to tune in) and be participatory notes on an almost infinite sea of relationality). This latter way of being is the “natural” state described by the few remnants of non-civilised humanity.

Complexity and Systems Theory

There is some confusion regarding the application of systems theory to Life processes. It is usual to think of a definitive balance between adaptation and efficiency; and in some ways this is true. A living organism cannot optimise itself for *all* possible eventualities without necessarily losing efficiency, because that degree of adaptation requires redundant capacity. However, Life does not work like that, and the definitions of “efficiency” and “adaptation” need to be better defined before this equation can be properly addressed. As is shown in Chapter 7, the metabolic organisation of Life (as expressed by the workings of the ANS) is centred around a normal range of functioning, within which metabolism is both efficient *enough* and adaptive *enough*, and is optimal. This range is based on a fairly stable physical structure (anatomy) in a fairly predictable landscape and relatively limited set of environmental conditions that supply resources (food etc) and certain threats and challenges. So a relatively narrow window of metabolic demand/need for adaptation can be defined for most common circumstances, and the whole organism – behaviour, “mindset”/outlook, lifestyle, structure (anatomy, skin covering etc.) and metabolic range - are fine tuned to that normality. Optimisation of energy efficiency is one of the basic rules that governs Life, and is hard-wired into every single metabolic and physical process. But the organism optimises itself *within the constraints of whatever adaptive state is current*. Although *energy* efficiency is a high priority, it is not the only priority in this optimisation process. After all, energy efficiency is only important because it is one factor (of many) that optimise survival. Other priorities might include hydration/water conservation, thermoregulation, relational aspects of behaviour (maintaining relationships is a high priority for many life-forms, including bacteria, because although that activity takes up resources, it enhances survival), the need to eat (acquiring more energy through collecting, eating and digesting food is never an energy-conserving activity), and the need to be adapt-ive (which also enhances survival), (etc). So given all possible demands, all one can say is that at each moment the organism optimises itself for survival of itself and its descendants across all demands, stressors and opportunities. Simply put, there is no inverse relationship between adaptation and efficiency.

However, Life does exhibit certain traits that are reminiscent of systems theory. On the one hand, Life likes order, and is dependent on characteristics such as coherence, wholeness, structure, form, stability and regulation. So for a given species of animal, anatomy, habitat, social body language (such as mating rituals) show relatively little



variation between individuals. But that apparent order and same-ness is somewhat illusory, and if these static traits dominate the animal will succumb to death through rigor. On the other hand, cell groupings, animals and animal populations also like instability and division, as expressed by processes such as multiplicity, chaos and criticality²⁵. Criticality is the spinning plate on top of a juggler's pole or the acrobat on top of a unicycle – an inherently unstable state that is central to metabolic processes, allowing organisms to constantly and efficiently self-optimize across multiple almost infinitely complex interactions. The apparently static forms of the animal are made efficient and adaptive by these potentially destructive forces – which will lead to death by dissolution if they become too dominant. This is shown in the figure below. Animals in position **A** are optimised to thrive in an energy-limited environment. For instance, deep sea creatures tend to be red because red pigments require less energy to make, and they tend to move slowly. And reptiles and other passive feeders have a metabolism centred around the capacity to lie doggo for long periods, just waiting, ticking over. This is the kind of metabolism used by bacteria that have remained trapped in pores in rock for millions of years. **A₀** would indicate situations such as hibernation or an extreme last-stage adaptation to starvation. In contrast (**B**), organisms in an energy-rich environment energy conservation is eschewed in favour of energy cycling and behaviours that optimise the total energy cycle and veer even more

towards something that can rather inadequately be described as *beauty*. So migration is expensive in terms of immediate energy use, but (in the case of migrating birds) reduces the climatic demand on metabolism; or for many animals (such as bowhead whales or monarch butterflies) improves the conditions for their young to thrive. The exuberant plumage of birds of paradise or the mating dance of storks and grebes cannot possibly be said to be energy-efficient of themselves, but nevertheless are efficient and beauty-full ways that Life uses to enrich its expression of potential. To anyone concerned with simplistic energy efficiency (and particularly energy conservation), all this might seem meaningless... except that we now know that difference (even the small difference between one organism and another of the same species or cell type) engenders a greater capacity for resonance. Whereas same-ness might appear to be more efficient (as an analogy to a Henry Ford's production line where any colour can be asked for so long as it's black) for an organism viewed out of context with the wholeness of its environment, difference causes a more (energy-) efficient resonance, interaction and harmonisation between the individuals in an integrated system²⁶. Just to complete the description of the diagram, as chaos and division increase (**B_o**) they cease to be efficiently functional, and instead lead to dissolution. Cells disseminate their organelles to the fluid in which they are immersed, a few pockets of surviving animals die out because they gradually lose their genetic diversity.

