Enflame

Newcastle

Number 2

Bifrons Creativity

ISSN 2047 – 0444

Newcastle Philosophy Society

Mathemagical Schemas for Creative Psych(a)ology

Patrick William Jemmer

School of CEIS

Northumbria University

Newcastle upon Tyne UK

Published by:

NEWPHILSOC PUBLISHING

BIFRÖST HOUSE

27 MYRTLE GROVE

SWANSEA

SA2 0SJ

UK

web: http://www.newphilsoc.org.uk

e-mail (Enflame): philoEditor@gmail.com

e-mail (General): philoSecretary@gmail.com

e-mail (Sales): philoSales@gmail.com

Newcastle Philosophy Society is a Registered Charity for the promotion of Philosophy (Registration Number 1106082).

This is a critical / scholarly / creative work
intended solely for educational and academic uses.

Edition 1 first published July 2011.

British Library Cataloguing-in-Publication Data

A catalogue entry for this book is available from the British Library.

ISBN 978-1-907926-14-3

Acknowledgements

I wish to thank the most recent "*Bifrons* Creativity" Editor, Dr Cristina Izura BSc (Salamanca), MSc (Barcelona), PhD (York), lecturer in the Psychology Department of the College of Human and Health Sciences at Swansea University, as well as the "*Enflame Newcastle*" Series Editors Dr Roy Sturgess (Chair, Newcastle Philosophy Society, and former Head of History at Sunderland University), and Dr Joel Yoeli (Trustee, Newcastle Philosophy Society, and former Consultant Clinical Psychologist based at Newcastle upon Tyne UK Child and Adolescent Mental Health Service) for their support and guidance, as well as highly useful encouragement and critical and constructive input in completing this work. My own study, practice, and development in psychotherapy over the past ten years have been graciously supported throughout by my Clinical Supervisor, Mr Joe McAnelly BA (Hons Psych), MNCP (Acc), MNCH (Acc), MBACP (Acc), MBPsS, MPNLP, MISMA.

Thanks are also due to Professor Nuria Lorenzo-Dus (Personal Chair in English Language and Literature, College of Arts and Humanities as of July 2011), Director of the Swansea University Language Research Centre (LRC) for affording support in completing this project. I am grateful to Swansea University Research Forum (SURF) for electing me to a Fellowship whilst on leave of absence due to illness from my job at Northumbria University.

Material presented in this book has been developed at Northumbria University and used in the teaching, learning, and assessment of the Level 4 (first-year) Module MS0402 ("Computational Mathematics" moderated by Principal Lecturer Dr Paul Oman) and the Level 6 (final-year option) Module MS0602 ("Dynamical Systems" moderated by Principal Lecturer Dr Charles Fall, Head of Subject Team for Mathematics and Statistics). Other work has been presented as invited lectures and at conferences, *viz*: "Neuro-linguistic Programming and the Unknown Tongue: Or All Ablaut how Eating Blue Öyster Umlaut can Give You Verbal Diæresis (The Third Northumbria Conference on Learning, Teaching and Assessment; Northumbria University, Newcastle upon Tyne, 25 June 2004); Northumbria University School of CEIS CM0430 ("Ludological Studies") Guest Lectures: "Pragmagic: Practical Semiotic Sorcery, Technoglossy, or Lingwiz'dry for the Twentyfirst Century" (26 November

2009); “Psycho-chaotic Semiotics and Psycho(a)logical Creativity” (27 November 2008). I would like very much to thank the Trustees of Newcastle Philosophy Society for giving me the chance to share ideas at: Salon Dydd Gŵyl Dewi Sant: Reality and the Rain (Reign? / Rein?) of Chaos (Jesmond, Newcastle upon Tyne: 4 Mawrth 2010); Philosophy in Pubs: Anarchy is Order (Cumberland Arms Newcastle upon Tyne: 9 February 2010); Hallowe’en Salon: Mascyrelsoth an Altermodern Approach to Magic (Jesmond, Newcastle upon Tyne: 29 October 2009); Café Philosophique: A Season of “The Other” Session 1: The O(the)r (O)the(r) … Mathemagical Reflections on the Dialectical Logistics of the Mathemic Relations Alter <> Idem, Homo <> Hetero, and Self <> Other (Quaker Meeting House, Jesmond, Newcastle upon Tyne: 5 September 2009).

Work in this book has been shared with members of the public attending the Swansea “*Philosophy Café*” sessions organized by Mr Roy Butler which have been running monthly since December 2010 at Swansea University and Swansea Metropolitan University.

The idea of the dialetheia, dialectics, and the logistic equation as embodying “Dialetheialectics” developed here was first introduced in a psychological context the book: Jemmer, P (2011) (Re)(De)(Con)structing Lacan: Mathemegenesis for a Rhizaleosemiotic Calculus. Swansea UK: NewPhilSoc Publishing; Published June 2011; ISBN 978-1-907926-13-6.

Absolutely invaluable insight has been gained through my conversations, friendship and practice with Joel Yoeli, Joe McAnelly, and Janet Darbyshire; I have also gained a great deal of “magical” maturity through the musical medium of “Chanting with Chris” – a great big loving laughing “*Aum*” for Chris Headland and all my friends!

Dr Patrick William Jemmer

Swansea

7 July 2011

“*Mathemagical Schemas*” – Contents

CHAPTER 1: CHAOTICS

The human brain lies at the zenith of æons of evolved biological complexity on Earth. However, despite this, the brain is ignorant of any postulated "objective reality" and merely intercepts and processes all incoming signals with the aim of recognizing and responding to differences. In this way the brain self-referentially governs further human evolution in the ongoing competition for existence by enforcing the two basic imperatives of competition removal and of genetic propagation. Yet the physical structures of the brain also generate the processes of human personhood and thinking. In this way, ethereal awareness (or consciousness, psyche, spirit, or soul) appears to wander freely through the virtual spaces of the mind, oblivious and unresponsive to the processes and substrata which support and sustain it. And whilst empirical evidence, enlightened science, and logical rationality have enabled humanity to tame the external environment, they have not granted us dominion over our own internal metaphorical "psychescapes." For human beings are fundamentally motivated and driven not by knowledge but rather by belief and by emotion. Thus whilst evolutionary theory can be seen as providing a map of humanity's past developmental history, this theory cannot be used as a tool with which to elucidate humanity's future trajectory. The human brain has controlled human history in the past. In the present, the human brain controls the fate of all living things on the Earth. The human brain will, in the future, control the destiny of the very Earth itself. It is vital, therefore, that we learn to understand the brain.

After Geoffrey Raisman, "What is the Brain For? [0]

1.0 Introduction

A dynamical system moves along trajectories defined by initial states, proceeding from one state to the next, as governed by its defining system equations, which include important modulating parameters. The collection of all states for a given system is called the state space and the collection of all the trajectories for a given system equation is called the phase portrait. The portraits are described in terms of qualitative topological features such as stationary points, maxima and minima. The modulating parameters for a particular dynamical system described by particular system equations can have a critical effect on the system's behaviour. Bifurcations occur when these features change suddenly, or undergo large changes in magnitude. In particular, deterministic-chaotic systems show behaviour which is highly complex and essentially unpredictable. Moreover, different dynamical systems can couple together to exert mutual influence, bifurcations, and differing behaviours. Or, a single system can couple with itself, leading to self-organization.

Perception and cognition proceed by filtering processes (through mathematical “transforms”) and mapping processes (through the generation of “holographs”). These always-ongoing filtering and mapping processes of produce “states,” which represent attractors in the embodied mind-brain’s phase space. The union of the linear dynamical systems used in perception and the nonlinear dynamical systems necessary for self-organization produces the mind-brain’s overall “landscape” of far-from-equilibrium chaotic attractors. Development occurs in a cascade of bifurcations towards increasing system complexity. The penultimate stage of this cascade is the imaginistic self-organization of mental models. These models allow “meta-awareness” and orientation with respect to temporal consciousness-development, from memory of the past, through perception of the present, and forward to projections into the future. In the final stage “outer speech” becomes internalized as “inner speech” allowing languaged self-organization of the image-models. Consciousness arises as a flux of information through a holographic, massively-overlayered, deterministic-chaotic neural network system. Chaotic human psyches, combined with chaotic environments, produce chaotically indeterminate behaviours, although this can be a positive existential feature. Language inefficiently implements a linear-processing “operating system” on the massively-parallel, neural-network “architecture” of the mind-brain. This means that conscious, superficial, logical, linear reasoning, using entrenched language-patterns, tends to become “stuck” when applied to problems originating in the unconscious, deep, metaphorical, nonlinear domain of filtered-transformed data.

However, the “self” can exhibit surprising creativity through the combination of predictable, linear, stability together with unpredictable, nonlinear, adaptability. This chaotic nonlinearity means that slight changes in language-patterns can cause large changes in internal imagery; and that small changes in internal imagery can cause large changes in mental models and meta-awareness. Successful therapeutic interventions seek to help us to “navigate” through a chaotic and potentially highly creative “psychescape” using “magical” confusion, symbolic patterns, and metaphor in order to find and to create novel resources and solutions.

1.1 Dynamical Systems

Let us start by defining a “dynamical system” as being composed of a set of “variables” each of which represents one “dimension” in a “phase space” [1], [2], [3], [4], [5]. Each of the variables can take on different values along its dimension at different times. The ensemble of all the variable-values at any particular time defines the “state” of the system at that time, and the state can be pictured as a point in a multi-dimensional “phase space.” The “evolution” of the system between subsequent states is described mathematically by a “vector field.” This vector field is defined by a fixed equation or equations (usually containing variable “modulating parameters”). The equations embody the tendency of the system to change from one particular state into another particular state as time progresses, and the mathematical description of the system’s evolution between states may be continuous (using differential equations), or discrete (using difference equations). Having defined an initial state, the system is said to move along a “trajectory” from one state to the next, as governed by the defining system equations. If the initial state is different, then the succeeding sates will be different, and the system will follow a different trajectory, still governed by the system equations. The collection of all states for a given system equation is called the system’s “state space,” and the collection of all the trajectories for a given system equation is called the system’s “phase portrait.” Phase portraits can be classified according to a variety of quite general features in the vicinity of particular points in phase space called “nodes.” If all trajectories “sufficiently near” to a given point approach and finally end up at that point then it is a node called a “stable (or attracting) fixed point.” If all trajectories “sufficiently near” to a given point start at that point but finally move away from it then it is a node called an “unstable (or repelling) fixed point.” If all trajectories “sufficiently near” to a given point move inwards towards that point along spirals of decreasing radius, then the point is a node called a “stable (or attracting) spiral center;” conversely, if they move outwards away from that point along spirals with increasing radius, then the point is a node called an “unstable (or repelling) spiral center.” If all trajectories “sufficiently near” to a given point cycle around that point in fixed closed loops without ever reaching it, then the point is a node called a “center.” If, in the vicinity of a center, all “sufficiently near” trajectories approach the fixed loop, and then cycle around center, then the loop is called a “stable (or attracting) limit cycle.” There are also “saddle points” which are nodes that “attract” along some dimensions, and which “repel” along other dimensions. Figure 1.1 shows a picture of the phase portrait for the (relatively complicated) continuous, 2-dimensional van-der-Pol dynamical system, which is often used in the description of psychobiological and mind-brain phenomena [6], [7], [8], [9], and which clearly exhibits a stable (or attracting) limit cycle.

The simplest possible models of any features of “reality” are given in terms of so-called “linear dynamical systems,” for which input is directly proportional to output. Even when the systems under consideration are known to be nonlinear, they are often “linearized” or approximated as a linear, so that they can be described by simple discrete equations such as:

$$u_{n+1} = \omega\, u_n \qquad u_0 = a \qquad \Longrightarrow \qquad u_n = \omega\, a^n \quad .$$

Here, the “initial state” is $u_0 = a \geq 0$, determines the sequence of subsequent “output states” is u_n (for $n = 1, 2, \ldots$), and $\omega > 0$ is a “modulating parameter” which controls the qualitative behaviour of the system. If the initial state $u_0 = a = 0$, then $u_n = 0$ (for all $n = 1, 2, \ldots$), and $\hat{u} = 0$ is described as a “fixed point” of the dynamical system since the system is “fixed” at the value of the initial state for all values of ω. For the case $\omega > 1$, and $u_0 > 0$, then u_n grows to infinity as n increases. For the case $\omega < 1$, and $u_0 > 0$, then u_n decreases to zero as n increases. For the case $\omega = 1$, and $u_0 = a > 0$, then $u_n = a$ remains constant as n increases, and $\hat{u} = a$ is a “fixed point” of the dynamical system for the particular value of the initial state $u_0 = a$.

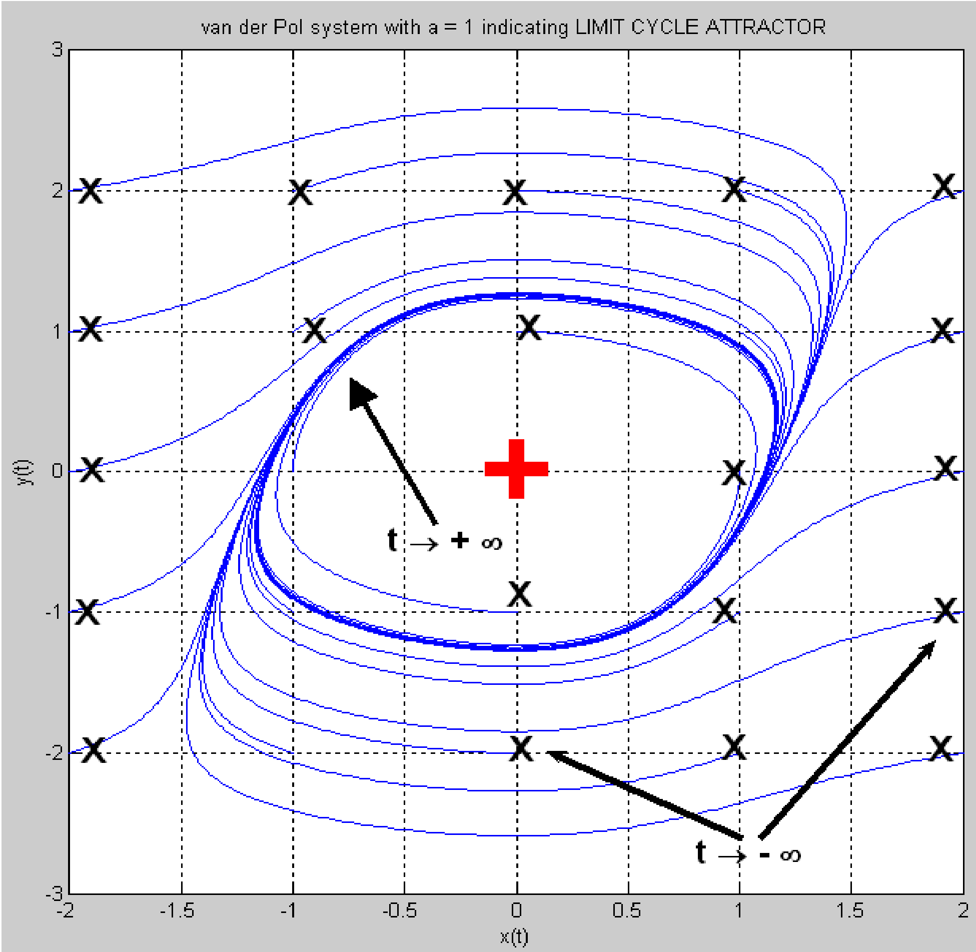


FIGURE 1.1: The general van der Pol Generator dynamical system, with parameter a, is given in terms of dynamical variable $x(t)$ by the system differential equation

$$\frac{\mathrm{d}^2 x}{\mathrm{d}t^2} - a(1 - x^2)\frac{\mathrm{d}x}{\mathrm{d}t} + x = 0 \quad .$$

This is analyzed by introducing the new dynamical variable $y(t)$ as well as $x(t)$, and rewriting the governing system differential equation as the two separate system equations

$$\frac{\mathrm{d}x}{\mathrm{d}t} = a\left(x - \frac{x^3}{3} - y\right) \quad \text{and} \quad \frac{\mathrm{d}y}{\mathrm{d}t} = \frac{x}{a} \quad .$$

The Phase Diagram for such a 2-dimensional van der Pol Generator (here in the specific case where the parameter $a = 1$) clearly indicates the presence of a stable (or attracting) limit cycle (SALC), located at position (+). Trajectories begin at positions labelled (x) as $t \to -\infty$, and are "entrained" to end up on the so-called "limit cycle" as $t \to +\infty$, either from outside, or from inside, the SALC.

However, even complex linear systems (described by many variables and many corresponding linear equations) can be shown to lack most of the richness and fundamental complexity of even the simplest nonlinear systems (which are those containing at least one nonlinear equation). The introduction of “nonlinearity” introduces a critical element of “self-interaction” or “feedback,” either within a single system, or between different systems. One of the simplest nonlinear dynamical systems is described mathematically by the so-called “discrete logistic equation” [10], [11],

$$u_{n+1} = \omega\, u_n(1 - u_n) \qquad\qquad u_0 = a \ .$$

This logistic formulation naturally includes the interaction between the state of the system (through the “increasing” term u_n) and itself (through the “decreasing” term $1 - u_n$). It also naturally incorporates competing tendencies to cause the growth, or the decay, of subsequent states. For small u_n (and thus for large $1 - u_n$), the tendency is to cause the growth of the next state linearly as $\omega\, u_n$. For large u_n (and thus for small $1 - u_n$), the tendency is to cause the decay of the next state quadratically as $-\omega\, u_n^2$. The amount of “coupling” between the “increasing” and the “decreasing” tendencies is represented by the modulation parameter ω.

For nonlinear systems such as those described by the logistic equation (and only for nonlinear systems), in addition to the nodes already described, there also exist so-called “chaotic (or strange) attractors.” These are neither stable fixed points, nor stable spirals, nor centers, and their behaviour is a subtle and complex balance of both attractive and repelling forces. The trajectories of chaotic attractors can range from those which appear almost-periodic, to those which appear almost-random. The modulating parameter(s) for a particular dynamical system described by particular system equation(s) can have a critical effect on the system’s behaviour. In some cases, the modulating parameter(s) can be varied over a large range of values with only “small (or gradual)” qualitative changes in the resulting phase portrait. However, in other cases, a small change in the modulating parameter(s) results in a “bifurcation.” This is a “large (or sudden)” qualitative change in the resulting phase portrait at a point of degeneracy where equilibrium between the “increasing” and the “decreasing” components of the system is extremely sensitive to perturbations [12]. Once again, bifurcations can only occur in nonlinear systems, due to the hugely subtle and complex nonlinear interactions between the simple components.

There are various ways of classifying bifurcations, using a plethora of confusing terminologies, depending on the particular features of interest. For example we might be more concerned with the general way in which the bifurcation happens than with the nature of the nodes involved, and Abraham suggests the following descriptions [1]. In a “subtle bifurcation,” one class of node changes into a different class of node. In a “catastrophic bifurcation” a node appears or disappears entirely. In a “plosive bifurcation” there is a sudden change in the magnitude of the effect of the node on the nearby trajectories. If we are more concerned with the way in which the type of node changes, then Rassband [13] identifies four basic types of bifurcation. In a “flip bifurcation” a stable fixed point changes into an unstable fixed point and a center. In a “fold bifurcation” a “nodal pair” comprising a stable fixed point and an unstable fixed point are created. In a “pitchfork bifurcation” a single stable fixed point changes into an unstable fixed point, and two new stable fixed points are created (or, conversely, the same thing can happen with the roles of “stable” and “unstable” fixed points reversed). In a “transcritical bifurcation” a “nodal par” of a stable fixed point and an unstable fixed point “swap stability” to give a “nodal par” of an unstable fixed point and a stable fixed point.