So Life walks along a tightrope between Order and Chaos. Or, in the symbology of alchemists from ancient China, Europe and every other corner of the world: in a balance between the creative/destructive forces of Water and Fire, or the fixed/mobile forces of Earth and Air. In fact this creative polarity operates at all scales, and applies to human affairs (such as economics) just as much as it applies to Life. If economics was fundamentally rooted in a respect for Life, then it would follow Life's rules and so would, like Life, result in the infinite multitude of variety and richness recognised by Darwin and Russell back in the 19th century during their explorations. There is no "optimum", except as defined by the circumstances and the specific adaptations that the any one organism is capable of and still reproducing so that the next generation can continue. Just so long as life can go on, it will adapt, and has adapted.

As it is, the economics we employ (or that employs us) appears increasingly to be inimical to Life. Life requires scale-dependent compartmentalisation – such as the division of the brain into two halves to give an enhanced appreciation of meaning, or the localisation of populations in micro environments to propagate new species, or to maintain the energy efficiency of the Krebs cycle. Life exists as a set of relationships that loop back on themselves, eating their own tails like the mythic Ouroboros through many layers of interdependent, self-referential and interwoven scale. But globalisation of economics removes barriers and weakens local economies to the extent that they eventually cannot sustain the global one that is eating them. Big global corporations might be efficient in producing goods and services at a cheap price in the short term, but they suck the life out of smaller economic entities. Cheap is as cheap does.

Instead of circulating in a way that enriches everyone a little, wealth simply rises to the top of the food chain to enrich a few and impoverish the rest; and then much of it stays there sequestered in tax havens. It is as if whales ate every other life form in the ocean, but whispered secretly to each other and came on land to defecate and die, thus giving nothing back to the environment in which they live.

The chain of Life is efficient because it is fundamentally relational and reciprocal. That reciprocity may sometimes be fairly obvious, such as the relationship between mycorrhizae and roots; but there are many, many relationships that so far we have not discovered. Who would have thought that the dawn chorus of bird song would open plant stomata so they can directly absorb the morning dew? Or that wombats would deliberately herd other animals into their deep burrows to help them escape bush fires?

One of the peculiarities of Life is that it locally reverses entropy. This nicely fits Prigogine and Stenger's description of dissipate structures, perhaps most simply described by use of a river as analogy. A river is a vast flow of energy, and within that flow there arise eddies and turbulence that exhibit a fractally organised order. So local order (standing waves and eddies that are in effect a local reversal of entropy) exist by drawing a tiny (or even zero) amount of energy ("dissipation") from the much larger total flow. Living processes encourage the local order arising largely from the flow of solar energy (though there are also other sources – such as hydrothermal vents) and perpetuate it, duplicate it and then diversify it. Which - unless one looks at life as being fundamentally self destructive - is defying rather than assisting the 2nd law over a substantial period of time – in the case of Earth, several billion years. Although individual living forms come and go, as do species in a series of extinctions, the trend has been towards an increasingly dense ecosystem with increasing diversity – i.e. a very long term local reversal of entropy. Since the Earth's ecosystem/Gaia is not closed to anything participating in it, the 2nd Law of thermodynamics doesn't really apply locally to life. Therefore - so far as Life is concerned as a whole - the 2nd Law should not be considered to be inviolable²⁷.

There are many ways in which this dance between order and chaos play out. If there is too much chaos we tend to seek order and predictability – something with significant political ramifications in an age of increasing uncertainty; and if there is too much sameness and featureless predictability eventually someone (or something inside) rebels and goes out to seek risk and newness. The basic set of three experiential zones defined by the Autonomic Nervous System (Chapter 7) fit very nicely into the diagram above. Solid mental-emotional states (too much order/fixity) such as depression are associated with the deep/Dorsal Vagal response, whereas neuroses and paranoidias are related to the more chaotic energy that comes with excess sympathetic activation. If the middle zone of this diagram is considered to be the core location of well-regulated homeostasis, these disturbed mental states represent a loss of homeostatic regulation of neuroception – depression being an excess suppression of

neuroception, and neurosis being a loss of the capacity to consciously regulate neuroception.

Interrupted Biological Processes

Melanie Goodwin from First Person Plural²⁸ was featured on Channel 4 in July 2012²⁹, and described how Dissociative Identity “Disorder” was actually her only available way to survive the events of her childhood. This is a very potent example of how normal adaptive loose coupling can become a more permanent **Interrupted Biological Process**³⁰, in which fragmentation then becomes a fixed part of the developing, plastic, adapting, growing structure of identity that arises in a young child. Some DID only consists of a handful of major “Alters” (fragments), and each of the smaller fragments would not be so large as to be considered a significant portion of the total identity. In other more extreme cases there are many fragments of identity. A recent court case in Australia involved a survivor of childhood trauma who had fragmented into over 2000 different identities³¹. This kind of internal experience is impossible to comprehend by someone who lives with primarily a single major (and apparently unified) core identity.

How does this happen? Why does the fragmentation remain, when this loss of integration is - to an external observer - a highly dysfunctional arrangement? Since the basic model I work with is one of health and wellness (Chapter 3), I asked the question – “where does fragmentation of any kind occur in a healthy situation?” The answer – known by every DID trauma survivor – is that the fragmentation was necessary so that they could survive. Fragmentation is in reality a survival mechanism that is universal, and is not only restricted to severe trauma, and is not restricted to humans. It turns out that loose coupling is a universal adaptive strategy, and fragmentation (a state in which the loosely coupled state becomes slightly more de-coupled, and then becomes jammed on) is extremely common. I was very surprised by the answer, because the more one looks, the more loose coupling appears to be an everyday arrangement in any complex life-form as well as being part of the everyday experience of walking round in a human body. It is certainly used by all forms of life, and may even be a feature of organelle behaviour below the level of single cells.

John Upledger developed the idea of “Energy Cysts” (EC's) and the “Interrupted Biological Processes” (IBP's) as part of his work with biophysicist Zvi Karni in the 1970's, whilst he was attempting to make sense of various phenomena that occurred during successful treatments^{32,33,34}. EC's and IBP's, loosely coupled fragments and Trauma are not exactly the same concepts, but there is a substantial amount of overlap in their definition :

- An EC is a volume of body tissue that contains (i.e. it prevents the release of so as to protect the rest of the body-mind) a somatic memory of overwhelm. So

EC's are more or less equivalent to trauma... Except that I once witnessed an EC (and/or IBP: see below) release that contained unexpressed laughter! EC's often arise as a result of direct impact trauma, and as such are often vectors, having an inherent direction, an associated body alignment, and a quality akin to momentum.

- Overwhelm does not have to be intrinsically “bad” - but rather it is simply a state in which the total magnitude of everything happening in a particular moment was such that the body-mind could not process it there-and-then.
- A fragment is a result of a loose coupling that became stuck in that state because it was overwhelmed; *or* is a deliberate de-coupling that was initiated *in extremis* as a desperate (though frequently also creative) survival tactic. It is a fragment of the total body-mind-identity that no longer functions as an integrated part of the whole. All fragments are eventually rather like Japanese soldiers on desert islands still fighting a war that has in reality come to an end. They exist in a time warp.
- An IBP is a biological process that did not complete for some reason, and continues to attempt to play out until it truly has completed. Therefore IBP's are always fragments. So trauma is an IBP in which the fight-flight response did not complete because it was overwhelmed. Somatic Experiencing often deliberately sets out to invoke the final stages of the fight-flight IBP by encouraging shaking. In a similar vein, a C-section birth may (*sometimes*) become an IBP for the mother because the cervix and womb have still to push the baby out; and (*sometimes*) the baby needs to experience passing through and being squeezed by the birth canal to truly know that it has been born. The fact that IBP's do not always form when a process is interrupted - points to their relationship to overwhelm/trauma processes - rather than all biological processes inevitably needing to complete.

The “odd” phenomena that can arise during treatment and in daily life of IBP's, EC's and fragments that somehow have to be accounted for may include many possibilities. The most common of these are one or any combination of :

(1) Detailed somatic memories of long-gone events or mental-emotional-physical states.

Sometimes these events were in very early childhood, or even pre-birth, or sometimes in previous generations in the same family, or sometimes what might be considered to be “past lives”. Personally I have experienced several such memories, and they have a strange quality – where I was aware of my present reality but was also equally living a very different reality, through sensations in my body as well as thoughts, emotions, movements, sometimes visual information, and/or sounds. One particularly vivid memory “flashback” that had absolutely no obvious rhyme or reason was that I experienced myself with a Neanderthal body – being acutely aware of the thick

eyebrow ridges and solid jaw, and powerful physique. Another was a memory of an early embryological stage, which included a sense of spherical gestures in and around my body and an essentially irresistible need to arch my body in the sagittal plane, first backwards, then forwards. Another was a memory of being a newborn baby, with a weak neck and a head so heavy that it felt like a cannonball, around which I was forced to move the rest of my body. So “long-gone” can include not only living memories but also pre-verbal, prenatal (gestational) memories, generational memories and what are commonly termed “past-life memories”.

(2) These memories often appear to be associated with a particular volume of body tissue.

Very often the memory resides in a specific location in the body (not the brain!), and is experienced as emerging, and/or metamorphosing and/or exiting from this location. Certainly they are often experienced as arising from within the body by both the person and an external observer, and often have distinctly somatic components (sensations, movements, gestures) and an immediate and unmistakable “reality” and detail that is typical of traumatic memory rather than normal memory. They may also be stored in the body in a diffused state (more like salt is stored in sea water), which is a technically more difficult configuration to work with. As these memories arise ready to (potentially) be released they can be associated with a temporary inner image similar to a dandelion seed head exploding into the air, or of a tightly rotating spiral inside the body, or a very slowly rotating spiral in the space around and outside the body (see Solitons, Chapter 8.1). If either the therapist or the patient gets enmeshed in these spirals/seed heads by paying them too much direct attention, then there is almost always a flood of overwhelm that prevents any significant healing from taking place. This overwhelm flood may sometimes also result in a distressing recovered memory (that increases the degree of trauma) with no resolution.