1.2 Nonlinearity, Chaos, and Complexity

The field of “chaotics” (of which “nonlinear dynamics,” “chaos theory,” and “complexity” can be seen as subsets) seeks to model the “real world” of nonlinear systems at the “edge of chaos” [14] appropriately [2], [3], [4], [5]. Indeed, Lewin states that complexity theory is a “theory of everything” able to describe the gamut of processes and phenomena ranging from those observed in embryology, evolution, ecosystems, sociology, right up to the “unified-world-dynamics” of “Gaia” [14]. Colloquially, the term “chaos” is synonymous with “disorder,” and “chaotic” with “disordered,” but the mathematical definition is much more precise, and actually appears to contradict the generally-understood meaning. In fact, chaos does not in a technical sense represent “disorder” or “randomness,” and chaos arises from (or can be described by) often very simple and exactly deterministic rules or equations. Let us start by defining deterministic systems (as exemplified by the mechanism of a “perfect” grandfather clock, or by the dynamics of a hypothetical “frictionless” snooker table) to be those which are totally stable, knowable, and predictable [14]. These simple deterministic systems are governed by “linear” equations, which can in general be solved in mathematically straightforward ways. This means that given what happens “now” you can say exactly what will happen “next” and so on *ad infinitum*. Systems which are described as “chaotic” are still governed by deterministic equations. However, in the chaotic systems the equations are always “nonlinear,” and in general these cannot be solved in mathematically straightforward ways. Often this nonlinearity results from “feedback” or “self-interaction” whereby the properties of a system affect the system itself. For example in a frictionless system, the quantity of energy needed to accelerate a mass is independent of the velocity with which the mass is moving, and the system is thus governed by simple linear equations of motion which are straightforwardly soluble. Prediction of future behavior is easy in the linear (although unrealistic) frictionless case. However, in a frictional system, the quantity of energy needed to accelerate a mass depends upon the velocity with which the mass is moving, and the velocity in turn depends on the acceleration due to the energy input. This system is thus governed by complex nonlinear equations of motion which are harder to solve. Prediction of future behavior is now harder in the nonlinear (although realistic) frictional case.

There are various technical complexities and disagreements in formulating a unified definition of a “chaotic system,” or of “chaos,” but the following set of properties is often used in classifying a dynamical system as chaotic [2], [3], [4], [5]: 1. The system must be “sensitive to initial conditions,” which means that points which are close now, may eventually lead to points which are very far apart (this is called the "signature of chaos" [14]); 2. Sensitive dependence on initial conditions alone does not give chaos since sensitive systems can still be regular or predictable. Chaos, though, implies "topological mixing," which means that the system's behaviour can always eventually move from one type of solution, to a qualitatively different type of solution (in other words, regions of the phase portrait can change being a picture from containing one class of node to being a picture containing different class of node); 3. Chaos always shows "dense orbits" so that the solutions in the vicinity of a chaotic attractor eventually evolve to cover all possible points in solution-space of that attractor. Technically, the highly complex behavior of deterministic-chaotic systems (such as the flow of water down the plug-hole of a sink) is characterized as being "unstably aperiodic" [14]. In this case none of the state-variables ever shows an exact repetition of its values; and, even the smallest perturbation to any of the state-variables persists as the system evolves in time. Thus, a chaotic system's future behaviour is not at all "random" (although it probably appears so superficially) and is in fact fully determined by its initial conditions. However, despite this, such a system's long-term behaviour cannot be predicted without explicit stepwise calculation. There exists no general analytic "solution" to the generating nonlinear equations, despite their usually apparent simplicity. Moreover, the observed sensitivity to initial conditions can propagate exponentially with each step of the calculation and can render correct future predictions impossible in practice. Thus, qualitatively, "order" and "chaos" are foundationally and inextricably linked, such that order can arise from chaos, and *vice-versa*. In fact, it is just these features that act as a crucial driving-force towards natural development, diversity, evolution, growth, and novelty. The use of the now-popular term "*Butterfly Effect*" to describe the "sensitivity to initial conditions" which is often cited as the defining characteristic of chaos is ascribed to the meteorologist Lorenz [15]. In an initial report of his work given to the New York Academy of Sciences in 1963 he commented that if one assumed his theories to be valid, then a single flap of a seagull's wings could change the whole world's weather patterns thereafter. By the time of his later talk at the December 1972 meeting of the American Association for the Advancement of Science in Washington DC, the rough-and-ready seagull had undergone a sudden and discontinuous bifurcation into a more poetic butterfly – and the title of the published talk was: "*Predictability: Does the Flap of a Butterfly's Wings in Brazil Set off a Tornado in Texas?*" [16].

Here, DeLillo reminds us that deterministic chaos is constantly with us as a nonlinear, intangible "basic, closely-woven, deep, fine-grained" feature of reality [17], [18]. We must be careful here to define "chaos" technically, not as a synonym of "random" or "stochastic," or "irrational," but rather as a term which implies "hidden, underlying, very complex, deterministic order" [17]. It is suggested that most, but not all, randomness is underpinned by chaotic complexity [19]. We may well ask whether "pure, unadulterated" randomness does in fact ever occur in "reality," or if it is restricted only to "mathematical" situations, such as, for example, the decimal expansion of the number "π" [17], [19]. Chaos produces patterns which are "determined albeit unpredictable" and are thus not "pure randomness" at all but rather "*pseudo*-randomness" [19]. We may well ask whether there is actually beyond this a "theoretical horizonless horizon" of "pure randomness" [19]. Between randomness and chaos lies the “grey no man’s land” of “Falk’s Pale,” the terrain of apparent, although not actual, randomness, which might be called “fool’s randomness” or the “footprint of chaos” [19]. Even sequences of purely random events or numbers exhibit some apparently ordered patterns of “random repetition” inside themselves [19].

In terms of the quantification and classification of “chaos,” we note that in fact all measurements are subject to “noise” or “error” so that no measured dataset ever represents pure “signal.” This observation is true even in the case “numerical experiments” (such as Lorenz’ weather-calculations) which always contain round-off or truncation error. Thus even measured data produced according to truly deterministic (including chaotic) underlying rules or processes, in general contain an element of randomness or “stochasticity” through the measurement errors. It is therefore problematic to deduce whether empirical or calculated datasets represent processes that are chaotic, rather than being truly stochastic. However, by definition, the behaviour of deterministic systems (including chaotic ones) always evolves identically over time from a given initial state; the behaviour of stochastic systems always evolves randomly over time from a given initial state.

1.3 The Fractal Mind-Brain

The “self-similar” patterns known as “fractals” arise naturally from the chaotic processes which very frequently underpin organic growth [20], [21], [22]. On “zooming in” on a fractal system’s large-scale structure, the same patterns are found to be repeated in subsystems at smaller and smaller scales. Biologically, fractal subsystems are useful as they introduce flexibility and durability into the parent system, since parts of them can be damaged or removed without compromising overall function [23]. Furthermore, self-similarity aids information storage and retrieval, since a potentially huge volume of data about the whole structure can be encoded much more efficiently as the much smaller volume of data describing a single subunit, together with data describing the distribution of these subunits. The “fractal dimension” D_{S} is a measure of the “self-similarity” of a particular structure S. If $N(\varepsilon)$ is the number of self-similar structures of linear size ε needed to cover the whole of structure S, then D_{S} is defined as:

$$D_{\mathrm{S}} = -\lim_{\epsilon\to 0}\frac{\log\,[N(\epsilon)]}{\log\,[\epsilon]} \qquad .$$

We can think of this as the efficiency with which the structure “packs” or “fills space.” Integral fractal dimensions indicate non-fractal structures: we are, of course familiar in Euclidean space with $D_{\mathrm{volume}} = 3$, $D_{\mathrm{line}} = 2$, and $D_{\mathrm{point}} = 1$. Non-integral fractal dimensions indicate fractal structures Good examples of these are: snowflake architecture, the fronds on a fern leaf, the florets on a cabbage head, the pulmono-circulatory system, the lymphatic system, the kidney’s calyx filters, and the folds of the small intestine. On the macroscopic scale, the “packing” of the brain’s crenulated cerebral cortex within the confines of the skull is of considerable interest from the viewpoint of complexity theory, since it, too, represents a biological "fractal" structure. Recent accurate, non-invasive brain-imaging experiments by Kiselev, Hahn and Auer [24] show that the brain cortex itself exhibits fractal structure, with $D_{\text{cortex}} = 2.75 \pm 0.75$, showing "self-similarity" down to a scale of $2.5\,\text{mm}$. Fractals do not just occur in the description of static physical structures, and Dilts points out that "many behaviours could be considered to be types of 'neurolinguistic' fractals" [25]. In this sense, dance might be described as a "somatic fractal," and musical compositions as "auditory fractals" [25]. We might venture further and say that paintings are "visual fractals" and that poetry, or trance-inductions are "psychosemiotic fractals." For Lacan, immersion in the unrepresentable, non-symbolic "real register" [26], [27], might be thought of as the all-encompassing synæsthetic fractal experience, as comprehended by Adam and Eve before the curse of language drove them from Eden [28], [29], [30]. These ideas lies at the heart of the use of metaphors and representational submodalities in accessing creative "altered states" of consciousness in hypnotherapeutic interventions [31].

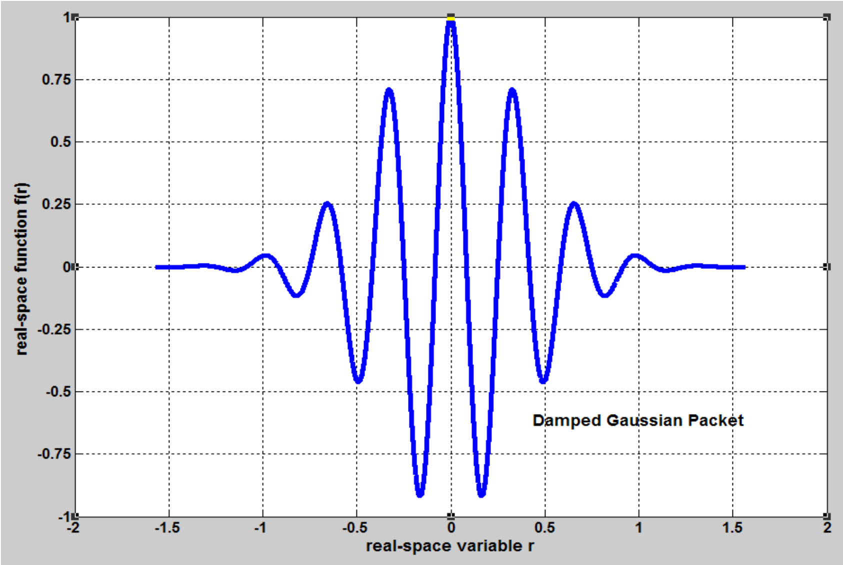
1.4 Holographic Data-Transformations

The brain's fractal physiological composition is reflected in Pribram's "holographic" (or "holonomic") description of brain-function in terms of information storage and retrieval, which is different in many important respects from conventionally accepted ideas [32]. The holographic model offers a totally holistic and integrated description of data representation. In this context a hologram can be thought of as a particular type of "image" of an "object." However, in the hologram, image-information about each object-point is distributed throughout the whole storage-medium, such that each discrete image-point within the medium contains some information about the entire image, and thus about the whole object. Moreover, each discrete image-point within the medium can and does simultaneously contain some information about many different images, and thus about many different objects. The distributed image or hologram is produced by recording the interference pattern between a reference beam, and an identical beam reflected by the object [33]. Changing the reference beam's angle, intensity, polarization, or wavelength, for example, changes the resulting hologram. The formal, symmetric inverse relationship between "internal" or "virtual" or representation $\overline{F}(\underline{\boldsymbol{k}})$ in so-called "reciprocal space" or "$\underline{\boldsymbol{k}}$-space," and "external" or "physical" reality $f(\underline{\boldsymbol{r}})$ in "real space" or "$\underline{\boldsymbol{r}}$-space," is given in mathematically in terms of "Fourier Transform" (FT) pairs [34].

$$\begin{array}{ccc} \text{"internal representation"} & & \text{"external reality"} \\ \overline{F}(\underline{\boldsymbol{k}}) = \iiint f(\underline{\boldsymbol{r}})\ \exp(-2\pi i\, \underline{\boldsymbol{r}} \cdot \underline{\boldsymbol{k}})\, \mathrm{d}^3\underline{\boldsymbol{r}} & \Longleftrightarrow & f(\underline{\boldsymbol{r}}) = \iiint \overline{F}(\underline{\boldsymbol{k}})\ \exp(+2\pi i\, \underline{\boldsymbol{r}} \cdot \underline{\boldsymbol{k}})\, \mathrm{d}^3\underline{\boldsymbol{k}} \end{array}$$

If we think of objects in "external" reality $f(\underline{\boldsymbol{r}})$ as being represented by a superposition of simple sinusoidal waves of different frequencies, then the "virtual" FT $\bar{F}(\underline{\boldsymbol{k}})$ measures the extent of the contribution of each individual frequency to a particular object-representation. Some simple examples of "$\underline{\boldsymbol{r}}$-space" and "$\underline{\boldsymbol{k}}$-space" pairs are shown in Figure 1.2 and Figure 1.3. More realistic examples showing images and FTs of printed text, and of the human brain, are to be found in [35], [36], [37], [38]. We note here some simple relationships between the "$\underline{\boldsymbol{r}}$-space" and "$\underline{\boldsymbol{k}}$-space" pairs. Figure 1.2 shows a real-space function which is a Damped Gaussian that oscillates repeatedly with diminishing amplitude at a constant frequency of 3 Hz. For this extended real-space function the corresponding reciprocal-space function is highly localized as a single peak at 3 Hz. Figure 1.3 shows a real-space function which is a rectangular Unit Impulse that is constant with sharp discontinuities when it is "switched on" and "switched off." It has a height of 10 unit and a width of 0.1 unit so that its area is 1 unit^2. This localized real-space function corresponds to a highly-extended and oscillating reciprocal-space function. In general the more localized is a particular $f(\underline{\boldsymbol{r}})$, the more extended is the corresponding $\bar{F}(\underline{\boldsymbol{k}})$. This idea can be developed further since if one squeezes / stretches $f(\underline{\boldsymbol{r}})$, then one simultaneously stretches / squeezes $\bar{F}(\underline{\boldsymbol{k}})$, and it is not possible arbitrarily to compact both $f(\underline{\boldsymbol{r}})$ and $\bar{F}(\underline{\boldsymbol{k}})$, at the same time. There is thus an inherent "uncertainty" or "indeterminacy" in the precision of any attempted simultaneous specification of both $f(\underline{\boldsymbol{r}})$ and $\bar{F}(\underline{\boldsymbol{k}})$ [39]. This symmetric reciprocal relationship allows all of "external reality" to be "filtered" by the senses, and "mapped" onto a "virtual representation" within the mind-brain [40]. Furthermore, (discrete) Fourier-transformation changes the sets of (difference or) differential equations which are the natural mathematical descriptions of dynamical physical processes into sets of algebraic equations which are naturally represented and solved by the mind-brain's massively parallel neural networks [41], [42].

Of course in practice the FT data are not infinite and continuous: rather a "sampling" or "filtering" process picks out the "most important features" for discrete representation. The fractal-holographic brain model proposes that this reflects the way in which information is encoded in the brain: "$\underline{\boldsymbol{k}}$-space" is represented by the "strengths" of the "connections" between the billions of elements comprising the mind-brain's massively-parallel, vastly interconnected, and self-similar neural networks, as described in more detail below. Cognition is guided by a matrix of neurological interference patterns as waves of electrical and chemical signals sweep through the brain. The experience of each and every new sense-impression, thought, memory-activation, or imagination, potentially ramifies through the entirety of the mind-brain. The mind-brain's biophysical neural network structure (to be described below) together with its holographic data-encoding, means that all of our internal virtual representations are massively overlayered, inescapably interpenetrating, and ineluctably interdependent. In fact, the Fourier Transform introduced here is mathematically "simple" in that it uses linear combinations only of periodic so-called "sinusoidal" waveforms in its representations. However, generalizations of the Fourier Transform, such as the Wavelet Transform [43], use differently-shaped waveforms of different frequencies to represent different parts of the input signal.



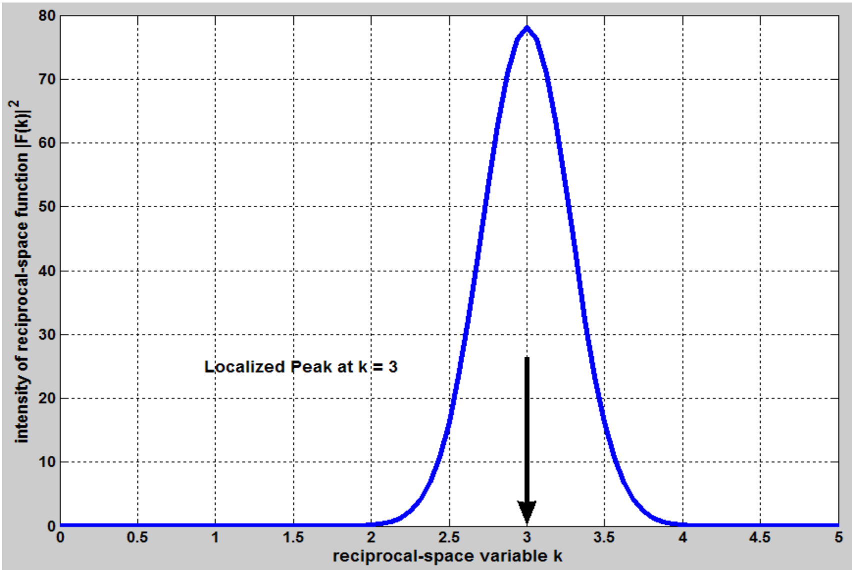
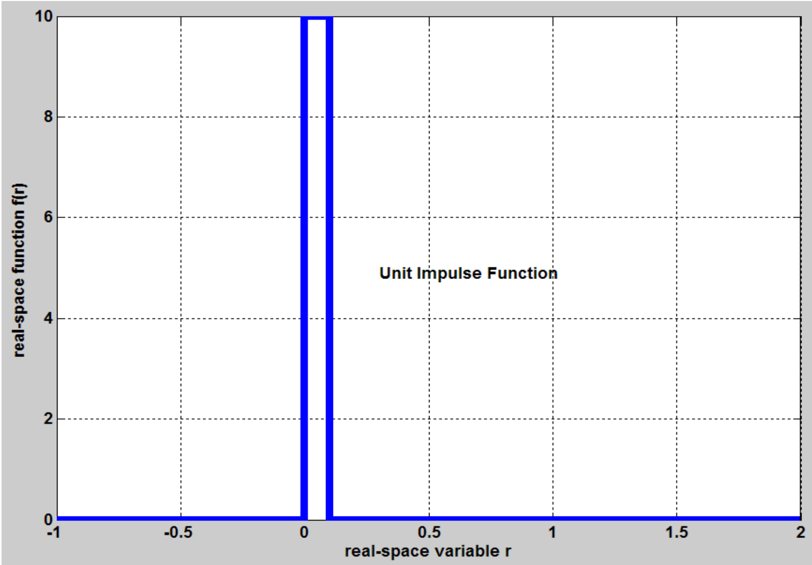


FIGURE 1.2: Fourier Transform pair. The real-space function is a "Damped Gaussian" which oscillates repeatedly with diminishing amplitude at a constant frequency of 3 Hz. Note that this extended real-space function corresponds to a highly-localized reciprocal-space "Peak" function.