(3) Despite the clarity of certain elements, there is rarely a complete or coherent narrative that is immediately available.

This again is typical of trauma memory. Anyone recalling a moderate to severe trauma that has happened from teenage years onwards will tend to remember a few (sometimes apparently random or trivial) details with extreme clarity, but have their order jumbled, and have complete memory blanks through large sections of time in the entire sequence of events. Recall of the entire sequence in a way that allows the sequence to be reconstructed may take years or may never in fact happen at all. So the apparently random and meaningless “Neanderthal Jaw”, “heavy head” or “spheres” mentioned in the first item are really not untypical⁵⁵. After all, if you know that a particular thing has happened (because it’s recent and you were conscious and proactive at least in the initial stages), then a narrative can be constructed to make sense of the fragments. If a memory fragment is from before the age of about 10 or 12 years old, and particularly when it is from the time in the womb, when experience and context was so different or there were no words with which to conceptualise those experiences), then there may be little immediate sense at all of any coherent narrative. In the place of a narrative there may be a set of powerful and confusing emotions,

visual experiences (which often have a spherical character to them), somatic gestures that emerge from deep inside the body, and so on. Or there may be an inexplicable “knowing” despite the strangeness of the experience.

(4) But often something knows

If there is DID/large fragments of identity, the fragments may indeed have very clear and continuous memories of the events – because one of the jobs of the fragment is to contain that experience/memory. The compartmentalisation of memory that may occur as a result of fragmentation can result in clear memory streams being available to some parts of the body-mind, and in some circumstances and under certain rules these memories may be accessible.

(5) Local identity

If there is DID/large fragments of identity, the fragments may indeed have a very clear self-identity of their own. Even relatively small or recent EC's/fragments can have something of a personality. The simplest explanation is to consider that the global immune system (in the largest and broadest possible sense of the term) protects not just cells against bacteria, but also protects against all insults to the body-mind, and is in its own right the seat of self-identity. Now, one can question exactly what this immune system might comprise of. The Glia (immune cells of the brain) have been found to not only protect neural tissue, but also to act rather like gardeners, trimming and disposing of synapses as the neural network reorganises itself. Titin (an immunoglobulin) represents the biggest part of muscular tissue, and a significant aspect of muscular function is “armouring” - a physical defense of the body that is activated under both physical and emotional threat/loss of safety. And the immune function of the body is massively dependent on the activity of the gut flora, raising questions as to how an immune “human” self-identity can arise from and be dependent on a variable ecosystem of non-human bacteria? So when there is fragmentation due to trauma/the formation of EC's or the creation of an IBP the fragment one way or another performs a dual role, attempting (within the limits of its awareness and scope) to protect the whole human organism, whilst at the same time having a reduced awareness of what that whole human might be. To perform that task, the protector has to also protect itself, because its task is one of survival... if it fails, then it will no longer survive. Furthermore, it often expresses qualities very reminiscent of the “Metal” element described in 5-element theory from TCM – in which Metal is associated with the skin (an important boundary), the lungs and large intestine (upper and lower orifices) and the immune system.

(6) Tissue compression

Somatized memories are held in physical body (connective) tissue, and one of the mechanisms that retains that memory is a lock-down of movement. This may be subtle and global. But – maybe because smaller more local memories are less likely to be overwhelming and are generally more easy to process - is more often experienced in local volumes of tissue. These may be layers of fascia, organs, muscles, acupuncture meridians, sites of physical impact, or something else. The tissue holds

the memory because it is compressed, and will resist attempts to de-compress it. If manual therapy does decompress that tissue, the memory is released, and if the person still feels “safe enough” when that occurs, the contents will be processed and the memory will no longer be held. If the contents are too big to process all at once, then the tissue release will be temporary.

Varela, Pask and Conversation Theory

Underlying all the models and processes described above is an intimate process of conversation between molecules, organelles, cells, organs, bodily systems, individual organisms, families, societies and ecosystems. The cybernetic “Conversation Theory” devised by Gordon Pask beautifully describes this subtle interplay that organises everything in the living world and underlies all relationality.

To put it into context I’m going to start with Francisco Varela’s idea of “*Not One, Not Two*”, probably derived directly from Shunryu Suzuki’s “*Zen Mind, Beginners Mind*”. To quote from the introduction...

“Now I would like to talk about our zazen posture. When you sit in the full lotus, your left foot is on your right thigh, and your right foot is on your left thigh. When we cross legs like this, even though we have a right leg and a left leg, they have become one. The position expresses the oneness of duality: not two, not one. This is the most important teaching: not two, not one. If you think that your body and mind are two, that is wrong; if you think that they are one, that is also wrong. Our body and mind are both two and one. We usually think that if something is not one, it is more than one; if it is not singular, it is plural. But in actual experience, our life is not only plural, but also singular. Each one of us is both dependent and independent.”

Gregory Bateson, Margaret Mead, Varela and several other figures in consciousness research came together for a conference³⁶ on Mind/Body dualism in Marin CA July 27-30, 1979. Basic principles agreed even before the conference started were :

1. *Phenomena are usually linked together in recursively (and often fractally / holographically) organised systems/subsystems* (which we will see later in Pask’s model).
2. *Information is triggering to the release and organised direction of energy* (“Information is the difference that makes the difference” - Bateson)
3. *In the biosphere it is common that differences are triggering events* (basic information theory : differences are more significant than samenesses)
4. *Significant differences are always distinct and distant from the processes they*

arise from and that they affect. Differences precipitate tidings of differences, and it is the tidings that then precipitate change. "The map is not the territory", and neither are the rules by which the map might be constructed/encoded or be read/decoded. For any discussion on physiology, this principle should make your eyebrows rise. There is a common logical fallacy in physiological and other forms of research relevant to being human – that mechanism or even a single correlation equates to causality. So, for instance, we see action potentials associated with muscle firing and assume that there is a direct causality. On one very limited and linear level that may be true, but on another it provides absolutely no explanation as to how a decision to move translates into actual movement. The statement "action potentials cause muscle contraction causes movement" is a linear sampling of a non-linear recursive self-referential wholeness – see later. It is both true and not-true.

5. *These rules apply not just to the investigated – but also to the investigators(!)* Objectivity in the investigation of conscious processes is in fact impossible, because the investigator is using consciousness to observe consciousness.

Writing in the midst of the Chilean civil war of the late 1970's, Varela composed "*The Logic of Paradise*". He had been struck by the craziness of a world that had descended into a kind of Hell – where different ideas were seen as mortally dangerous, and people were killed because of them. Varela wrote in his essay as an antidote to this collective insanity :

"...we must incorporate in the enactment, in the projecting out of our world views, at the same time the sense in which that projection is only one perspective, that it is a relative frame, that it must contain a way to undo itself."

This recognition that a single perspective is inherently pathological informed his future investigations of consciousness. The idea "*...must contain a way to undo itself...*" is difficult to interpret but was a recurring theme. Perhaps an analogy is the most straightforward answer. I struggled with my mother's narcissism for 60 years of so, until a few years ago during a typically disjointed rambling she mentioned that she was unable to look me in the eye for three months after the birth, and then suddenly saw me and declared "there you are!" The insight of that story of profound degree of post-natal depression kicked me into a different perspective, and I found a lot more compassion and sense of shared connection to her. The kinds of relative frames that Varela is referring to are synonymous with the integer relationships described by Kurt Godel's Incompleteness Theorem – which may appear impossibly contradictory until one can step outside their domain and view from a broader perspective – we might say "from outside the box". With the proviso that there is an infinite stack of self-referential embedded boxes at all scales, just as there are "turtles all the way down".

Influenced by his experience of the ideologically driven violence of the Chilean revolution, Francisco Varela (1946 -2001) was seeking for a way to construct systems of society, politics and even knowledge that were not stuck in a frame of thinking where they become the only way to view the world; and could – given the correct impetus or feedback – transcend and let go of one way of seeing and take up another which served them better – which was more inclusive of a greater proportion of society. The interesting thing is that Life has evolved with exactly this capacity to self-reset. If it were not the case, we would never be able to adapt to a new environment. Settlers to Australia would still be attempting to plant in the wrong season. Animals would never adapt to the arrival of a new kind of predator – or a new source of food – or a new potential such as the option to sleep in a cave instead of under a tree. The question posed by Varela was – how is this biologically commonplace process of resetting to a new reality to be transferred to a more mental and linguistic (human / societal) setting?

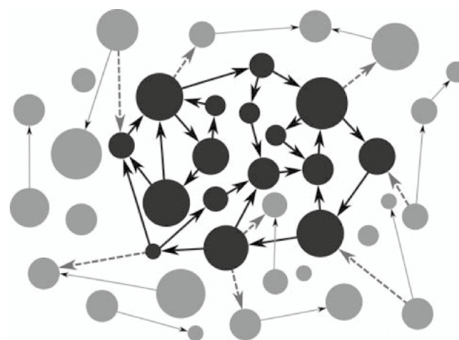
Varela started by saying...

“If there is to be a change in our perception of the Mind-Body relation, there has to be a change in the context in which the problem is seen to arise.”