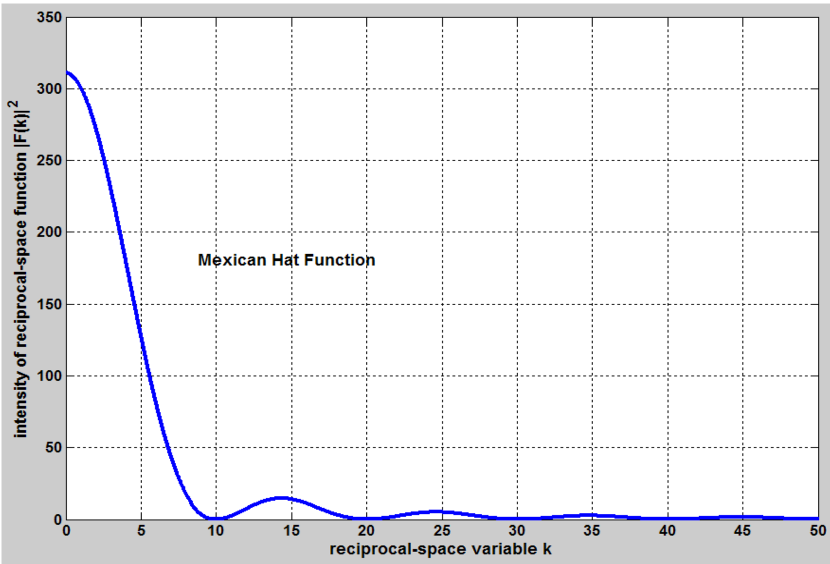


FIGURE 1.3: Fourier Transform pair. The real-space function is a "Unit Impulse" which is constant with sharp discontinuities when it is "switched on" and "switched off." Note that this localized real-space function corresponds to a highly-extended and oscillating virtual-space function often referred to as a "Mexican Hat."

Chapter 2 introduces “neurological positivism” as a dynamical-systems *meta*-description of human beings based on the idea that the mind-brain, body, environment, phenomenology, psychology, and behaviour form a single, hugely complex, holistic unity. Within this picture humans are far-from-equilibrium, open, and self-organizing systems which are naturally creative. The natural chaotic background of neural activity is considered essential for healthy mind-brain functioning and creativity. Consciousness exists as a virtual serial machine running inefficiently on the parallel-hardwired mind-brain-strata. Linear linguaform input to the mind-brain results in high-level cognitive “re-programming” of the parallel mind-brain hardware. Part 2 goes on to integrate these ideas to investigate “rhizomatics” as a philosophical-mathematical complexity-theory approach to understanding, explaining, and changing the mind-brain’s dynamical functioning and thus human behaviour.

1.5 Chapter 1 References

> For brevity, all websites in this listing are referenced with a unique alphanumeric “tinyurl” address generated at http://tinyurl.com/. These were all checked and found to be available at 1800H 12 February 2011. The tinyurl referenced as “tURL: 6dxpx6m” for example can be accessed at http://tinyurl.com/6dxpx6m .

[0] Raisman, G (2007) The Royal Institution of Great Britain: Events: Event Details: Professor Geoffrey Raisman: What is the Brain For? 2000 – 2100 Friday 16 November 2007. tURL: 5u2m3hp.

[1] Abraham, F D (1992) Chaos, Bifurcations, and Self-organization: Dynamical Extensions of Neurological Positivism and Ecological Psychology. Psychoscience. Volume 1, Number 2, pp 85 – 118; tURL: 6dxpx6m.

[2] Devaney, R L (1989) An Introduction to Chaotic Dynamical Systems. Reading MA: Addison-Wesley.

[3] Ott, E (1993) Chaos in Dynamical Systems. New York NY: Cambridge University.

[4] Gleick, J (1988) Chaos: Making a New Science. London UK: Penguin.

[5] Hilborn, R C (2000) Chaos and Nonlinear Dynamics: an Introduction for Scientists and Engineers. Oxford UK: Oxford University.

[6] Van der Pol, B and Van der Mark, J (1927) Frequency Demultiplication. Nature. Volume 120, Issue 3019, pp 363 – 364.

[7] FitzHugh, R (1961) Impulses and Physiological States in Theoretical Models of Nerve Membranes. Biophysics Journal. Volume 1, pp 445 – 466.

[8] Nagumo, J, Arimoto, S and Yoshizawa, S (1962) An Active Pulse Transmission Line Simulating Nerve Axon. Proceedings of the Institute of Radio Engineers. Volume 50, pp 2061 – 2070.

[9] Kanamaru, T (2007) Van der Pol oscillator. Scholarpedia. Volume 2, Number 1, Article 2202. tURL: scholarpedia2202.

[10] Hirsch, M W, Smale, S and Devaney, R (2003) Differential Equations, Dynamical Systems, and an Introduction to Chaos. San Diego CA: Academic.

[11] Jemmer, P and McNamee, J (2005) From the Discrete to the Continuous: Relationships and Results in Single-species Population Models. Mathematical and Computer Modelling. Volume 41, pp 71 – 98.

[12] Thom, R (1975) Structural Stability and Morphogenesis: A General Outline of a Theory of Models. Reading MA: Benjamin.

[13] Rasband, S N (1990) Chaotic Dynamics of Nonlinear Systems. New York NY: Wiley.

[14] Sardar, Z and Abrams, I (2004) Introducing Chaos. London UK: Icon.

[15] Lorenz, E N (1963) Deterministic Non-periodic Flow. Journal of Atmospheric Science. Volume 20, pp 130 – 141.

[16] Lorenz, E N (1998) The Essence of Chaos (The Jessie and John Danz Lecture Series). London UK: Routledge.

[17] Ward, B (1998) The Literary Appropriation of Chaos Theory – Psychology (PhD Thesis). Perth AUS: University of Western Australia: Department of English.

[18] DeLillo, D (1986) White Noise. New York NY: Picador.

[19] Littell, R (2006) The Visiting Professor: A Novel of Chaos. London UK: Duckworth.

[20] Mandelbrot, B B (1982) The Fractal Geometry of Nature. New York NY: Freeman.

[21] Falconer, K (2003) Fractal Geometry: Mathematical Foundations and Applications. Oxford UK: Wiley-Blackwell.

[22] Lesmoir-Gordon, N, Rood, W and Edney, R (2009) Introducing Fractals: A Graphic Guide. London UK: Icon.

[23] Losa, G A, Merlini, D, Nonnenmacher, T F and Weibel, E R (editors) (1994, 1998, 2001, 2005) Fractals in Biology and Medicine (Volumes I – IV). Berlin GER: Berkauser.

[24] Kiselev, V G, Hahn, K R and Auer, D P (2002) Is the Brain Cortex a Fractal? Ludwig-Maximilians Universität München: Institut für Statistik: Sonderforschungsbereich 386, Paper 297, pp 1 – 19. tURL: 5s7nlxk.

[25] Dilts, R (1998) The Article of the Month: Fractals and Human Behaviour. tURL: 6jels3d.

[26] Leader, D and Groves, J (2005) Introducing Lacan. London UK: Icon Books.

[27] Lacan, J; Fink, B (editor, translator) (2006) “Écrits”: The First Complete Edition in English. New York NY: Norton.

[28] Jemmer, P (2007) “Lingua Creationis” and the Creative Nature of Language. The Hypnotherapy Journal. Issue 3, Volume 7 (Autumn 2007), pp 25 – 31.

[29] Jemmer, P (2007) “Nomen Omen” – Languaging and the Nature of Names. The Hypnotherapy Journal. Issue 4, Volume 7 (Winter 2007), pp 24 – 30.

[30] Jemmer, P (2009) “Omen Nomen” – Naming and the Nature of Life. The Hypnotherapy Journal. Issue 1, Volume 9 (Spring 2009), pp 23 – 27.

[31] Hoffman, K (2000) Trance Workbook: Understanding and Using the Power of Altered States. New York NY: Sterling.

[32] Pribram, K H; Hiley, B J and Peat, F D (editors) (1987) Quantum Implications: Essays in Honour of David Bohm – The Implicate Brain. London UK: Routledge.

[33] Dilts, R (1998) The Article of the Month: NLP and Self Organization Theory. tURL: 6f7qyqn; Dilts, R (1998) The Article of the Month: Motivation. tURL: 69ar8rh; Dilts, R (1998) The Article of the Month: Pragmagraphics. tURL: 5vlysd5; Dilts, R (1996) The Article of the Month: Darwin's “Thinking Path”: Strategies of Genius and “Somatic Syntax”. tURL: 5wlsuz2.

[34] Bracewell, R N (1999) The Fourier Transform and Its Applications. Burr Ridge IL: McGraw-Hill.

[35] Fisher, R, Perkins, S, Walker, A and Wolfart, E (2003) Image Processing Operator Worksheets:

Image Transforms: Fourier Transform: Guidelines for Use. tURL: klkbv.

[36] Cowtan, K (2007) University of York: Chemistry: York Structural Biology Laboratory: People: Academic and Senior Staff: Kevin Cowatan: Further Information: Kevin Cowtan's Book of Fourier: Math by Pictures. tURL: r45uk.

[37] Marshall, A D (1997) Geometric Computing and Computer Vision Group: Dr A D Marshall: Contributions to WWW: Computer Vision Courseware: Image Processing: Fourier Methods: Fourier Theory. tURL: 5wuj4th.

[38] Perkowski, M A (2008) Portland State University: Department of Electrical and Computer Engineering: Marek Andrzej Perkowski Professor of Electrical Engineering: Classes: 17: ECE412 and ECE413: Capstone Projects and Projects in FPGA Architectures for DSP, Robotics and Image Processing: Fourier Transforms: 25: Lecture 3: Reciprocal Space: Fourier Transforms. tURL: 64crmgh.

[39] Dirac, P A M (1981) The Principles of Quantum Mechanics (International Series of Monographs on Physics). Oxford UK: Clarendon.

[40] Gamez, D (2007) What We Can Never Know: Blindspots in Philosophy and Science. London UK: Continuum.

[41] Jerri, A J (2010) Linear Difference Equations with Discrete Transform Methods (Mathematics and Its Applications: Volume 363). Berlin GER: Springer.

[42] James, J F (2002) A Student's Guide to Fourier Transforms: With Applications in Physics and Engineering. Cambridge UK: Cambridge University.

[43] Boashash, B (editor) (2003) Time-Frequency Signal Analysis and Processing: A Comprehensive Reference. New York NY: Elsevier.

CHAPTER 2: RHIZOMATICS

2.0 Introduction

Neurological positivism is a dynamical-systems *meta*-description of human beings based on the idea that the mind-brain, body, environment, phenomenology, psychology, and behaviour form a single, hugely complex, holistic unity. Humans are far-from-equilibrium, open, and self-organizing systems which are naturally creative. Within the mind-bran a combination of neurones, with possibly multiple mutual connections over many layers, is imagined to form a neural network. The functions of the mind-brain are organized around neural network modules which have evolved to perform fundamental tasks such as pattern matching and prototype fitting. The natural chaotic background of neural activity is considered essential for healthy mind-brain functioning and creativity. Consciousness exists as a virtual serial machine running inefficiently on the parallel-hardwired mind-brain-strata. Linear linguaform input to the mind-brain results in high-level cognitive "re-programming" of the parallel mind-brain hardware. The linear figure of the "arbor" represents the mathematical function as a directional, hierarchical, temporal mapping which binarily separates its source domain from its target domain. In contrast the nonlinear "rhizome" exhibits no such segregation of state automata into logic and memory components. The rhizome thus naturally represents "fuzzy relationships" since it is connected and heterogeneous, and it also naturally encodes semiotics since the process of "rupture" is able to create new semantic and pragmatic meaning through the (re)(inter)connection of diverse and parallel heterogeneous fuzzy networks. This process of "psycho-chaotic semiosis" leads to bifurcations and to creative self-organization throughout the holistic organism.

2.1 Neural Networks and the Mind-Brain

On a microscopic scale, it is estimated that the adult human brain is composed of about 10^{11} "brain cells" or "neurones" [0], [1], [2], [3]. These pass electrical signals along the length of their "axons" which act like electrical wires. At the end of each axon is its "cell body" or "soma" which extrudes "connections" or "dendrites." Connected neurones signal chemically across a "gap" or "synapse" between their dendrites. It is estimated that an adult human brain has about 5×10^{14} synapses. A simple mathematical model of a single neurone postulates a number (N) of "inputs" (y_i) to the neurone labelled (j). These inputs are then "weighted" numerically by "weights" (w_{ji}) and the weighted inputs $(w_{ji}\ y_i)$ are then summed. This combination of weighted inputs is then passed through an "activation function" (g) and if the result of this "activation" is bigger than a stipulated threshold (τ_j), then the neurone is deemed to "fire," producing an "output" (y_j). The relationship between these quantities is given mathematically by the equation:

$$y_j \;=\; g\left(\sum_{i=1}^{N} w_{ji}\, y_i \,; \quad \tau_j\right)$$

In general, neurones are modelled on the basis of an "all-or-none" response such that higher levels of input electrical stimulation do not produce correspondingly stronger output signals, although they may result in a higher output frequency. Thus each neurone is said either to be "active" or to be "quiescent" depending on whether or not it "fires" a chemical signal at any particular, discrete instant of time. A combination of single neurones, modelled as described, with possibly multiple mutual connections over many "layers," is called a "neural network." Data enter a network through its "input layer" and the results of the network's processes are fed outward through its "output layer," each of which may consist of a single neurone. Of course, coordination of a collection of neurones in a "module" can produce variable signal strengths, and there may be many inputs or outputs. Furthermore, the role of analogue, continuous, "fuzzy" chemical signalling across synapses is not accounted for in such simple mathematical models. These biological networks act as learning systems that "discover" strategies for solving problems by an iterative process of "training." This involves exposure to data which arrive through the input layer of neurones followed by "error-correction," whereby the output data are compared with the input data, and the differences used to modify the weightings between individual neurones in the network in order to reduce the error. We can thus think of neural networks as "learning" from their "mistakes". As a result of this process they produce often highly *non-linear* models for solving complex problems represented by the interactions between many variables, which are intrinsically open to chaos [4].

Elman proposed the first, simple mathematical models of neural structure in terms of "recurrent, partially-connected" networks [5]. Whilst these are of great use in modelling large classes of both linear and nonlinear dynamical-system behaviour [6], their incorporation of a monotonic sigmoidal activation function (g) means that they possess only fixed points and periodic orbits; it is not possible for them to exhibit determined but practically unpredictable "chaotic" behaviour [7]. However, experiments show that biological neural systems exhibit a very rich variety of dynamical behaviours, including chaos [8]. A complexity theory approach suggests that simple, non-random processes involving nonlinearity and feedback, balanced at the "edge of chaos" between stability and turbulence, undoubtedly provide a sufficiently rich and diverse toolkit for packing and unpacking, encoding and decoding, and folding, unfolding, and refolding biological information, structures, and processes from the simplest right up to those with the complexity of the human brain [9]. The natural chaotic "buzz" of neural activity is in fact considered essential for healthy mind-brain functioning [9]. Moreover, overly periodic order and *loss* of chaos in the mind-brain is the signature of epilepsy [10]. Such behaviours can be modelled using neural-network theory with different assumptions and degrees of complexity in terms of asymmetric weightings, coupled oscillations, dynamic thresholds, and temporal damping, for example [11], [12], [13], [14], [15], [16]. Li *et al.* [17] propose a particularly simple nonlinear-activation Elman model which produces chaotic behaviour and can be analyzed analytically. They do, however, point out that "rigorous analysis" of more complex systems "seems to be rather difficult, but certainly is an interesting topic for future research" [17].

2.2 Rhizomatic Thinking

Deleuze can be seen as extending these mathematical insights by his insistence that it is the experiencing of “difference” rather than of “sameness” by “equivocal” human individuals that constantly spawns new and unexpected conceptualizations [18]. Such “thought without image” (in transform-space) recursively and chaotically evolves in a neverending, alogical (logically-unconstrained), problem-solving dynamic [19]. This is expressed metaphorically in terms of the “*rhizome*” which describes the “burrow” in terms of its functions in the processes of breakout, evasion, movement, shelter, and supply [20]; and which also describes the both the “best and worst” things [20] -- bulbs and tubers; crabgrass, potatoes, and weeds; and the “antics” of ants, children, and wolfpacks [21]. The rhizome satisfies the following “principles” [20]. The rhizome represents a “fuzzy relationship” since it is “connected” and “heterogeneous” such that any node “can and must” be connected to any other node in a fuzzy way. The rhizome’s multiple nodes are taken as a “multiplicity” so that any link with the concept of “the one” is severed [20]. Such a “multiplicity” is an “exact, fuzzy, many-many relation” between “fuzzy sets” [22]. The “fuzzy sets”, each containing different magnitudes of different “fuzzy vectors,” exist in different “plateaus” or “dimensions” since they represent qualitative as well as quantitative descriptions. The rhizome is “asignifying” and represents “fault-tolerant, distributed memory,” since it may be “ruptured” but will always regrow, but in general in a new and randomly different configuration. The rhizome corresponds to an astructural “cartograph” and not to a structure-generating “decalcomania” [20]. This is a conceptual statement of the rhizome’s “fuzziness,” which derails the application of Ockham’s Razor, and calls for constant Nietzschean attempts at self-overcoming through encounters with new obstacles, dilemmas, and uncertainties [22].

Horizontal, non-hierarchical, *inter*-species rhizomatic growths have multiple possible input and output points for pluralist-multiplex data; they thus naturally apprehend “multiplicity” as “multiple-unities” [18]. They stand in opposition to vertical, hierarchical, *intra*-species *arborescent* growth which has single well-defined input and output points for dualist-binary data, and is strictly unitary [18]. Formally, the “*tree*” represents the “mathematical function” of the ontological threading of “is” as a directional, hierarchical, temporal mapping which binarily separates its source domain from its target domain. Syntactic structure is encoded in the binary dichotomies of linguistic trees, which are insufficiently abstract to represent semiotics or meaning. Conversely, the rhizome is a non-rooted, directed, fuzzy-weighted graph that contains the algebraic superposition of all potential meanings [22], and that represents the conjunctive alliance of “and … and … and” [20]. In the rhizome, there is no von-Neumann segregation of state automata into logic and memory components [22]. It is thus an exact model of the “weave” of the pristine, acentered, neural networks of the human brain, upon which training imposes arborescent structures for meaning-judgement [22]. The rhizome encodes semiotics, since the process of “rupture” is able to create new semantic and pragmatic meaning through the (re)(inter)connection of diverse and parallel heterogeneous fuzzy networks. Rhizomatic thinking is hence a form of self-referential “soft computing” that tolerates and indeed exploits the ambiguity, imprecision, uncertainty, and partiality inherent in real-world problems in order to make them tractable

[22], [23]. The rhizome can be seen at work in *anti*-literature, and in *anti*-philosophy. In the first case, Joyce's "multiply-rooted," nonlinear texts fragment the "linear unity" of language, instead asserting the circular completion of the knowable. In the latter case, Nietzsche's works fragment the "linear unity" of the knowable, instead asserting the circular completion of "eternal recurrence."

2.3 Modularity and the Mind-Brain

The foundational understanding of "neurological positivism" as a dynamical-systems *meta*-description of human psychology and behaviour [24], [25], [26] is that human mind-brain, body, environment, phenomenology, and behaviour form a single, hugely complex, holistic unity [27]. Prigogine would describe human beings as examples of the general class of "self-organizing systems" [28], [29]. These are vastly intricate "open systems" which exchange energy and information with their environments, and thus represent "dissipative structures" which are "far from equilibrium," and which require energy to form and to maintain their complex structures in globally unstable equilibria [9]. Thus mind-brain, body, environment, phenomenology, stimuli, responses, and behaviour are inextricably intertwined so that any proposed distinctions between them are essentially arbitrary [27]. This is exemplified by the difficulties encountered in trying to produce abstract model descriptions of biological process management systems (such as those proposed for cognitive attribution, internal environment stabilization, nervous system mediated centrifugal control, proprioception, psychoimmunological activity, and stimulus-response), in conceptual isolation from other, interrelated systems. If the all-important external energy input is naïvely ignored, "open systems" appear to contradict the Second Law of Thermodynamics by decreasing entropy and increasing order [30]. The particular complexity of open systems arises from two separate but related effects. The first is that there are so many basic components that no causal relationships can be straightforwardly imputed between any subset of elements; secondly, there is also a vast amount of feedback which interconnects all the components in extremely complicated ways. Open systems cannot therefore be described simply in the same terms as stable mechanical systems, since they are inherently dynamic and internally subject to reordering and to evolution. Prigogine showed that such far-from-equilibrium open systems are naturally "creative" [9]. When they become chaotic, the energy-flows already present allow them spontaneously to undergo "self-organization" (including "self-bifurcation") as a result of which totally novel, complex "emergent" behaviours and structures can appear irreversibly, independently of any external causes, through the interaction of simpler parts [28], [29], [31]. A prime example of this is seen in the biological phenomenon of morphogenesis whereby organs spontaneously emerge during an embryo's development [32], [33]. Complex systems are also actively "adaptive" in response to external stimuli [9]. The networks in the brain, for example, show amazing "neuroplasticity" incessantly readjusting the weightings of their connections in order to capture novel features learned from the interaction of new experiences with imagination and memory. Farber [34] here comments that novel neural connectivity continues to develop throughout life [35], and claims that it is "imprinted" through the active invocation of memetic entities [36], [37], [38], [39], [40]. He contrasts this with normal behaviour conditioning in which information flow is changed but the already-existing neural networks through which the flow is channelled remain unchanged. The difference between these two types of learning is that memetic imprinting can be totally transformative – allowing the death of outmoded internal construct(s), and the emergence of new consciousness(es). He allies this with increases in *understanding*, by which experience, wherever this may lie amongst the "macrocosmic fractal swirl" of information is meaningfully expressed.

Given the simplicity of individual neurone architecture, coupled with the astronomical number of neurones, it is useful to propose a simple mathematical model of cognitive function in terms of a vast array of highly specialised "modules" or "ensembles" in the brain, each constructed from a coordinated subset of neurons or tissue-areas. One might speak of language modules, vision modules, and so on. For example, human primates have especially large cerebral cortices, distributed across the two brain-hemispheres, and these cortices are considered to be the location of advanced mentation. This involves coordination of sense-data and synthesis of these data with thoughts and memories in order to "make sense of" and to "operate upon" the environment. However, the whole mind-brain acts as a holistic, integrated unity of highly interconnected modules. The ascending and descending fibre-tracts, for instance, connect higher and lower centres and facilitate communication between the hindbrain, the midbrain and the forebrain. Thus the postulated mind-brain modules are not necessarily contiguous regions of brain tissue, and the functions of any particular module might well be considered to be distributed "holographically" throughout the mind-brain. Any one module might require coordination of different brain regions such as the corpus callosum, the temporal lobe, and the cerebellum, for example. The particular neurones or areas involved in the coordinated activity, and the degree of coordination, may well change on different occasions [41]. For example, "conscious" cortical awareness is involved in the process of acquiring a new skill through learning, but "unconscious" sub-cortical control is observed when an individual executes a previously-learnt and well-practised activity [41].

Churchland discusses in detail the fundamental evolutionary importance of such neural network modules in "pattern matching" and "prototype fitting" [42], [43]. It is postulated that the brain's massively-parallel, multiply-connected, and vastly-overlayerd nets and modules developed to meet real-time challenges in the analysis of real-world situations, for example, in the interpretation of visual images. Dennett [44] goes on to discuss human consciousness as a "virtual serial machine" running inefficiently on parallel-hardwired brain-strata. "Linguaform" (language-based) input to the mind results in high-level cognitive "re-programming" of the parallel brain-hardware. This allows simulation of serial logic engines by the brain, in a fashion akin to literal computer re-reprogramming by the introduction of new software. Clark [45] extends these ideas in discussing the "*supra*-communicative" functions of language which make it much more than a device for conveying information. The apparently "magical" effects of language arise from its ability to reconfigure "internal" neural computational spaces to solve whole new classes of problem, in the same way that physical tools enable manipulation of physical world. We might say that the human mind-brain operates simultaneously in two quite distinct and yet parallel modes. The first mode is innate or instinctive "biological processing" which has evolved "naturally" with the species to preserve life, maintain homœostasis, propagate genes, and so on. The second mode is "cultural processing" which is learned "unnaturally" through a process of socialization, and which deals with "invented" tasks such as computer-programming, election-voting, music-making, painting, reading, theorem-proving, and so on [41]. And whereas biological processing can be thought of as linear and "non-reflexive" since it depends on essentially fixed species-properties, cultural processing is nonlinear and "reflexive" since it constantly allows and undergoes both subtle and gross self-modifications. Moreover, as human beings we inhabit two quite distinct worlds [41]. The first is the external, physical, perceptible and "*inter*-(re)active" realm of self-other, where information is accessed by sensory-investigation and where communication is mediated by language and actions. The second is the internal, psychic (or mental), imperceptible and "*intra*-(re)active" realm of self-self, where thoughts, intentions, and desires are accessed by introspection and where communication is mediated by metaphor. We extend this idea even further in our discussions of the "metaphoric psychescape" to be introduced below.

2.4 The Mathematics of Mind-Brain Modularity

In the light of these studies we therefore propose for any one of the postulated brain modules, a mathematical model based on a nonlinear "Brain Module Function" (BMF). This is based on the discrete logistic equation discussed previously, and is described in terms of a "modulating parameter" ($\mu > 0$) and a "saturation threshold" ($\theta > 0$). Within this model, modules of the fractal mind-brain can exist in different discrete "excitation levels," given by values of the quantity $0 \leq X_n \leq \theta$, which depend on the stimulation levels of their constituent neurones. First, a brain module receives an initial input $0 \leq X_0 \leq \theta$, perhaps from a different module. The BMF then recursively describes the level of the module's subsequent excitation in state $n+1$, in terms of its current excitation in state n, for states labelled by $n = 0, 1, 2, \ldots$, as follows:

$$X_{n+1} = F(X_n) \qquad\qquad F(X) = \mu X (1 - X/\theta) \qquad (*)$$

This model represents modulated feedback interaction between a signal of strength X and the fractional difference in the strength of that signal with respect to the threshold, namely $(\theta - X)/\theta = (1 - X/\theta)$. It is characterized as a deterministic, 1-dimensional, quadratic, discrete, unimodal, first-order, recurrence mapping. This discrete logistic formulation naturally includes competing tendencies to increase or decrease a module's excitation. For small signal strength, the tendency is to increase the signal linearly as μX; for large signal, the tendency is to decrease it quadratically as $-\mu X^2/\theta$. For convenience, this mathematical formulation is often non-dimensionalized by means of the substitution $x = X/\theta$, which results in inputs and outputs always between zero and one, namely $0 \leq x_0 = a \leq 1$ and $0 \leq x_n \leq 1$. This mapping leads to stable excitations which are always within the stated range, provided that $0 \leq \mu \leq \bar{\mu} = 4$. If we introduce a scaled modulation parameter $0 \leq \lambda = \mu/\bar{\mu} \leq 1$, which measures the fractional extent of modulation between zero and the maximum, then the "scaled" BMF derived from (*) is defined mathematically as:

$$x_{n+1} = f(x_n) \qquad\qquad f(x) = \lambda\,\bar{\mu}\,x(1-x) \quad . \quad (\ddagger)$$

We can imagine the BMF as representing the modulated coupling between signal-presence x and signal-absence $(1-x)$ measured on a scale whose maximum is $\bar{\mu} = 4$, and for which the coupling strength is measured fractionally by λ. Moreover, a further "sigmoidal" (or "S-shaped") "Feedback Damping Function" (FDF) given in terms of a "switch variable" s can also be introduced, defined by:

$$s = 0 \qquad \text{without damping:} \qquad g(y) = y$$
$$s = 1 \qquad \text{including damping:} \qquad g(y) = (1 + e^{-y})^{-1} \quad .$$

Figure 2.1 shows a schematic flow diagram for the scaled BMF with the FDF. The point about the nonlinear logistic mapping used in the BMF is that its output is exceedingly sensitive to the values of the scaled modulating parameter λ, as will be discussed in detail below [46], [47], [48], [49].

The following discussion relates to the behaviour of a brain module in the absence of any signal-damping, that is, with $s = 0$ in the model presented here. The Bifurcation Diagram shows the behaviour of "long-term solutions" (that is, of fixed points) as the scaled modulating parameter λ varies. The general structure of the Bifurcation Diagram shows changes of stability and the creation or destruction of new states. The simply analytically calculated branches are indicated in Figure 2.2. Brouwer's Fixed Point Theorem states that any continuous function $f(x)$ defined on a closed interval such that $0 \le x \le 1$, and taking values in the same interval, possesses a period-1 fixed point $\hat{x}_k$ such that $f(\hat{x}_k) = \hat{x}_k$ [50]. For the logistic map, $\hat{x}_1 = 0$ is *stable* for the range $0 < \lambda < 1/4$, and $\hat{x}_2 = 1 - 1/(\lambda\bar{\mu})$ is *stable* for the range $1/4 < \lambda < 3/4$. For $0 < \lambda < 1/4$ the signal is eventually extinguished, reaching zero monotonically; for $1/4 < \lambda < 1/2$ the signal reaches non-zero saturation, sometimes after undergoing damped oscillations; and for $1/2 < \lambda < 3/4$ the signal reaches saturation whilst undergoing damped oscillations. A transcritical bifurcation of the period-1 fixed points occurs at the critical value $\lambda_1^{\text{crit}} = 1/4$, when the stability of the fixed points $\hat{x}_1$ and $\hat{x}_2$ swaps, as shown on the Bifurcation Diagram. A general period-2 pair $(\hat{x}_k, \hat{x}_{k+1})$ is defined as two points such that $\hat{x}_{k+1} = f(\hat{x}_k)$ and $\hat{x}_{k+2} = f(f(\hat{x}_k))$ (or alternatively such that $\hat{x}_{k+2} = \hat{x}_k$), and the system's behaviour oscillates between these two values. The onset of period doubling occurs when the first period-2 cycle of (‡) appears, when $x_3 = x_5$. The period-2 pair is created discontinuously at $\lambda_2^{\text{crit}} = 3/4$, together with exchange of stability of the period-1 fixed point, in a supercritical pitchfork period-doubling flip bifurcation.

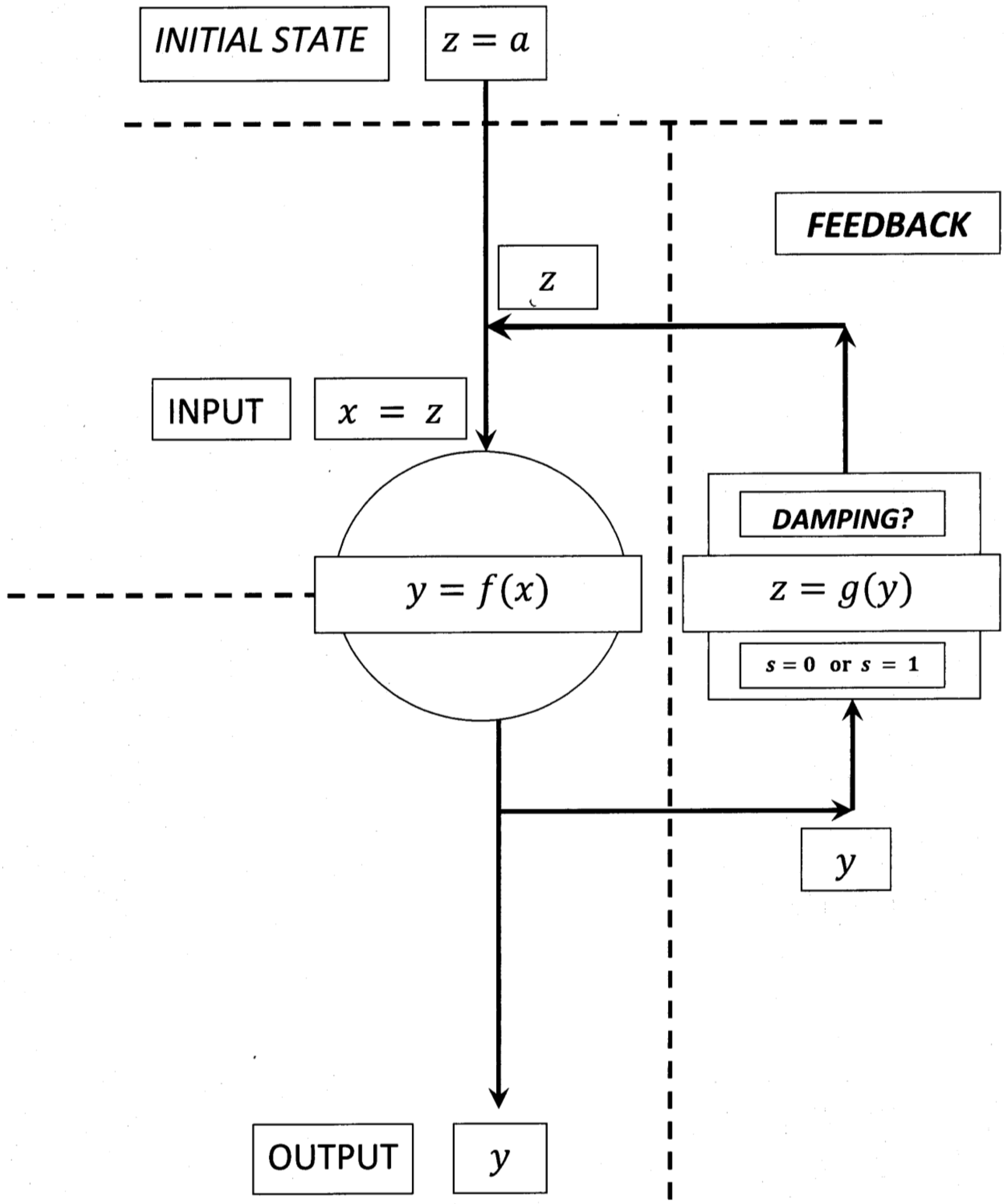


FIGURE 2.1: Schematic diagram depicting the operation of a putative "Brain Module." The initial state input value is $0 \leq a \leq 1$, and the output $0 \leq y \leq 1$ is repeatedly fed back through the Feedback Function which involves either damping (if $s = 1$) or no damping (if $s = 0$).

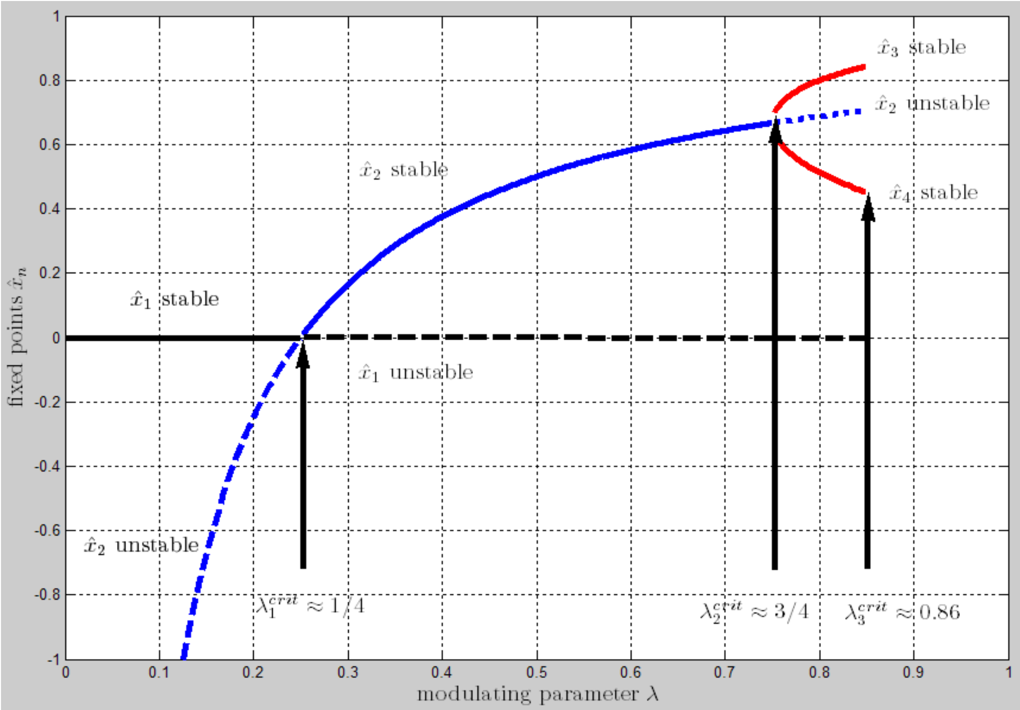


FIGURE 2.2: Bifurcation Diagram for the scaled logistic equation, showing the simply, analytically-calculated features in a plot of the position of fixed points $\hat{x}_n$ against the scaled modulating parameter λ. Stable "branches" are indicated by solid lines, and unstable "branches," by dashed lines. The first few bifurcations and the corresponding critical values of λ_n^{crit} are indicated.

The period-2 fixed points are given by:

$$(\hat{x}_3, \hat{x}_4) = \frac{(\lambda\bar{\mu} + 1) \pm \sqrt{(\lambda\bar{\mu} + 1)(\lambda\bar{\mu} - 3)}}{2\lambda\bar{\mu}}$$

With some algebraic manipulation, the period-2 pair can be shown to be stable for the range of values $3/4 < \lambda < (1 + \sqrt{6})/4$. Further calculation of bifurcation values λ_n^{crit} and the corresponding fixed points involves the solution of very high-degree polynomials, and requires numerical methods. The supercritical pitchfork flip bifurcation at $\lambda_2^{\text{crit}} = 3$ is repeated again and again for higher-order periods (period-4, period-8, and so on) at increasingly close values of λ_n^{crit}, in what is described as the "period doubling cascade." Figure 2.3 shows the Phase Diagram of the next output value x_{n+1} against the current value x_n for the scaled logistic in the period-doubling-cascade region for $\lambda = 0.891$, for a starting value $x_0 = 0.5$. Figure 2.3 clearly shows the structure of a period-8 stable attractor.

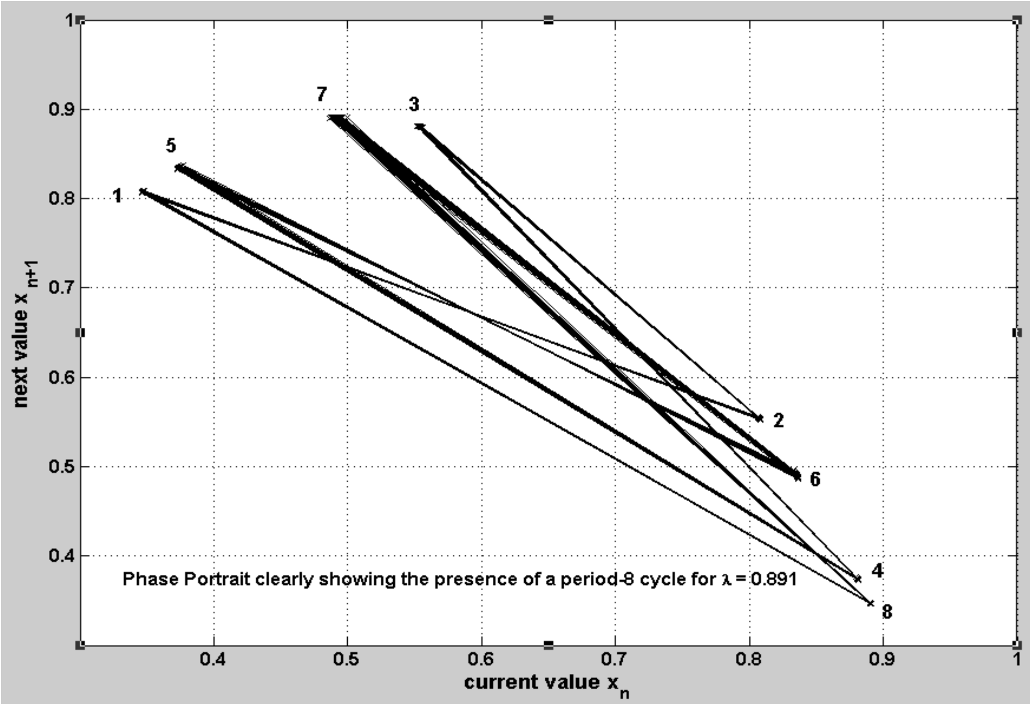


FIGURE 2.3: A Phase Diagram for the scaled logistic mapping with $\bar{\mu} = 4$, in the period-doubling-cascade region for $\lambda = 0.891$, for a starting value x_0 = 0.5. The picture clearly shows the structure of a period-8 stable attractor.