Thus, given a setting in which a constructed world (e.g. a city) is the norm of experience, then focus naturally tends to fall on the “parts” that “make up” a whole just as bricks make up a building. If the context is changed to an ecosystem, then things become much more relational and less fragmented – as do the world views of indigenous peoples who still live closely tied to their living landscape. This change in perception and contextual frame was further described as

1. seeing wholes and multiples differently (as in One, Two and “not One, Not Two” being visible as a result of three very different frames of reference),
2. understanding mind as a conversational domain of information, distributed amongst the stable interactions occurring in the biosphere, and
3. the experiential phenomenology of mind (as e.g. cultivated by meditation) has to be part of the total understanding. An awareness of the inner processes is something that is possible for anyone, but some practice is required to develop skill and insight. A superficial glance is rather like expecting to be able to carve a marble masterpiece in the style of Michaelangelo – simply because one has picked up a chisel.

Item (2) is particularly interesting in the context of this book, because in its loosely framed yet precise wording, it allows for multiplicity of identity, fragmentation, and shifts in the physical or “geographic” relationship and degree of embeddedness between consciousness and physical



body tissue. The description arises directly from a consideration of Gordon Pask's "Conversation Theory". Conversation Theory applies throughout society, language, artificial intelligence – but has a universality that is also capable of describing complex homeostatic interactions that maintain a living organism, or an ecosystem.

All relationships in the natural world are open ended and stretch out almost infinitely to all scales of distance, time and operational medium³⁷. Within this near-infinite One-ness, there are multiple individual processes that can be identified, singularised and pulled out (of context) as One-nesses in their own right... such as an individual person (or small group of friends) in a football crowd, where the entire crowd has a recognisable movement and activation dynamic such that there is a "Not One, Not Two" relationship between the individual/group and the larger crowd. Which can be symbolically illustrated by the "operational closure" diagram (right)³⁸. A greater complexity and richness of mutual interactions brings a particular sub-entity into focus and so it can be Id-entified.

This process of Id-entification in turn was described by Varela as "Star Cybernetics" - a simplification of a closed network in which an individual process is identified from within a greater whole, by taking up a particular way of seeing the whole that separates it into parts (i.e. that undoes its appearance of wholeness)...

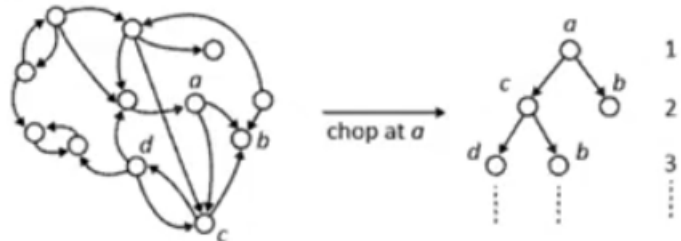
The general thrust of Varela's work in seeing the interconnectedness of processes is not particularly new. It is a modern and technologically-oriented re-working of a long tradition of humoral medicine, as expressed by (e.g.) William Harvey (1578 – 1657) in his thinking³⁹ of organs as having "offices" – i.e. of having intelligence and working in service of a greater whole (human) intelligence, which in turn worked in the service of an even greater (Divine) intelligence. The Göttingen School⁴⁰ [of teleology] also considered the principle of wholeness in the early 19th Century. Both they and Varela considered reductionism to be something that allowed the inner marvels to be made visible, whilst simultaneously hiding (through its myopic way of seeing) much that was of necessity to the continuation of Life.

Teleomechanism as originally conceived in the works of the Göttingen school was a comprehensive program advancing simultaneously on several research fronts, including physiology, systematic zoology, and later embryology. For men such as Kiehmeyer who had originally formulated the itinerary of future lines of research these were not to become separate research specialties. Such a notion was far from their minds. Rather these research areas were viewed as closely related aspects of a comprehensive science of life, which was referred to as Biologie, allgemeine Zoologie, or Morphologie. In each stage in the development of their program, the teleomechanists considered their task to be the construction of general descriptive laws in each of these several areas and their synthesis into a unified system. Only once the systematic interdependence of these laws could be demonstrated in terms of a single unifying principle did they think that a causal explanation could be attempted: as Humboldt expressed it, only then would Naturbeschreibung [description of Nature as a

collection of objects] give way to Naturgeschichte [“natural history” or an understanding of nature as a living process]⁴¹.

Conversation Theory

Pask’s *Conversation Theory* can be compared to a dance in which there is contingent cooperation due to an assumed mutuality that Pask termed “*amity*”. Each of the two dancers has a common goal – what they want, that can include the desire simply to dance – and they have various means to achieve that including the externalisation of information (information not externalised can only communicate internally). When their dance has reached an immersive quality of perfection, they constitute a self-referential One-ness (Left drawing) that can also be seen as a Two-ness by choosing to see each of them as an individual dancer (Right drawing, the way of seeing “chops at a”).



Each dancer subtly moves (controls) their partner, and the partner accepts the (respectful) movement as also being in their own interests being part of the dance (and dancing is the mutually agreed common goal) - and so takes it up as their own. Then they notice where that has taken them and perform a similar reverse exchange of information... and so the dance proceeds as a cascade of mutually shared and mutually respectful controllings and yieldings. There always has to be some control exerted by someone (or something), but as long as the mutuality of interest is recognised (*amity/love*) then the control is generally light and is continuously passed backwards and forwards as the dance proceeds.