Thus the logistic mapping shows the fractal behaviour which is characteristic of systems in which chaos can appear, as "zooming in" on each successively bifurcating branch reveals exactly self-similar structure. In terms of this brain-module activity we thus clearly see Prigogine's "self-organizing criticality" and "emergent behaviour" [28], [29]. Feigenbaum proved that, for *all* unimodal maps, the ratio of the differences between the critical parameters for successive and current pairs of bifurcations is a constant, δ [51]. It is found that

$$\delta = \log_{n\to\infty}\left[\,(\lambda_{n+2}^{\text{crit}} - \lambda_{n+1}^{\text{crit}})\,/\,(\lambda_{n+1}^{\text{crit}} - \lambda_{n}^{\text{crit}})\,\right] = 0.2141\ldots \qquad .$$

At $\lambda \approx 0.8924$ a "crisis" occurs, and the system's behaviour enters the Pomeau-Manneville scenario and becomes "chaotic" (as defined and discussed in detail above) until $\lambda \approx 0.9571$ [49]. Figure 2.4 shows the Phase Diagram for the scaled logistic mapping in the chaotic region for $\lambda = 0.925$, for various starting values $x_0 = 0.1,\ 0.5,\ 0.85,\ 0.9$. The picture clearly shows the structure of a "harp-shape" (effectively "period-∞") chaotic attractor. For various values of λ within the chaotic region, however, "intermittent periodicity" is observed [52]. This means that amidst the chaos, stable-unstable pairs of "ghost" oscillations (beginning with those of period-3) "encounter and annihilate" each other in tangent bifurcations [53].

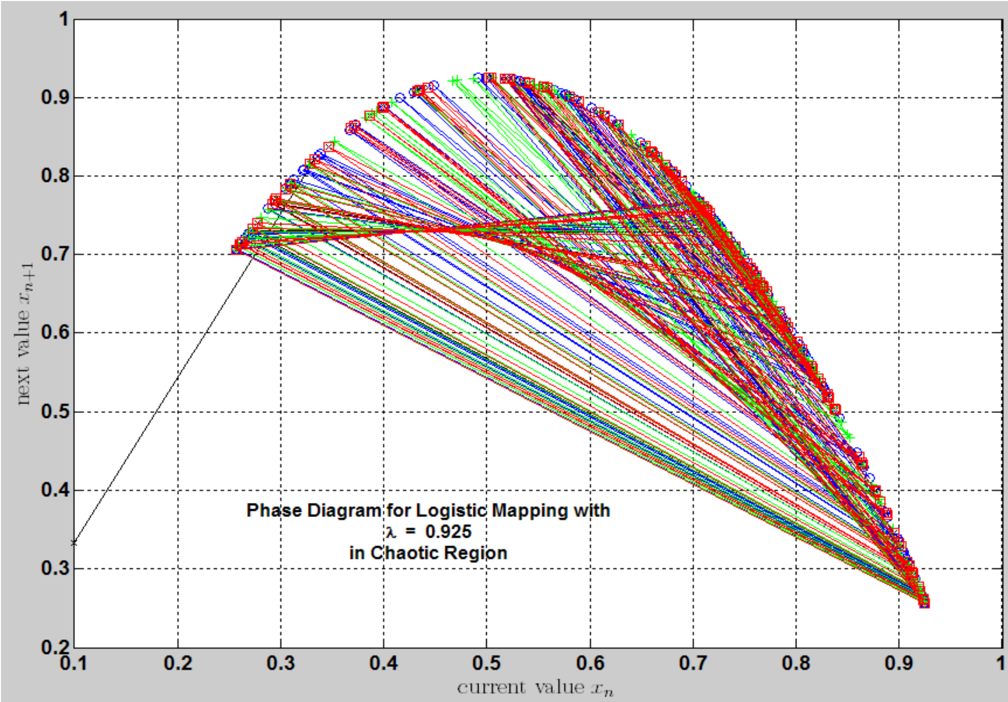


FIGURE 2.4: Phase Diagram for the scaled logistic mapping with $\bar{\mu} = 4$, in the chaotic region for $\lambda = 0.925$, for various starting values $x_0 = 0.1, 0.5, 0.85, 0.9$. The picture clearly shows the structure of a "harp-shape" (effectively "period-∞") chaotic attractor.

This transient behaviour presages the "islands of stability" (based on cascades of cycles of period-3, period-6, period-12, and so on) that arise at a value of $\lambda = (1 + \sqrt{8})/4 \approx 0.9571$ [54]. In fact, by Sharkov'skiĭ's Theorem [55], since period-3 cycles exist for this mapping, cycles of *all* periods exist (as well as does chaos, as proved by Li and Yorke [56]. For $\lambda > 1$, the behaviour is catastrophically divergent. Metropolis [57] showed that for *all* mappings of the form $x_{n+1} = \lambda\bar{\mu}\, f(x_n)$ with the boundary conditions $f(0) = f(1) = 0$, the ordering of qualitative features such as period-doubling and the onset of chaos is universal with respect to λ, and is invariant with respect to the particular form of the mapping $f(x)$. Figure 2.5 shows the overall Bifurcation Diagram for the scaled logistic equation, indicating the numerically-calculated features in a plot of the position of fixed points $\hat{x}_n$ against the scaled modulating parameter λ. The highly complex structure is characteristic of topological transitivity and density of periodic orbits. This behaviour is summarized in Table 2.1. In the presence of damping (that is, with $s = 1$ in the model presented here), none of these rich chaotic features is seen.

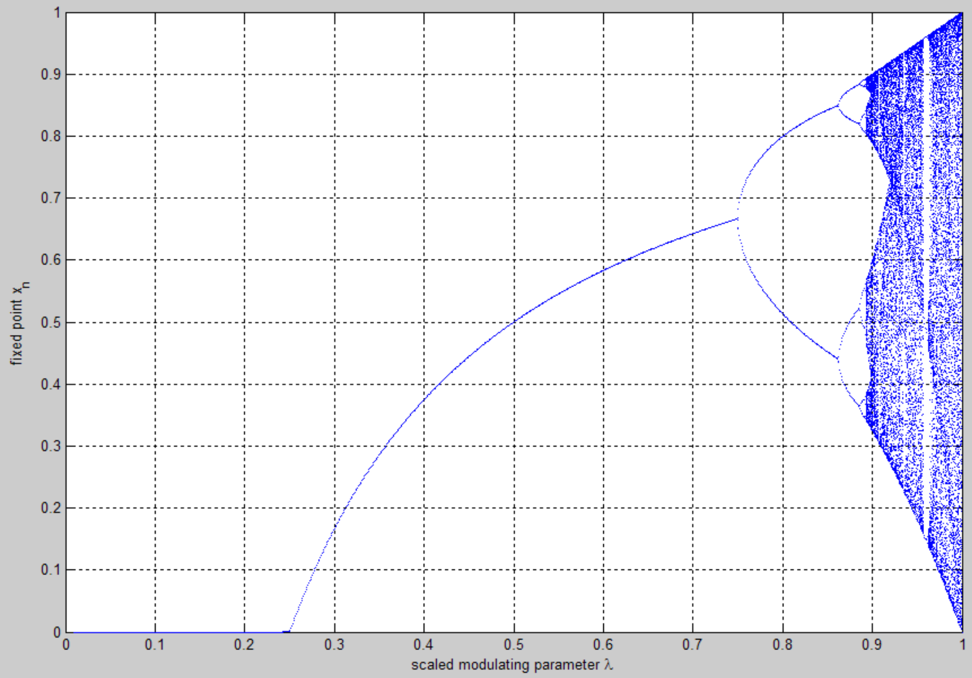


FIGURE 2.5: Bifurcation Diagram for the scaled logistic equation, showing the numerically-calculated features in a plot of the position of fixed points $\hat{x}_n$ against the scaled modulating parameter λ. Only the positions of stable fixed points are indicated. The onset and continuation of period-doubling and chaos, and the intrusion of stability islands can be seen on the far right-hand side of the Bifurcation Diagram. The highly complex structure is characteristic of topological transitivity and density of periodic orbits.

Having discussed the very varied types of behaviour exhibited by the simple, nonlinear logistic model as represented by the values of its output x_n, we can return to a more quantitative discussion of the relationship between deterministic chaos and statistical randomness or stochasticity. Let us first consider a deterministic continuous-time system as described mathematically (without loss of generality) by a differential equation with velocity function $\varphi(x) = dx/dt$, initial condition $x(0)$, and fixed point(s) $\hat{x}$ such that $\varphi(\hat{x}) = 0$. The system's state at time t is given by $x(t)$. In order to distinguish a deterministic dataset from a stochastic dataset, one first chooses a suitable "test" initial state from the data, and secondly chooses another, "neighbour" initial state. The time-evolutions of the succeeding states arising from the "test" and from the "neighbour" states are then observed. We define the "error" as the difference between the time evolution of the "test" state and the time evolution of the "nearby" state. The initial error at time $t = 0$ between the states is measured by $(\delta x)(0) = x(0) - \hat{x}$, and the error at time $t > 0$, by $(\delta x)(t) = x(t) - \hat{x}$**.** Any system's behaviour can be described in terms of the mean exponential rate of divergence of two initially close orbits, and one finds, to first order in $\delta x(t)$, that: $|(\delta x)(t)| \approx |(\delta x)(0)| e^{\beta t}$.

range of $\boldsymbol{\lambda} = \boldsymbol{\mu}/\bar{\boldsymbol{\mu}}$	qualitative regime	system behaviour
$0 < \lambda < 1/4$	signal extinction	monotonic
$1/4 < \lambda < 1/2$	period-1 stability	jump then monotonic
$1/2 < \lambda < 3/4$	period-1 stability	damped oscillation
$3/4 < \lambda < (1+\sqrt{6})/4$	period-2 stability	stable oscillation
$0.8623 \ldots < \lambda < 0.8860 \ldots$	period-4 stability	stable oscillation
$0.8860 \ldots < \lambda < 0.8924 \ldots$	stable period-doubling cascade	stable oscillation
$0.8924 \ldots < \lambda < 0.9571 \ldots$	Pomeau-Manneville crisis	chaos
$\lambda = (1+\sqrt{8})/4 \approx 0.9571 \ldots$	stable island (period-3) cascade	stable oscillation
$1 < \lambda$	catastrophe	divergence

TABLE 2.1: Approximate ranges of the scaled modulating parameter $\lambda = \mu/\bar{\mu}$ together with definition of the qualitative régime and qualitative descriptions of the system's behaviour.

The Maximal Lyapunov Exponent (MLE) $\beta \equiv d\varphi(\hat{x})/dt$ dominates the evolution of the error with time, and can be approximated from the limit:

$$\beta = \lim_{|(\delta x)(0)| \to 0} \lim_{t \to \infty} \left\{ \frac{1}{\mathrm{t}} \ln \left| \frac{(\delta x)(t)}{(\delta x)(0)} \right| \right\} .$$

A deterministic system will have an "error" that either remains small (this is a "stable, regular" solution) or increases exponentially with time (a "chaotic" solution). Values of $\beta < 0$ characterize dissipative or non-conservative systems and which are represented by deterministic solutions with asymptotic stability.

These solutions converge to a stable fixed point or stable periodic orbit, such that small initial perturbations decay. The more negative are the values of $\beta < 0$, the greater is the stability. Superstable fixed points and superstable periodic points have $\beta \to -\infty$, and tend towards equilibrium as fast as possible. Values of $\beta > 0$ indicate conservative, deterministic-chaotic systems which are represented by unstable aperiodic solutions. These solutions are highly sensitive since small initial perturbations grow exponentially. The value $\beta = 0$ is indicative of conservative, marginally stable "steady-state" systems. The solutions here are "neutral fixed points," and bifurcations occur for values of λ^{crit} at which $(\beta < 0) \to (\beta = 0)$. In reality, since there are generally many different choices for the test state, and thus many different orientations of the initial error $(\delta x)(0)$, there generally exists a spectrum of Lyapunov Exponents. The dimension of this spectrum is equal to the dimension of the phase-space, and it can be used to measure the system's rate of entropy production and its fractal dimension. For a discrete data-sample generated by the mapping $x_{n+1} = f(x_n)$ with iterations labelled by the index $n = 0, 1, \dots, N$, initial value x_0, fixed points $\hat{x} = f(\hat{x})$, initial error $(\delta x)_0 = x_0 - \hat{x}$ and subsequent errors $(\delta x)_n = x_n - \hat{x}$, the MLE can be estimated by calculating:

$$\beta \approx \lim_{N\to\infty} \left\{ \frac{1}{N} \sum_{n=0}^{N} \ln \left| \frac{(\delta x)_{n+1}}{(\delta x)_n} \right| \right\} \quad ,$$

which for analytically-defined mappings such as the logistic function discussed here can be expressed explicitly as:

$$\beta \approx \lim_{N\to\infty} \left\{ \frac{1}{N} \sum_{n=0}^{N} \ln \left| \frac{df(x_n)}{dx} \right| \right\} \quad .$$

Figure 2.6 shows the evolution of the error $(\delta x)_n = x_n(x_0) - x_n(x_0^{'})$ in the chaotic region (with $\lambda = 0.925$) for two signals with starting values $x_0 = 0.4$, and $x_0^{'} = x_0 + (\delta x)_0$, where the starting error is $(\delta x)_0 = 10^{-10}$. Figure 2.7 further illustrates the evolution of the maximal Lyapunov Exponent β for various values of λ, for a starting value $x_0 = 0.4$. Figure 2.8 completes the picture by demonstrating the variation in Lyapunov Exponent β as a function of λ for a starting value $x_0 = 0.4$. Similar information is yielded in Figure 2.9 which shows the variation in mean module excitation $\langle x_n \rangle$ (after $N = 2 \times 10^4$ iterations) as a function of modulating parameter λ. In this case there is very little sensitivity to starting value x_0. In contrast to the situation for chaotic systems, "truly random" or stochastic systems will have a randomly distributed error with a mean of zero. Skarda and Freeeman [58] put forward the idea that a chaotic background "buzz" of neuro-electric activity is essential for perception, thus displacing more mechanistic models based on the identification "*brain = computer*" [58]. These conjectures are supported by experimental observations of chaotic brain activity in wakefulness, as well as in rapid-eye-movement sleep [59], [60], [61].

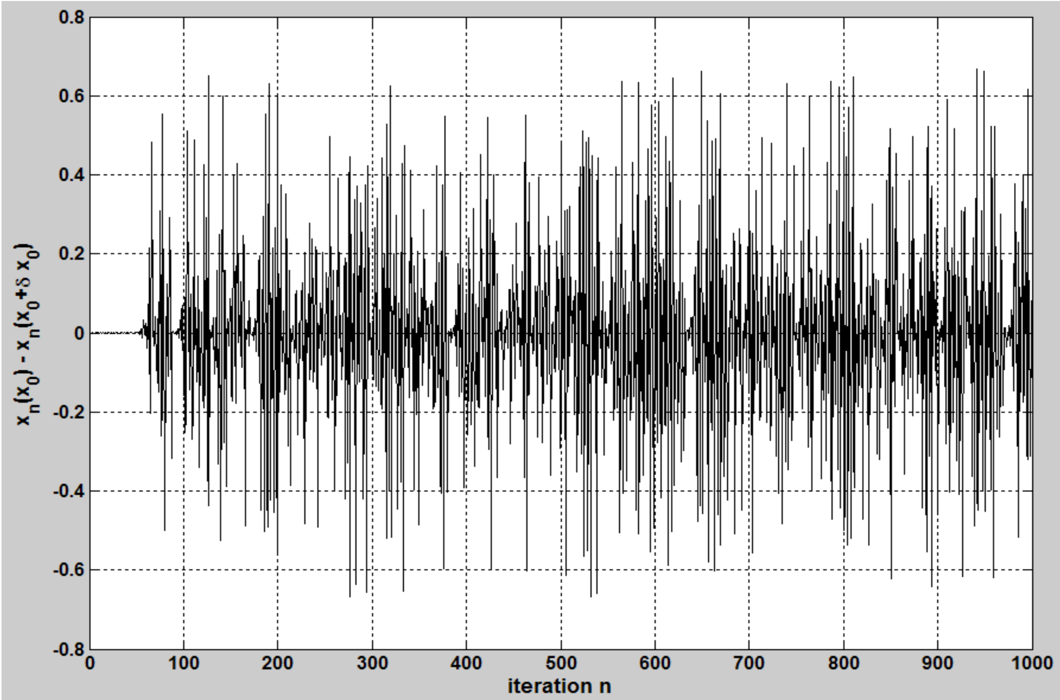


FIGURE 2.6: Diagram showing the evolution of the error δx_n for the scaled logistic mapping with $\bar{\mu} = 4$, in the chaotic region for $\lambda = 0.925$, for a starting error $\delta x_0 = 10^{-10}$.

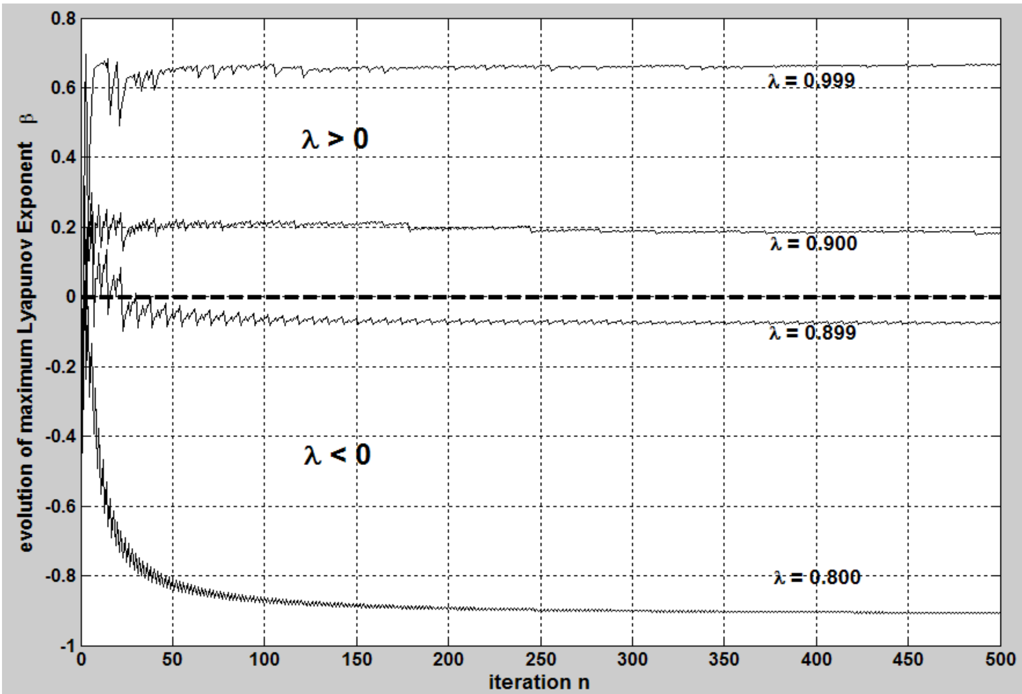


FIGURE 2.7: Diagram showing the evolution of the maximal Lyapunov Exponent β for the scaled logistic mapping with $\bar{\mu} = 4$, for various values of λ, for a starting value $x_0 = 0.4$.

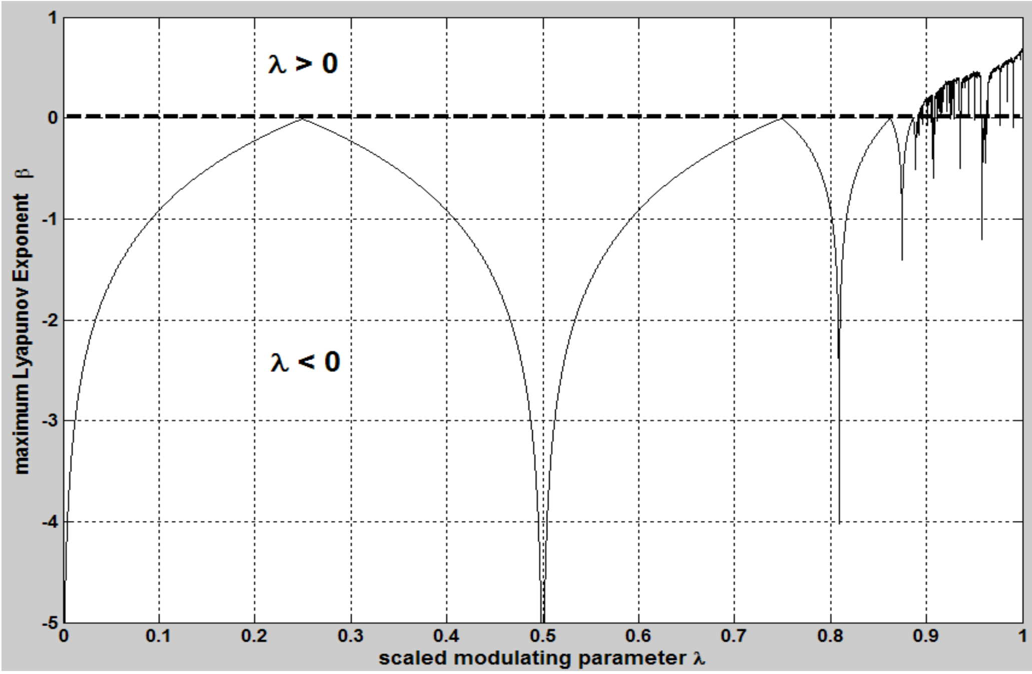


FIGURE 2.8: Diagram showing the variation in Lyapunov Exponent β as a function of modulating parameter λ for the scaled logistic mapping with $\bar{\mu} = 4$, for a starting value $x_0 = 0.4$. In regions where the Lyapunov exponent is negative, the solutions will eventually converge to stable solutions. Bifurcations occur when the Lyapunov exponent is zero. Chaos occurs in regions where the Lyapunov exponent is positive.

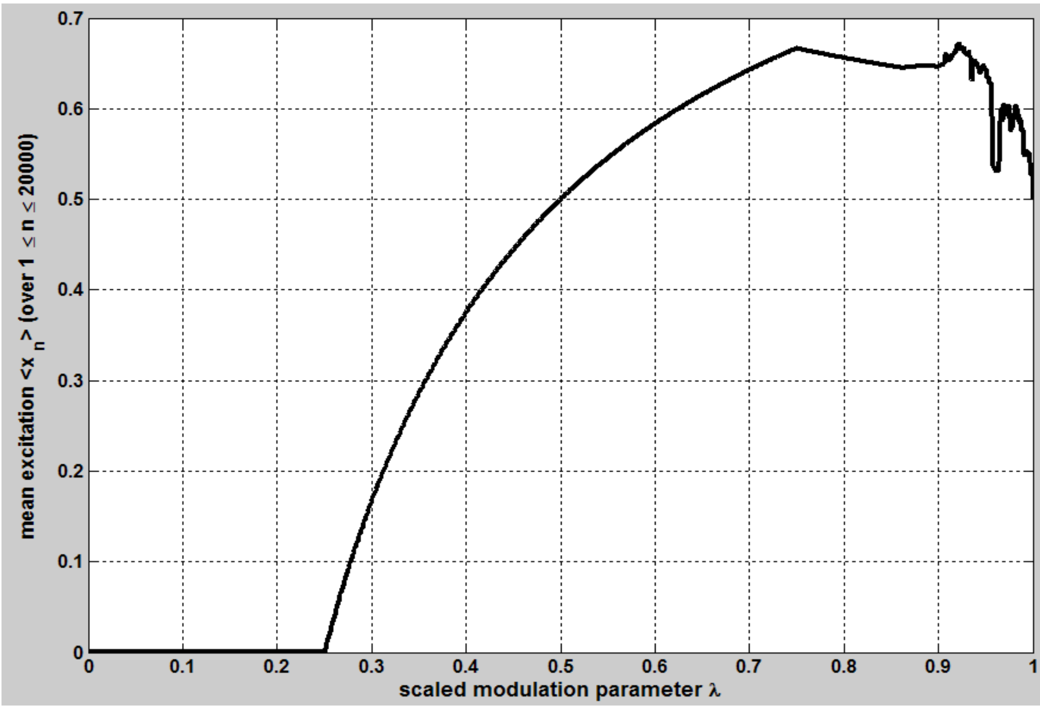


FIGURE 2.9: Diagram showing the variation in mean module excitation $\langle x_n \rangle$ (after 2×10^4 iterations) as a function of modulating parameter λ for the scaled logistic mapping with $\bar{\mu} = 4$. In this case there is very little sensitivity to starting value x_0.

Chapter 3 goes on to extend these ideas to investigate “dialetheialectics” as the mechanism of “psycho(a)logical autopoiesis” by which the mind-brain’s dynamical systems form, self-organize, grow, develop, and through which we can learn to change behaviours. We find that first first, neural networks self-organize to produce a coherent conscious self. Then, the union of the linear dynamical systems used in perception and the nonlinear dynamical systems necessary for self-organization produces the mind-brain’s overall “landscape” of far-from-equilibrium chaotic attractors. Different dynamical systems can “couple” together to cause mutual influence, bifurcations, and differing behaviours. Self-coupling within a single system, whereby the modulating parameters of the system are functions of the state of the system itself, leads to “self-control” and “self-organization” within that system. The depth of particular attractors controls degrees of awareness, and awareness can thus change gradually or bifurcate suddenly. Thus the bifurcating, chaotic dynamical systems picture readily suggests a “continuum of awareness” in which we can learn to “destabilize” from one attractor and “restabilize" onto another attractor at will

2.5 Chapter 2 References

For brevity, all websites in this listing are referenced with a unique alphanumeric “tinyurl” address generated at http://tinyurl.com/. These were all checked and found to be available at 1800H 12 February 2011. The tinyurl referenced as “tURL: 6dxpx6m” for example can be accessed at http://tinyurl.com/6dxpx6m .

[0] Gurney, K (1997) Introduction to Neural Networks. Boca Raton FL: CRC.

[1] Callan, R (1998) The Essence of Neural Networks. Upper Saddle River NJ: Prentice Hall.

[2] Picton, P D (2000) Neural Networks (Grassroots). New York NY: Palgrave Macmillan.

[3] Haykin, S (2008) Neural Networks and Learning Machines: International Version: A Comprehensive Foundation. Upper Saddle River NJ: Pearson.

[4] Author Unknown (2008) Peer Science LLC: Intelligent Data Analysis: Neural Networks Basics. tURL: 69b7y33.

[5] Elman, J L (1990) Finding Structure in Time. Cognitive Science. Volume 14, Number 1, pp 179 – 211.

[6] Pham, D T and Liu, X (1996) Training of Elman Network and Dynamic System Modeling. International Journal of Systems Science. Volume 27, Number 2, pp 221 – 226.

[7] Marcus, C M and Westervelt, R M (1989) Dynamics of Iterated-map Neural Networks. Physical Review A. Volume 40, Number 1, pp 501 – 504.

[8] Freeman, W J (1991) The Physiology of Perception. Scientific American. Number 2, pp 78 – 85.

[9] Sardar, Z and Abrams, I (2004) Introducing Chaos. London UK: Icon.

[10] Schwartzkroin, P A (editor) (1993) Epilepsy: Models, Mechanisms and Concepts. Cambridge UK: Cambridge University.

[11] Inoue, M and Nagayoshi, A (1991) A Chaos Neuro-computer. Physical Letters A. Volume 158, Number 5, pp 373 – 376.

[12] Kaneko, K (1984) Period-doubling of Kink-antikink Patterns, Quasiperiodicity in Antiferro-like Structures and Spatial Intermittency in Coupled Logistic Lattice. Progress in Theoretical Physics. Volume 72, pp 480 – 486.

[13] Kaneko, K (1990) Clustering, Coding, Switching, Hierarchical Ordering, and Control in Networks of Chaotic Elements. Physica D. Volume 41, Number 2, pp 137 – 172.

[14] Ishii, S, Fukumizu, K and Watanabe, S (1996) A Network of Chaotic Elements for Information Processing. Neural Networks. Volume 9, Number 1, pp 25 – 40.

[15] Aihara, K, Takabe, T and Toyoda, M (1990) Chaotic Neural Networks. Physics Letters A. Volume 144, Number 6, pp 333 – 340.

[16] Chen, L and Aihara, K (1995) Chaotic Simulated Annealing by a Neural Network Model with Transient Chaos. Neural Networks. Volume 8, Number 6, pp 915 – 930.

[17] Li, X, Chen, Z, Yuan, Z and Chen, G (2001) Generating Chaos by an Elman Network. IEEE Transactions on Circuits and Systems (Part I: Fundamental Theory and Applications). Volume 48, Number 9, pp 1126 – 1131.

[18] Massumi, B (1992) A User's Guide to “Capitalism and Schizophrenia”: Deviations from Deleuze and Guattari. Cambridge MA: MIT.

[19] Deleuze, G; Lapoujade, D and Taormina, M (editors) (2004) “Desert Islands” and Other Texts (1953 – 1974). Cambridge MA: MIT.

[20] Deleuze, G and Guattari, F; Massumi, B (translator) (2004) A Thousand Plateaus (Capitalism and Schizophrenia: Volume 2). London UK: Continuum.

[21] O’Riley, P A (2003) Technology, Culture, and Socioeconomics: A Rhizoanalysis of Educational Discourses. New York NY: Lang.

[22] Shor, S (1999) Shirley Shor: Texts: Introduction to Rhizome – Overlay / Assemblage (Between Cybernetics and Postmodernism: Collaborative Net.Art Hypertext Project: Last Updated 17 July 1999). tURL: 6j5dkfq.

[23] Tsoukalas, L H, Uhrig, R E; Zadeh, L A (foreword) (1997) Fuzzy and Neural Approaches in Engineering. Oxford UK: Wiley-Blackwell.

[24] Abraham, F D, Abraham, R H and Shaw, C D (1990) A Visual Introduction to Dynamical Systems Theory for Psychology. Santa Cruz CA: Aerial.

[25] Kugler, P N, Shaw, R E, Vincente, K J and Kinsella-Shaw, J (1990) Inquiry into Intentional Systems (Part I: Issues in Ecological Physics). Psychological Research. Volume 52, Numbers 2/3, pp 98 – 121.

[26] Vandervert, L R (1993) Neurological Positivism's Evolution of Mathematics. The Journal of Mind and Behavior. Volume 14, Number 1, pp 277 – 288.

[27] Abraham, F D (1992) Chaos, Bifurcations, and Self-organization: Dynamical Extensions of Neurological Positivism and Ecological Psychology. Psychoscience. Volume 1, Number 2, pp 85 – 118; tURL: 6dxpx6m.

[28] Nicolis, G and Prigogine, I (1977) Self-organization in Nonequilibrium Systems: From Dissipative Structures to Order through Fluctuations. Hoboken NJ: Wiley.

[29] Jensen, H J (1998) Self-Organized Criticality: Emergent Complex Behavior in Physical and Biological Systems (Cambridge Lecture Notes in Physics: Volume 10). Cambridge UK: Cambridge University.

[30] Ben-Naim, A (2010) Discover Entropy and the Second Law of Thermodynamics. London UK: World Scientific.

[31] Weiner, N (1961) Cybernetics or Control and Communication in the Animal and the Machine. Cambridge MA: MIT.

[32] Thompson, D W (1917) On Growth and Form. Cambridge MA: Cambridge University.

[33] Rosser Jr, J B (2000) Aspects of Dialectics and Nonlinear Dynamics. Cambridge Journal of Economics. Volume 24, Number 3, pp 311 – 324.

[34] Farber, P H (2008) Meta-magick: The Book of Atem: Achieving New States of Consciousness through NLP, Neuroscience, and Ritual. York Beach ME: Red Wheel Weiser.

[35] Begley, S (2009) The Plastic Mind. London UK: Constable.

[36] Heylighen F (1991); Heylighen F, Joslyn, C and Turchin, V (editors) (1997) Principia Cybernetica Web (Principia Cybernetica Brussels): Memetics: November 2001. tURL: 5v3ajco.

[37] Chielens, K (2003) The Viral Aspects of Language: A Quantitative Research of Memetic Selection Criteria (Unpublished Master's Thesis). Brussels BEL: Vrije Universiteit Brussel; tURL:

6zd5qy3.

[38] Dawkins, R (1990) The Selfish Gene. Oxford UK: Oxford University.

[39] Godin, S (2000) Unleashing the Ideavirus. London UK: Simon and Schuster.

[40] Blackmore, S (1999) The Meme Machine. Oxford UK: Oxford University.

[41] Gellatly, A and Zarate, O; Appignanesi, R (editor) (2005) Introducing Mind and Brain. London UK: Icon.

[42] Churchland, P M (1989) The Neurocomputational Perspective. Cambridge MA: MIT.

[43] Churchland, P M (1995) The Engine of Reason, the Seat of the Soul. Cambridge MA: MIT.

[44] Dennett, (1991) Consciousness Explained. New York NY: Little Brown.

[45] Clark, A; Carruthers, P and Boucher, J (editors) (1998) Language and Thought: Interdisciplinary Themes – Magic Words: How Language Augments Human Computation. Cambridge UK: Cambridge University.

[46] Devaney, R L (1989) An Introduction to Chaotic Dynamical Systems. Reading MA: Addison-Wesley.

[47] Ott, E (1993) Chaos in Dynamical Systems. New York NY: Cambridge University.

[48] Gleick, J (1988) Chaos: Making a New Science. London UK: Penguin.

[49] Hilborn, R C (2000) Chaos and Nonlinear Dynamics: an Introduction for Scientists and Engineers. Oxford UK: Oxford University.

[50] Samelson, H (1963) On the Brouwer Fixed Point Theorem. Portugaliae Mathematica. Volume 22, Number 4, pp 189 – 191.

[51] Feigenbaum, M J (1978) Quantitative Universality for a Class of Nonlinear Transforms. Journal of Statistical Physics. Volume 19, Number 1, pp 25 – 52.

[52] Holden, A V (editor) (1986) Chaos (Nonlinear Science Theory and Applications). Manchester UK: Manchester University.

[53] Kohyama, T and Aizawa, Y (1984) Theory of the Intermittent Chaos: 1/f Spectrum and the Pareto-Zipf Law. Progress of Theoretical Physics. Volume 71, Number 5 pp 917 – 929.

[54] Lorenz, E N (1998) The Essence of Chaos (The Jessie and John Danz Lecture Series). London UK: Routledge.

[55] Sharkov'skii, O M (1964) Co-Existence of Cycles of a Continuous Mapping of a Line onto Itself. Ukrainian Journal of Mathematics. Volume 16, pp 61 – 71.

[56] Li, T Y and Yorke, J A (1975) Period Three Implies Chaos. American Mathematics Monthly. Volume 82, pp 985 – 992.

[57] Metropolis, N, Stein, M L and Stein, P R (1973) On Finite Limit Sets for Transformations on the Unit Interval. Journal of Combinatorial Theory (Series A). Volume 15, Number 1, pp 25 – 44.

[58] Skarda, C A, Freeman W J (1987) How Brains Make Chaos in Order to Make Sense of the World. Behavioral and Brain Sciences. Volume 10, pp 161 – 195.

[59] Babloyantz A, Salazar J M and Nicolis C (1985) Evidence of Chaotic Dynamics of Brain Activity during the Sleep Cycle. Physics Letters A. Volume III, Number 3 (September 1985), pp 152 – 156

[60] Babloyantz A; Basar, E (editor) (1988) Dynamics of Sensory and Cognitive Processing by the Brain. Chaotic Dynamics in Brain Activity. Berlin GER: Springer.

[61] Hobson, J A (1989) The Dreaming Brain. New York NY: Basic.

CHAPTER 3: DIALETHEIALECTICS

3.0 Introduction

The union of the linear dynamical systems used in perception and the nonlinear dynamical systems necessary for self-organization produces the mind-brain's overall "landscape" of far-from-equilibrium chaotic attractors. First, neural networks self-organize to produce a coherent conscious self. Within this landscape ordered behaviours or "mind-brain-processes" (such as awareness and memory) evolve from low-level chaos. Different dynamical systems can "couple" together to cause mutual influence, bifurcations, and differing behaviours. Self-coupling within a single system, whereby the modulating parameters of the system are functions of the state of the system itself, leads to "self-control" and "self-organization" within that system. Process-changes occur when the dynamical system undergoes either a reversible subtle bifurcation from chaotic to subtle attraction; or when a plosive bifurcation causes sudden expansion or sudden contraction of a periodic attractor embedded within the chaotic matrix of the dynamical system. The depth of particular attractors controls degrees of awareness, and awareness can thus change gradually or bifurcate suddenly. Thus the bifurcating, chaotic dynamical systems picture readily suggests a "continuum of awareness." Many trajectories, each starting from a quite different initial state, approach any given chaotic attractor, resulting in the paradoxical and counterintuitive feature of "mind-brain-process initial-condition-insensitivity." This means that with a conscious input of psychic energy individuals can learn to destabilize from one attractor and to restabilize on another, so changing behaviours and states at will.

3.1 Dialectical Logistics: "Dialetheialectics"

Krippner [0] explains that the potentially large chaotic amplification of small fluctuations is a means of accessing novelty [1] in situations ranging from the quantum explosion of the cosmos to human thinking, and perceived freewill [2], [3]. In some cases there is a bifurcating "transition to chaos" such that the chaotic behaviour is present for some values of the parameters which describe the system, and not for others, as we have seen. This is particularly evident in simple dialectic or holistic "ecological" models described using equations related to the discrete logistic mapping discussed above, but it is also the case in both gross and subtle features of much more complex models [4]. Rosser interprets the simple logistic mapping as an excellent example of the rhizomatic "interpenetration of opposites," since the same variable occurs in both a positive (or increasing) sense (as x or "the one"), and in a negative (or decreasing) sense (through $1 - x$ or "the other"), meaning that these are inextricably coupled together, as Deleuze observed [5]. It is the interaction between these self-opposing forces which generates the ongoing "dialectical" movement [6]. As the strength of the interaction intensifies, bifurcations push the system into qualitatively new régimes. This is the mechanism proposed by Naser [7] for the complex organization evident in evolutionary scenarios. Levins and Lewontin refute Popper's view on the incompatibility of dialectic and science [8] with their maxim that "Part makes whole, and whole makes part" [9]. They put forward "reductionist" science as the vehicle for a dynamic, self-reflexive dialectic between the heterogeneous "parts" which combine to give an "emergent" independent and homogeneous "whole" [9]. Finkelstein goes on to discuss the use of "Game Theory" [10] to answer related dialectical questions such as "How should you behave, given that your behavior produces a reaction from others?" [11]. The central dialectical dilemma here is that "The outcome results from an interaction between your choice and the response of others" [11].

Andreev's [12] implementation of "computational evolution" to mimic independent development and self-organization produced interesting counter-intuitive results. The synthetic dialectical process of "iterative averaging," rather than homogenizing the system under study, as one might expect, instead produced sharp analytic dichotomization into two non-overlapping groups which could be labeled "one" and "other" [12]. Kreidik [13], [14] extends these ideas to generalize a formal "qualitative" dialectical mathematics which includes "quantitative" Aristotelian logic as a special case. He shows how this mathematics can be used to solve previously intractable problems in physics and technology, as well as to provide significant insight into computer hardware and software development, and into cognitive processes. Petersen [15] goes further in formally synthesizing dialectical logic and Gödel's methods in an appropriately restricted way. Várdy [16] points out that one way to avoid Gödel's mathematical "incompleteness" is to prohibit self-reference, and thus to rule out the road to chaos described in the simple models presented here. However, he sees this severe limitation as necessarily abandoning "mathematical objectivation" and admitting that there is a "spiritual region" in which concepts such as "freedom – justice – life – person" are defined. Hoffman [17] utilizes the idea of dialectic expressed through the idea of the "symmetric difference" ("one or the other, but not both") to produce a model of consciousness. In terms of brain structure and function, this model includes the facets of basic awareness, self-awareness, perception and cognition (along with attention and emotion); and it allows descriptions of knowledge and learning, long- and short-term memory, negotiation and dialogue, and problem-solving. Non-dialectical and dialectical logics can be synthesized to combine knowledge-structuring, information-retrieval, and reasoning [18]. Furthermore, Wells and Reed [19] show how "computational dialectic" is used in practice for inter-agent communication in multi-agent systems in order to enable information-seeking, and conflict-resolution. Dialectic methods can also be implemented efficiently for many other highly complex computational problems such as optimization [20]. In terms of modern theoretical physics, it is conjectured that Bohm's Marxist political leanings were integral in his application of dialectical reasoning in proposing the "Pilot Wave" theory of quantum mechanics [21]. Moreover, these dialectical ideas can be shown to be at the heart of ideas such as "hyperspace – parallel universes – time warps" and the "tenth dimension" [22].