In living systems the control is inferential – conveyed by information as a tiding of something “elsewhere”. e.g. in the Dance, the dancer chooses to go in a certain direction. This is translated into movement, and the partner perceives the movement rather than the thought from which the movement arose. Even *meaning* can be emergent from this dance, starting off neutral or ambiguous, and then arise of itself through his kind of mutual amicable conversation. In order for the process to work it always has to be grounded in the real world – ideas that are ungrounded in experience or practicalities have no inherent purpose, and therefore have no mutual interest to coalesce around around. I’m sure you are aware of the way that an open-ended philosophical conversation that has no single practical application almost inevitably dissolves into platitudes and meaninglessly generalised statements. In essence, this process of Conversation describes the dance of two cells that find themselves next to each other in a growing organism.

John Wheeler asked the deepest question about how we can be both participants and observers, exemplified by his diagram of the universe as a

"self-excited circuit"

- Heinz von Foerster

Pask took Wheeler's extremely simple self-excited feedback circuit and made it practical as follows :

Each "participant" of the process holds a common sense of purpose or "amity" (or Love) – a mutual interest powerful enough to result in a state of "Not One, Not Two" (or in Varela's cybernetic terminology, a **/ Star-Slash* relationship) in their process of interaction.

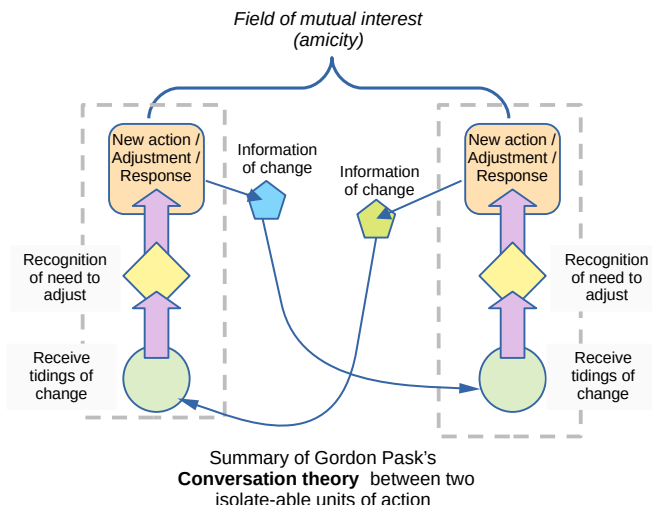
And this **/ conversation* exists between the two dancers; between each dancer and the dance; between the two dancers and the other pairs of dancers on the dance floor; between internal physiological processes in the dancers; between the bodies and minds of each individual dancer; between individual

metabolic processes, adjacent cells, in their bodies, and between the dance floor and the outside world (via the electrical, water and sewage lines, the caretakers and cleaners, ticket sales, the musicians and their families), the dancers extended connections in their lives, the surrounding city and landscape; and so on in a *recursively* (fractally / holographically) *organised set of system and subsystems*.

Which model gives us a good handle on what has to be in place to generate a productive conversation in which "Not One, Not Two" is possible; and therefore as a corollary, a list of the things that can go wrong and dis-Id-entify something into parts that are incapable of maintaining a fully coherent conversation. Which is in effect a structured definition of both organic wholeness, loose coupling and dissociation.

From Pask's cybernetic Conversation Theory, self-referential wholeness ("Not One, Not Two"-ness) requires :

- A physical or other significant (inter-)connection with real consequences (*i.e. this is a real-world situation, not a conceptual one*).
- An amity that is the basis for a shared and recognised mutuality – i.e. a common and shared and sustained interest in starting and maintaining a conversation for some duration of time. This in turn implies some form of intelligence along with a recognition of *both* "I/Other" and "We".
- The capacity (sensitivity, attention) to detect the tidings of change occurring
- The capacity to derive significance (meaning) from that information such that a



meaningful response is possible. This meaning may simply be an awareness of the “other”.

- The capacity to respond meaningfully to that derived meaning.
- The externalisation of information about the latest action (which may or may not be a response) – in a form that carries meaning. *Given a small amount of “training” time in mutual interaction, any detectable information will eventually convey relevant meaning.*
- And for volition to be possible, it must also be possible to provide something new into the conversation. This newness must be large enough to carry significance, but not so large or different that it offends the sense of amity. Thus, there is an upper tolerance limit for surprise, and without tolerance there can never be anything new.