3.2 Chaotics and Fuzziness

Rosser goes on to extend complexity theory into a new, “continuous” way of understanding the dialectical law of the “unity of opposites” and of rebutting the “excluded middle” of bimodal or discrete logic [5]. Georgescu-Roegen takes these ides to their limits in suggesting that a “fuzzy” area can, and must, always exist as a result of the interaction between interdependent polarities, or superficial binary oppositions, in the way quantified by Zimmermann [23]. Terminologically, some care should be exercized in talking of “fuzziness” and “probability” [24]. This is because both alike are different aspects of Generalized Information Theory, but whereas probability describes likelihood of each of an event’s definite possible outcomes, fuzziness describes the extent of a single event’s occurrence. However, since fuzzy sets (and fuzzy logic) generalize Boolean sets (and Booolean logic), fuzzy theory also generalizes probability theory. Thus all probability distributions are in fact fuzzy sets, but not all fuzzy functions represent probabilities. The words “fuzzy” and “fuzziness” are used only in a descriptive sense here.

Now, using the continuous variables $0 \leq x \leq 1$, and $0 \leq t < \infty$, the “fuzzy state” labelled “*A*” is represented by the function $\psi(x) = x(t)$, and the fuzzy state labelled “*not-A*” is represented by $\bar{\psi}(x) = 1 - x(t)$. The “mixing” of states “*A*” and “*not-A*” can be represented by the linear combination $\Psi(x) = N\{(1-h)\psi(x) + h\bar{\psi}(x)\}$, where the extent of mixing is represented by $0 \leq h \leq 1$. Average quantities are given by integration over x from $x = 0$ to $x = 1$, and are represented by diamond “bra-kets” so that the normalization constant for $\langle \Psi\Psi \rangle = 1$ is $N = \sqrt{3/(1-h+h^2)}$ [25]. The average values of the fuzzy states are $\langle \psi \rangle = \langle \bar{\psi} \rangle = 1/2$. We can also work out the average “overlaps” contributing to $\langle \Psi\Psi \rangle$, representing the average interactions “*A with A*” / “*not-A with not-A*” / “*A with not-A*” and we find that these are $\langle \psi\psi \rangle = \langle \bar{\psi}\bar{\psi} \rangle = 1/3$, and $\langle \psi\bar{\psi} \rangle = 1/6$, whence the total overlap is $\langle \Psi\Psi \rangle = 1$. We are interested specifically in the “dialetheiality” $\psi\bar{\psi}$ which is the overlap representing the interaction “*A with not-A*” [26]. We have so far been dealing with discrete complexity-theory representations of different phenomena, and the relationship between discrete and continuous mathematical models is developed in detail in [27]. The simplest model of the continuous time-evolution of such a “dialetheialectic” system is given by what we might call the continuous “dialetheiagistic equation” whose “velocity function” $\phi(x)$ is proportional to the dialetheiality [26]:

$$\phi(x) \;=\; \mathrm{d}\psi(t)/\mathrm{d}t \;=\; -\,\mathrm{d}\bar{\psi}(t)/\mathrm{d}t \;=\; \mu\,\psi(x)\,\bar{\psi}(x) \;=\; \mu\,x\,(1-x) \;=\; \mathrm{d}x(t)/\mathrm{d}t\,.$$

This has the “sigmoidal” or S-shaped time-solution, starting from $\psi(0) = x(0) = k$ when $t = 0$,

$$\psi(t) = k\,(\,k \;+\; (1-k)\mathrm{e}^{-\mu t}\,)^{-1} \quad .$$

The modulation parameter $\mu > 0$ influences the rate of change of ψ by scaling the interaction between ψ and $\bar{\psi}$. This continuous logistic formulation naturally includes competing tendencies to increase or decrease the value of ψ. For small ψ (or large $\bar{\psi}$), the tendency is to increase ψ linearly as μx; for large ψ (or small $\bar{\psi}$), the tendency is to decrease it quadratically as $-\mu x^2$. How does the smooth, continuous, monotonic evolution of ψ occur?

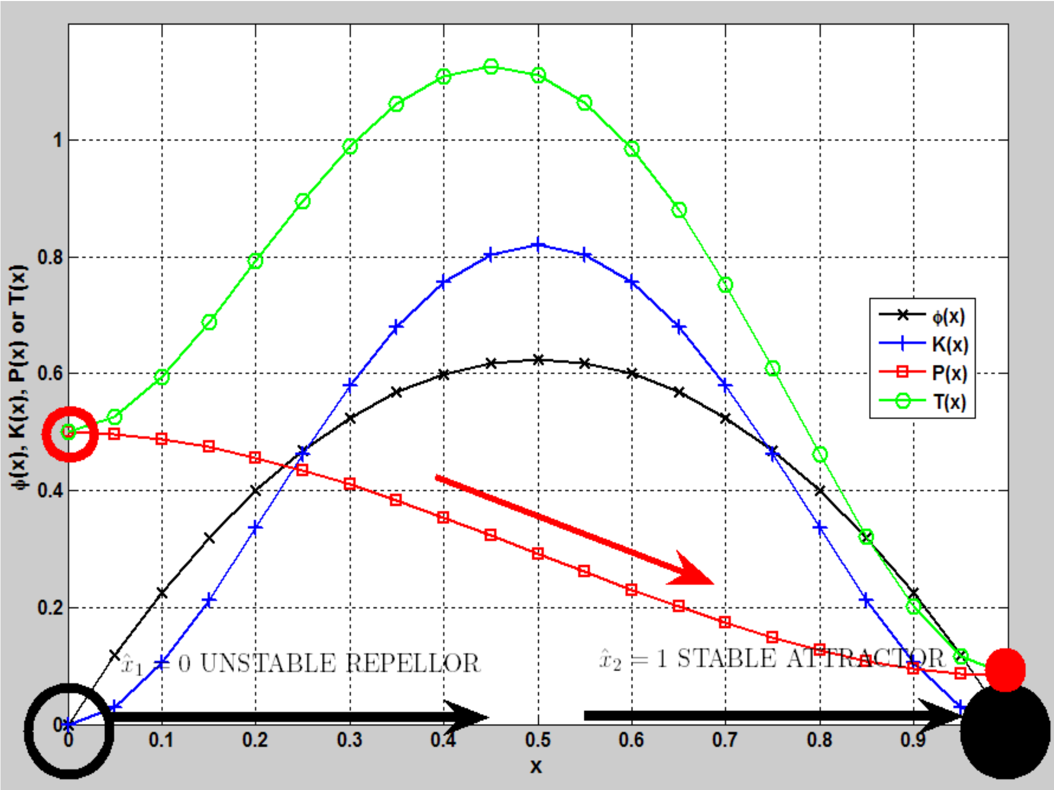


FIGURE 3.1: This shows $\varphi(x)$, $K(x)$, $P(x)$ and $T(x)$ as functions of $0 \le x \le 1$. Without loss of generality, the parameters are taken to be $\mu = 2.5$, $q = 2.1$ and $P_0 = 0.5$. The solutions evolve with time from the unstable, repelling fixed point at $\hat{x}_1 = 0$ (the open circle at the bottom left), ending up at the stable, attracting fixed point $\hat{x}_2 = 1$ (indicated by the closed circle at the bottom right), as $t \to \infty$. This corresponds to movement in the direction of decreasing potential from the "hill" at $P(\hat{x}_1 = 0)$ down to the "valley" at $P(\hat{x}_2 = 1)$, as shown by the circles jopined by the oblique downwarde arrow. The maximum kinetic energy in this case, $K(x = 1/2)$ occurs exactly midway in the motion from the fixed points $\hat{x}_1 = 0$ to the fixed point $\hat{x}_2 = 1$.

In terms of the evolution of ψ, the average velocity is given by $\langle\phi\rangle = \mu\,\langle\psi\,\overline{\psi}\rangle = \mu/6$. The kinetic energy is $K(x) = q\phi(x)^2$, with "inertia" $q > 0$, so that the average is $\langle K\rangle = q\mu^2/30 = 6q\,\langle\phi\rangle^2/5$. The kinetic energy is related to the momentum $w(x)$ through the equation $K(x) = w(x)^2/q$. Since the force $F(x)$ is defined as $F(x) = \mathrm{d}w(x)/\mathrm{d}t$ we can see that $\mathrm{d}K(x)/\mathrm{d}x = 2\,F(x)$. The potential energy $P(x)$ is defined through $\mathrm{d}P(x)/\mathrm{d}x = -\phi(x)$, with $P(0) = P_0$, $P(1) = P_1$, and $P_0 = P_1 + \mu/6$ so that we always have $P_0 > P_1$. From this we find that $P(x) = P_0 + \mu(2x - 3)x^2/6$, and that the average is given by $\langle P\rangle = (P_0 + P_1)/2$. The kinetic and potential energies are related differentially through the equation $K(x) = q(\mathrm{d}P(x)/\mathrm{d}x)^2$. The kinetic energy varies between minima of $K(0) = K(1) = 0$ and has a maximum of $K(1/2) = q\mu^2/16$. The potential $\mathrm{d}P(x)/\mathrm{d}t = -(\mathrm{d}P(x)/\mathrm{d}x)^2 \ge 0$ so that potential energy decreases along trajectories such that the system evolves towards states of lower potential. The total energy is given by $T(x) = K(x) + P(x)$, and we introduce the important quantity $m = q\mu$ in investigating the motion of the dynamical system along trajectories determined by the gradient of the total energy $\mathrm{d}T(x(t))/\mathrm{d}t = \phi(x)(\mathrm{d}T(x)/\mathrm{d}x)$. The condition that this total-energy-gradient be stationary only for values $\hat{x}_1 = 0 < \bar{x} < \hat{x}_1 = 1$, enforces the constraint that $m > 1/2$. The particular value of the stationary point is given by $\bar{x} = (2m-1)/(4m)$ which varies from $\bar{x} = 0$ (exactly when $m = 1/2$), asymptotically approaching $\bar{x} = 1/2$ (as $m \to \infty$). Under these circumstances the total energy first increases, reaches a maximum (the so-called "potential barrier" at $\bar{x}$), and then decreases to a minimum, as the system progresses along its trajectory, defined by $\mathrm{d}T(x(t))/\mathrm{d}t$. In order to move "uphill" or "against" an energy gradient, external work must be done upon the system, and external forces must be applied. Conversely, in order to move "downhill" or "along" an energy gradient, work is done by the system as the external forces acting upon it are relaxed. The relationships between $\varphi(x)$, $K(x)$, $P(x)$, and $T(x)$ are pictured and explained in Figure 3.1.

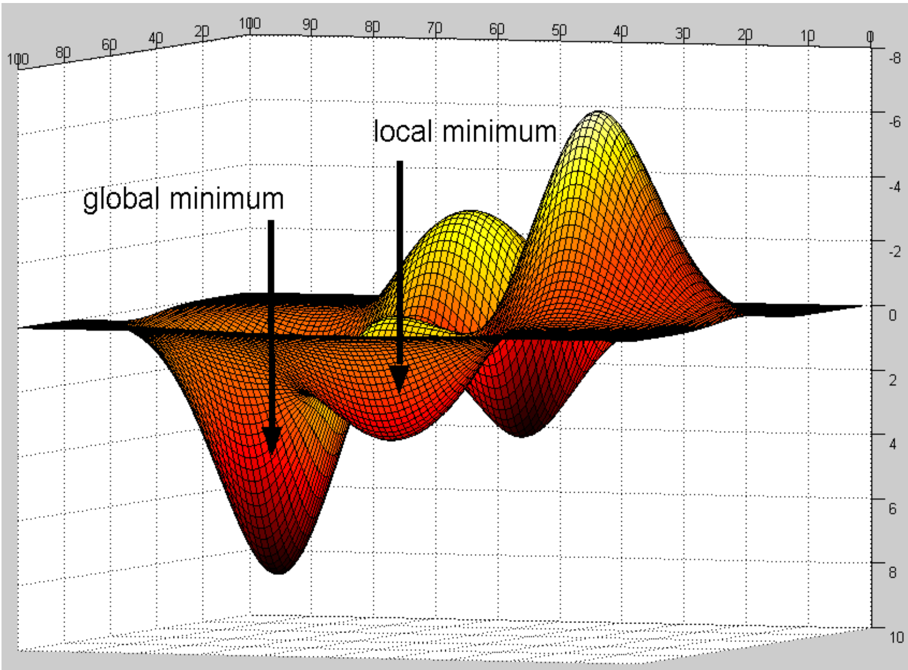


FIGURE 3.2: Schematic diagram of the phase-space (notionally projected from N-dimensions into 3-dimensions) of the dynamical system representing a brain-module neural network. The several local minima and the single global minimum represent attractors of the dynamical system and can be though of as "solution states" to which "consciousness fluxes" converge in attempting to resolve problems. In so-doing these fluxes may have to surmount local or global maxima in the phase-space.

Continuous dialetheialectic systems have a smooth, continuous, monotonic, analytically-representable time-evolution as discussed above. In contrast, discrete dialetheialectic systems are governed by the discrete dialetheiagistic equation:

$$\psi_{n+1} = \mu\,\psi_n\,\bar{\psi}_n = \mu\,\psi_n(1-\psi_n) = \mu\,x_n(1-x_n) = x_{n+1} \quad ,$$

starting from $\psi_0 = x_0 = k$, which does not have an analytic solution. However, as analyzed and discussed in detail in Chapter 2, the phenomenon of “overlap” or “indeterminacy” or “uncertainty” or “fuzziness” in such discrete dialetheialectic systems once again allows nonlinear interactions between the otherwise simple linear components. In the discrete case, these interactions can give rise to chaotic features such as “bifurcations” or sudden qualitative changes in behaviour at points of degeneracy in regions of interaction between “*A*” and “*not-A*” in which equilibrium is extremely sensitive to perturbations [28]. A very simple physical instance of this is the co-existence of solid ice and liquid water in “slush” [29]. In fact, we find that “complex chaos” or “chaotics” is present as a dynamical driving force in almost all systems, whether biological or physical, ranging from deserts, to economies, to electronics, to jungles, to space stations, to stock markets [30]. In the words of Adams' fictional “holistic detective” Dirk Gently, we must therefore learn to embrace the “fundamental interconnectedness of all things” [31], since nothing is isolated, and all things are intertwined: oceans and weather-patterns, populations and environments, societies with societies, technologies with economies, economies with oceans – and so the cycle continues, recursively, unstably, and chaotically [30]. It is the chaotics of fuzzy complexity in combination with chaotic dynamical behaviour that creates the metaphorical psychic “landscape” with its maximum-energy “hills” and minimum-energy “valleys” illustrated in Figure 3.2. And it is within this landscape that the extraordinary richness of bifurcating and self-organizing human psychobiological development takes place through the ever-ramifying processing of transformed input data in the mind-brain's massively parallel neural networks.

3.3 Cognitive Chaotics

The very structure of the mind-brain's neural networks can be understood as having evolved such as to provide the environment necessary for learning, neuroplasticity, consciousness, and creativity. If each neurone is considered to represent one “variable” (each with its own “dimension”) in the astronomically complex dynamical system that represents human consciousness, personality, and cognitive function, then this corresponds to a “phase space” of 10^{11} dimensions. Despite the vast but finite number of neurones, the density of points in the phase space is nevertheless infinite. Given the massively complex interactional nature of the “dynamical organism,” the choice of variables (whether representing “measured” or “hypothetical” features and interactions [32]) included in any particular mathematical model is essentially arbitrary [33]. Nevertheless, even with less than optimal variable-choices, important and useful predictions can often be made regarding the overall behaviour of the dynamical organism under study, if the “meaning” of individual variables is not necessarily overemphasized. With respect to this phase space, ordered behaviours or “mind-brain-processes” (such as the process of memory) emerging from low-level chaos are organized around chaotic attractors that are far from equilibrium [30], [33]. The chaotic attractors represent the virtual landscape” of local (or global) minima in the phase space of the neural networks and brain modules, as shown in Figure 3.2 [34]. In order to help us visualize the concept of attractors we can imagine a ball being rolled around inside a bowl due to some outside manipulation. When the external source of energy maintaining the rolling motion is removed, then the ball is “attracted” to a stable equilibrium position at the very bottom of the bowl, where it gradually comes to rest [30]. Skinner *et al.* [35] emphasize the implication of chaotic dynamical systems and the associated bifurcations in packaging information into, storing it as, and retrieving it from, “compressed representations,” in mind-brain processes such as awareness and memory [33]. It is postulated that these chaotic, bifurcating dynamical systems produce effects similar to the recursive affine mapping algorithms devised for use in computational data storage and retrieval [36]. Indeed it is suggested that such dynamical systems provide the best, most general models for all continuously-evolving mind-brain process [37]. Process-changes occur when the dynamical system undergoes either a reversible subtle bifurcation from chaotic to subtle attraction; or when a plosive bifurcation causes sudden expansion or sudden contraction of a periodic attractor embedded within the chaotic matrix of the dynamical system.

Thus the bifurcating, chaotic dynamical systems picture readily suggests a “continuum of awareness” [33]. On this continuum, important process-tasks can be occurring subliminally, below the threshold of consciousness; and conversely, process-changes can appear to consciousness as if they occur spontaneously as catastrophic bifurcations. In these terms, attractor activation (or excitation, or expansion), is an endothermic process, as energy is input into the system to enable forces to work against the system’s energy gradient in deepening the system’s potential basin. Conversely, attractor deactivation (or relaxation, or contraction), is an exothermic process, as energy is released by the system as forces working against the system’s energy gradient to maintain the system’s potential basin are relaxed. In terms of stimulus–response, for example, a specific stimulus activates the “input basin” of the associated receptor which is “linked” to an array of learned attractors, each characterized by different spatial-amplitude-modulation response-patterns [37]. Prior to stimulus, each of these periodic attractors is maintained far-from-equilibrium in a chaotic “basal state,” which allows easy “random access” to the attractor, and thus easy “activation” of the appropriate corresponding response. On receipt of a particular stimulus the corresponding attractor is quickly accessed and moved in its periodic “equilibrium state,” thus activating the matched response. As another example we can consider the dynamical system responsible for internal approach-avoidance conflict behaviour, modulated by fear-sensitivity wither respect to the desired/feared goal [33]. As fear-sensitivity increases, the system goes through a series of subtle bifurcations. The system’s initial fixed-point attractor (present at low fear-sensitivity) undergoes a Hopf bifurcation to become a periodic attractor (at medium fear-sensitivity), and this undergoes chaotic excitation to become a chaotic attractor (at high fear-sensitivity). Indeed, chaotic attractors are believed to be responsible for organisms’ multifunctionality, behavioural blending, and response selection, through their mediation of scale-independent interactions between single neurones, neuronal clusters, brain modules, and the organism and its environment [38]. Consciousness emerges as fluxes of electro-chemical energy traverse neurones and activate brain-modules: either as new transform-information is filtered and processed; as learning occurs and new connections and pathways are created; or as the mind-brain’s vast phase space is explored in the search for minima that represent the solution of problems. This gives weight to James’ observation that human thinking proceeds by a “stream of consciousness” in which there are “transitive” or fast “thoughts” which are very difficult, if not impossible, to monitor introspectively, and “intransitive” or slow “conclusions” of which we are more readily aware [39]. During all parts of this search, holographically-encoded neuronal connections are altered according to the “Hebb Rule” [40], as generalized mathematically by Singer [41]. This expresses the fact that if two linked neurones in similar states are excited simultaneously, then the connection strength between them is increased. Electroencephalogram (EEG) recordings of brain activity are used to attribute large numbers of identifiable attractors for different functionalities such as solving mathematical problems [30]. The consciousness-fluxes arise and flow through a holographic, massively-overlayered, deterministic-chaotic neural network system. Thus their evolution is not random, although it is in theory predictable only by stepwise calculation in the vicinity of the particular attractors they approach, and in practice it is not precisely predictable at all. This is why it is crucial to remember always that we are discussing dynamical, ongoing mind-brain-*processes* rather than instantaneously-observable *states* [33]. It thus also takes a finite time to “integrate over a trajectory” for a given mind-brain process, and thus, for example, a mind-brain-process such as memory-access is not instantaneous.