Loose coupling arises as a result of one or more of these processes becoming less available, leading to a loss of coherence. Dissociation and/or fragmentation and/or loss of resilience arises because this loose coupling becomes stuck in a state that is no longer congruent with the “real” needs of the organism. Conversely, an increase in availability of these processes can lead to new kinds of Conversation. Both an increase or reduction in availability leading to a broadening or degradation of Conversation would be followed by (and/or caused by) a process of adaptation (Ukhtomsky’s “*Dominant*”), as described previously in this Chapter – i.e. a shift in optimised energy state. So two dancers waiting for a partner have more potential energy – more untapped possibility – than two dancers who have coalesced. But the reduction on potential energy is matched by a release of expressive energy. So one can actually view Ukhtomsky’s **Lability** curve as being a dividing line running through a constant pool of energy – below the line being the energy available for further adaptation, and above the line being the energy being used for expression of the current adaptation. This above-the-line energy may be bound (in chronically stuck adaptation) or free (in the case of dancers who have just come into partnership for a dance).

If “Not One, Not Two”-ness is the definition of a coherent integrated organism, it would appear from the list of qualifications above that there are many things that can go wrong – so many different ways that the process of Conversation can be interrupted or degraded. I believe that this apparent vulnerability is something of an illusion, partly because separation is used by Life as an organisational tool in its own right. When it comes to cellular processes and vegetative processes (such as homeostasis), surprise is minimal, and as described in the first three Chapters, Life has evolved a robustness through its choices of signalling molecule. As a body grows itself, there is a constant unfolding of a fractal “hierarchy” of self-referential dances and dancers in which – more or less regardless of the starting conditions, meaning is inferred as the dance evolves in complexity and progresses through time. This does however provide

a mechanism for instability (such as described by the Cell Danger Response hypothesis) – because when forced into a homeostatic corner, the dance may shift in pace and rhythm, which may lead to subtly different meanings being learned during its first few cycles of unfolding.

But the issue for any complex multicellular organism is – how does the holographic “it” (i.e. every cell, every accumulation of cells, every homeostatic mechanism and its various parts, etc etc) “know” that it is One, and not Two (or more)? Mere physical connection is insufficient unless the physical connection itself is a means of near instantaneous communication. We know that nerves can be excised with relative impunity, and blood and lymph circulation can be sluggish, and the whole can still continue. It is therefore very difficult to attribute this wholeness to nerves or blood circulation – “something else” must be at work. And at the same time, lower level very chemical processes, even lower level cellular-mechanical processes (see work by Donald Ingber on cellular tensegrity) and neurological and fluid/vascular information is also in action. Which leads to a realisation of the fact that biological organisation occurs on multiple levels. Information on physical, chemical, neurological (etc) levels are interleaved on each other, with some even more global message of identity – that must have a subtle and yet important effect. Coming back to the dancer analogy, we have the dancers, the dance floor, the music, the building – and we are looking at something perhaps far less physical that holds them together – maybe a common membership of the local Tango club, or a sense of friendship that endures? Neither of which would be obvious to someone coming with measuring instruments...

Which rather brings us in a rather splendid self-referential loop back to the Kirlian photography at the beginning of this Chapter.

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- 5 Elena Yu. Zueva & Konstantin B. Zuev (2015) Dominance Concept by AA Ulkhtomsky and Anticipation. Researchgate DOI:10.1007/978-3-319-19446-2_2
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- 11 Considering that to a homeostatic process, “external” can mean to and from internal processes that have a different primary function – that will also have to adapt to the overall change in systemic balance. So it is not only referring to the environment outside the physical and immunological bounds of the body.
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- 13 Andres Kurismaa (2015) op. Cit. p. 53
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- 19 A Low Pass Filter allows lower frequencies to pass but blocks higher frequencies. If this is achieved at the sensor by fitting a hard wired capacitive circuit, the higher frequency signals are discarded before they even reach a recording device.
- 20 According to the standard model of nerve-muscle action, (1) muscles are only activated through action potentials in nerves, (2) nerve synapses fire to create action potentials through ionic diffusion across the synapse junction, (3) this can only take place at quite a slow rate (max about 3000 Hz), and (4) there are no other means of electrical or electromagnetic communication in the body, because everything that needs to be explained about nerves and muscles can be explained by (slow) action potentials. Therefore all signals of significance occur at less than 3000 Hz, and anything higher than this frequency can only be meaningless noise.
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- 28 <http://www.firstpersonplural.org.uk/>
- 29 <http://www.channel4.com/programmes/4thoughttv/episode-guide/series-2/episode-12>
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- 40 Specifically the natural scientists Albrecht von Haller (1708–1777), Johann Friedrich Blumenbach (1752–1840), Carl Friedrich Kielmeyer (1765–1844), and Heinrich Friedrich Link (1767–1851). The sciences were not quite so pigeon-holed and specialised in those days, and so the natural sciences – practiced as a single discipline - included biology, physiology, zoology, embryology, anatomy, medicine, philosophy, physics & chemistry, with philosophy being at its heart. Indeed, the many confusions in modern science, medicine and technology regarding ethics and epistemology suggests that philosophy should continue to be a core subject (and not consigned to the periphery). Then at least there would have to be some acknowledgement of the many (currently) invisible a-priori assumptions that plague scientific declarations of “fact”.
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