A particular mind-brain-process is neither uniquely restricted to, nor is it uniquely described by, any fixed, local, spatiotemporal configuration of the underlying neural network. Many trajectories, each starting from a quite different initial state, approach any given chaotic attractor [33]. Moreover, for any given chaotic attractor, all the attracted trajectories eventually flow through any arbitrarily small volume in the attractor’s phase space. Indeed, a specified mind-brain process is governed not by the ensemble of approaching trajectories, but rather by the general, invariant, multi-dimensional geometry in the vicinity of the associated attractor. In chaotic systems, large-scale, invariant patterns are of much more significance than instantaneous, highly-variable ones. A corollary of this is that putative “projection backwards along a trajectory” from the basin of attraction of an activated mind-brain process (“now”) to discern information about “past times” in general is very limited, and the possibility of finding a particular initial state is essentially impossible. Following Abraham we might refer to these paradoxical and counterintuitive chaotic-attractor properties as “mind-brain-process initial-condition-insensitivity” [33]. However, the Poincaré Section and the Lorenz Section [42], [43], which investigate the multiple crossings of trajectories through the phase space of an attractor, can yield useful general information regarding the attractor’s fractal complexity, and its generalized invariant properties. We can this envisage the mind-brain as functioning in two, quite different “temporal modes” [33], [44], [45], [46]. The first mode is operation in linear, reversible “chronos time,” when the mind-brain surveys holonomic functional relationships between the values of variables representing different states along a trajectory, in a process which does not change the system’s state. The second mode is operation in nonlinear, irreversible “chairos time,” when the mind-brain time-integrates nonholonomic, internal, cognitive models of agents, environments, and behaviours, in a process which leads to saltatory jumps in the system’s state.

3.4 Psychic Self-Organization

Here we should note Abraham's "First *proto*-Platitude" [33], namely that depending on the particular mind-brain-process considered, any type of attractor may be either desirable or undesirable; and any type of attractor may be normal or abnormal. Thus in psychobiological processes the fixed-point attractors of classical homœostasis are not the only permitted type, and periodic attractors, and chaotic attractors, are natural, and can actaully be desirable. This strongly suggests a "fluid and flexible" model of "consciousness" and of "personality" that is non-algorithmic, non-sequential, and essentially unpredictable [30]. The depth of the attractor controls the degree of awareness, and awareness can thus change gradually, or suddenly as bifurcations in the dynamical system occur. For any given dynamical mind-brain-system there may well be several attractors active simultaneously at different "depths of awareness," ranging from the subliminal to the fully conscious, and these attractors can exert mutual influence [47]. Moreover, different dynamical systems can "couple" together to cause mutual influence, bifurcations, and differing behaviours. In coupling, the modulating parameters of one member of the coupled system are functions of the state variables of the second member of the coupled system. It is well recognized that the actual conceptual "compartmentalizing" of a highly complex system into subsystems for analytical purposes is essentially trivially arbitrary in terms of the predicted overall behaviour of the system [33]. However, the identification of the minimum level of overall bifurcation-control by the most significant modulating parameters has been found to be desirable in constructing dynamical-systems "networks" to model a wide range of complex mind-brain processes [47], [48], [49], [50], [51], [52], [53], [54], [55], [56]. For example, a subliminal message causes anxiety by changing the magnitudes of affector-variables within the affective system; these affector-variables then go on to modulate bifurcations in the magnitudes of response-variables within the cognitive recall-recognition system [47].

Abraham extends the idea of coupling between different systems to define the concept of "self-coupling" within a single system, whereby the modulating parameters of the self-coupled system are functions of the state variables of the self-coupled system itself. This self-coupling behaviour leads to "self-control" and "self-organization" within a system, which Abraham sees as the most agiential, humanistic, teleological and transcendental features to arise from any nonlinear dynamical system [33]. Furthermore, by definition, chaotic systems have dense orbits and are topologically transitive, and thus can (and eventually, will) explore all points in their phase space. This implies that in some sense the potential of consciousness to explore new ideas, to experience novel states, and to form new concepts, is unbounded [30]. However, in order to move (or "stabilize") from attractor A to attractor B, one must "destabilize" or "unfixate" the focus on A, and then "restabilize" or "fixate" the focus on B [34]. This mind-brain stabilizing process initially requires an input of energy for its "activation," even when the final attractor B is "more stable" or "energetically lower" than initial attractor A [33]. Such "change of focus" is ideally suited to control by processes occurring in a chaotically-ordered, fractal phase space. Studies of both ontogeny and phylogeny indicate that developmental processes generally involve irreversible sequences of endothermic bifurcations which lead to ever increasing complexity [33]. Bifurcations are endothermic due both to the topologically instability of the bifurcation point, and to the local stability of the competing attractor basins. At a bifurcation point much energy is required simply to maintain awareness at that particular unstable point in linear time. Much energy is also required to integrate along trajectories in nonlinear time in order to detect, contrast, evaluate, and select new features of the available competing attractor landscapes. However, it appears that with the conscious expenditure of energy, control can be exercised over such self-organizational development processes in order to find new solutions to problems and to generate new resources by blending past experiences and present perceptions.

Furthermore, novel stable emergent processes can be engendered within a dynamical system by externally supplying appropriate new modulating parameters [57]. Thus new, stable, global psychobiological structures and new variable, adaptable, local psychobiological structures can co-emerge [58]. We note here that the direct control of time-perception as time appears to undergo dilation and contraction whilst an individual performs different psychic tasks can itself act as a modulating parameter in further self-organizing bifurcations [33]. Within this picture, development is thus seen as a series of irreversible, potentially deterministic (but not predetermined) bifurcations along a sequence of *quasi*-stable, and increasingly topologically complex, task-assembled attractors [45], [59], [60]. Abraham [33] claims that these views have previously produced a “quiet revolution” in developmental psychology [50], [61], and could produce a radical *meta*-paradigm shift for psychology in general, and for personal development psychology in particular.

3.5 Psycho(a)logical Autopoiesis

Pribram [62] suggests that the union of the linear dynamical systems used in perception and the nonlinear dynamical systems necessary for self-organization produces the mind-brain’s overall “landscape” of far-from-equilibrium chaotic attractors. We thus move beyond the continuous linear differential-equation systems of Drive Reduction Theory, and beyond the discrete linear difference-equation systems of Statistical Learning Theory [63], [64], [65]. Such a landscape exhibits a paradoxical “stability” in that perturbation from one far-from-equilibrium attractor (as during reinforced learning) does not necessitate return to the same far-from-equilibrium attractor, but instead can potentially result in the accessing of quite different, novel, far-from-equilibrium attractors (which we can identify with “learned behaviours”) [66], [67], [68]. We are thus able to bypasses normal, linear, logical, constrained conscious-perception functions, and more readily to access a host of unusual, nonlinear, “alogical,” unconstrained unconscious-creative ones. Schwalbe [69] reports that, in terms of development and maturing, the result is a sequence of *anti*-entropic, self-organizing bifurcations towards increased order and complexity through the creation of new information. First, neural networks self-organize to produce a coherent conscious self. Secondly, the body selectively mediates between the internal, mind-brain environment and the external, physical environment in the acquisition of information, leading to self-organization geared towards physical survival and growth.

Thirdly, the imaginistic self-organization of mental models generates "*meta*-awareness" and orientation with respect to temporal consciousness-development, from memory of the past, through perception of the present, and forward to projections into the future. Fourthly, "outer speech" becomes internalized as "inner speech" allowing languaged self-organization of images. For Schwalbe, the "self" can exhibit surprising creativity through the combination of predictable, linear, stability together with unpredictable, nonlinear, adaptability. This chaotic nonlinearity means that slight changes in language-patterns can cause large changes in internal imagery; and that small changes in internal imagery can cause large changes in mental models and *meta*-awareness. Indeed Kurzban denies the existence of a stable and unitary "I" and rather sees the self as a fluid and interactional "we" comprised from separate but inter(re)acting subsystems [70]. The ongoing disputes, mediations, alliances, and resolutions within and between members of this unstable constellation of parts and processes govern all self-self, self-other, and self-world interactions.

This approach provides a framework for choice-behaviour which foregrounds the undecidability of the question of (in)determinism, and gives support for the conceptualization of "constrained freewill" [3], [33]. Within this conceptualization, for any intentional individual, the distribution of goal-state attractors gives rise to an internal "field" which constrains the number and type of degrees of freedom available to that individual. Similarly, for any effective individual, the possession of particular action-capabilities gives rise to an internal field which constrains the courses of action available to that individual. The individual's intentionality and effectivity are exercised within an ever-changing external, ecological field. However, it is not the individual fields in isolation, but rather the coupling between the internal intentional-effective field and the external ecological field, which governs complex, global, goal-driven behaviour. Human beings are thus seen as massively complex self-organizing systems, sensitive to the determinate local effects of nonlocal constraints [44]. They are capable of intending (as well as simply perceiving and moving) by selecting initial states appropriate to the attainment of particular, final, goal states. However, the choice-behaviour is governed by a chaotic attractor whose topology is fractal [71]; and, we are in any case restricted by physically imperfect knowledge regarding both the initial state and the goal state [33]. Thus on both counts, exact (or reproducible) prediction of the outcome of any choice is impossible, and the choice is psychologically free, whatever the unknowable (in)determinate state of "reality" [33]. Choice is here seen as involving two coupled factors. The first is the nonlinear-time exploration of alternate attractors within the dynamical "model self" in order to choose modulating parameters which result in appropriate self-organizing bifurcations. The second is the selection of and navigation towards a new initial state in the phase space of the dynamical "model self" in order to instigate motion along a novel trajectory in the basin of a different attractor. The imaginative, intentional exploration of novel behavioural territories can lead to the construction, or to the discovery, of new selves [70].

The implication is that an individual (whether this be a friend, parent, teacher, therapist, or the individual herself or himself), can become familiar with various stable, repeating psychobehavioural patterns in that individual, together with their modulating parameters. Sometimes such a psychobiological state is stable and secure, but nevertheless be deleterious in a cognitive-behavioural sense, to that individual, who can feel trapped and frustrated, or may even be self-harming [53]. By changing the modulating parameters in different ways it is possible to stimulate bifurcation into either more (or, potentially, less), desirable psychobiological states. In social systems an individual can learn to exercise self-organizational control over the modulating parameters implicitly and subliminally; therapeutic work can lead to a conscious "personalization" of this control [33]. Abraham here uses "therapy" in a liberalized sense to describe people as seeking such control-personalization through altered states of consciousness, biofeedback, consciousness-raising groups, meditation, peak experiences, and self-help workshops, for example [33]. All of these ideas are readily accommodated into the framework provided for creative growth through psycho(a)logical autopoiesis (PAA) provided by neuro-linguistic programming (NLP), in conjunction with psycho-chaotic semiotics (PCS), each of which we consider in turn [72], [73], [74], [75], [76], [77], [78], [79], [80], [81], [82], [83].

3.6 Creative Dialetheialectics

The question then arises as to how we might reach the "deepest" mind-brain representations of in order to instigate psycho-chaotic dialetheialectic in order to restructure meanings creatively, congruently, ecologically, and lastingly, by manipulation of Schwalbe's third developmental level (the imaginistic self-organization of mental models) and his fourth level (the languaged self-organization of images). First, we note that in terms of standard electroencephalograph measurements of electrical activity in the brain, Beta-state (13Hz – 40Hz) [84] is normal for subjects who are highly alert and well focused, with their eyes open, although it can point to anxiety. Alpha-state (8Hz – 13Hz) is described as one of relaxed alertness, as observed routinely in unstressed adults over the age of 13 years. It appears to be enhanced by physical relaxation with the eyes closed, and conversely, to be reduced by mental concentration with the eyes open. Delta-state (0.5Hz – 4Hz) is the usual state in children of up to 1 year of age, in "background" rumination, and in deep, dreamless sleep. It has the largest amplitude of the four states described here, is described as being akin to "bass sound." The difficulty here is that *conscious* thinking in any of these three states is tied inextricably to surface structures and behaviours. It is linear and logical, and can only access previously tried-and-tested solutions and often-explored neural pathways. In so-doing it ignores the creative and the emotional, and passes over potentially fruitful but "crazy" explorations, even at the expense of trapping the mind in self-destructive modes of behaviour and response. We might say that in conscious problem-solving the available "search space" is highly constrained. The conscious mind is unable to access any of the underlying deep structure. Bandler sums this up with his statement that "I don't trust the conscious mind; it's a dick head; it will only mess things up" [85].

However, Theta-state (4Hz – 8Hz) can be observed as normal in mentally alert children below the age of 13 years. It is uncommon in awake adults over the age of 13 years other than when they are doing "indirect thinking" or "imagining," particularly in a state of daydreaming or drowsiness. It is common in both adults and children in the hypnagogic stage prior to full sleep. This specific altered state of deep physical relaxation coupled with heightened awareness, commonly called "trance." It is noted here that more coherent and homogeneous electroencephalogram activity is observed bilaterally throughout much of the brain-cortex during meditation practice [86]. Similarly coordinated brain-activity is also seen during the growth of cortical networks in gender development, and also during the in stimulation of hypothalamic feeding systems, and of cortical-behavioural systems [87], [88], [89], [90], [91]. Abraham proposes that this provides evidence of the mind-brain's ability whilst in "altered states of consciousness" to use perturbations and the resulting bifurcations in order to self-organize towards the attractors for of increased awareness, task-focus, growth, and development [33]. In order to overcome the problems with conscious awareness and to access creative "alternative states," people often resort to "sex, drugs, and rock 'n' roll," or, more generically, to "exertion, stimulants or depressants, and music." However, there are much less harmful, more predictable, and more useful, ways to achieve and to manipulate creative altered states using hypnotherapy.

Chapter 4 starts from the idea that the filtering and mapping processes of human information-processing produce states which represent attractors in the embodied mind-brain's phase space. Each human reality is then played out primarily in an individual's unique, internal metaphoric psychescape in which the particular topology depends on the individual's personal developmental history. Chaotic psyches, combined with chaotic environments, produce chaotically indeterminate behaviours. Emotion, experience, memory, and reason act as strange attractors which define the chaotic psychescape. The experience of creative confusion by individuals stuck in the attractor basin of a deleterious process can push them into regions of highly unstable chaotic activity. In general, strategies are designed to Deep-changes (using neuro-linguistic and psycho-chaotic techniques) actually modify the attractor topology by iteratively destabilizing links between destructive attractors, and stabilizing links between creative attractors**.** Part 4 goes on to investigate the ingenious "magical" paycho(a)logical linguistic patterns of neuro-linguistic programming under psycho-semiotic semiosis [92]. These methodologies allows the mind-brain to wander much more freely (and yet safely) across the metaphoric psychescape [93], [94] in executing its highly unconstrained psycho-chaotic trans-derivational search [95]. The overall process engenders a fundamentally novel symbolic way of thinking allowing novel creative self-discovery through psycho(a)logical autopoiess [70].

3.7 Chapter 3 References

For brevity, all websites in this listing are referenced with a unique alphanumeric "tinyurl" address generated at http://tinyurl.com/. These were all checked and found to be available at 1800H 12 February 2011. The tinyurl referenced as "tURL: 6dxpx6m" for example can be accessed at http://tinyurl.com/6dxpx6m .

[0] Krippner, S (1994) Humanistic Psychology and Chaos Theory: The Third Revolution and the Third Force. Journal of Humanistic Psychology. Volume 34, Number 3, pp 48 – 61.

[1] Crutchfield, J P, Farmer, J D, Packard, N H and Shaw, R S (1986) Chaos. Scientific American. Volume 254, Number 12, pp 46 – 57.

[2] Erickson, M and Rossi, E (1989) The February Man: Evolving Consciousness and Identity in Hypnotherapy. New York NY: Brunner Mazel.

[3] Sappington, A A (1990) Recent Psychological Approaches to the Free Will versus Determinism Issue. Psychological Bulletin. Volume 108, pp 19 -- 29.

[4] May, R M (1976) Simple Mathematical Models with Very Complicated Dynamics. Nature. Volume 261, Number 5560, pp 459 – 467.

[5] Rosser Jr, J B (2000) Aspects of Dialectics and Nonlinear Dynamics. Cambridge Journal of Economics. Volume 24, Number 3, pp 311 – 324.

[6] Jemmer, P; Jemmer, P (editor) (2010) Engage Newcastle Volume 1: Cafe Philosophique: A Season of "The Other" – The O(the)r (O)the(r). Newcastle UK: NewPhilSoc.

[7] Naser, C R (1995) The Dialectics of Self-organization and Nonlinear Systems. Dialectic, Cosmos, and Society. Number 7, pp 3 – 24.

[8] Popper, K R (1940) What is Dialectic? Mind (New Series). Volume 49, Number 196 (October 1940), pp 403 – 426.

[9] Levins, R and Lewontin, R (1987) The Dialectical Biologist. Cambridge MA: Harvard University.

[10] Davis, M D (1997) Game Theory: A Nontechnical Introduction. New York NY: Dover.

[11] Finkelstein, D (2009) Game Theory Can Help to Predict the Future: And It Can Save Us Money. The Times: Saturday Review: Arts Books and Ideas: Ideas: Thoughts for the Week. 5 September 2009, p 4.

[12] Andreev, L (2008) Tucson AZ: Equicom Incorporated: 29 February 2008: From a Set of Parts to an Indivisible Whole. Part I: Operations in a Closed Mode. tURL: 642gjvq.

[13] Kreidik, L G (2005) Dialectical Academy Russia-Belarus: Journal of Theoretical Dialectics – Physics – Mathematics: Issue B01: Mathematical Expression of the Main Categories of Dialectical Philosophy and Logic. tURL: 6fyperg.

[14] Kreidik, L G (2005) Dialectical Academy Russia-Belarus: Journal of Theoretical Dialectics – Physics – Mathematics: Issue B02: Elementary Dialectical Kinematics and Dynamics of Exchange. tURL: 6c6cmex.

[15] Petersen, U (2002) Diagonal Method and Dialectical Logic: Tools, Materials, and Groundworks for a Logical Foundation of Dialectic and Speculative Philosophy (Volume 1: Tools for Dialectic; Volume 2: Historical-Philosophical Background Materials; Volume 3: Groundworks for Dialectical Logic). Osnabrück GER: der Andere.

[16] Várdy, P; Brainard, M (translator) (1994) On the Dialectics of Metamathematics. Graduate Faculty Philosophy Journal. Volume 17, Numbers 1 – 2, pp 191 – 216; partially available at: Dumain, R (editor) (2010) The Autodidac Project. tURL: 6eyxte8.

[17] Hoffman, W C (1999) Dialectic: A Universal for Consciousness? The final Period of Cognitive Development. New Ideas in Psychology. Volume 17, Number 3 (December 1999), pp 251 – 269.

[18] Stranieri, A, Zeleznikow, J and Yearwood, J (2001) Argumentation Structures that Integrate Dialectical and Non-dialectical Reasoning. The Knowledge Engineering Review. Volume 16, Number 4, pp 331 – 348.

[19] Wells, S and Reed, C; Aarts, H and Westra, J (editors) (2005) A Drosophila for Computational Dialectics. Proceedings of the 4th International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS05) The Netherlands 25 – 29 July 2005 (New York NY: ACM Press), pp 1263 – 1264.

[20] Kadioglu, S and Sellmann, M (2009) Dialectic Search. Proceedings of the 15th International Conference on the Principles and Practice of Constraint Programming (CP-2009) Lisbon Portugal 20 – 24 September 2009 (Berlin GER: Springer), pp. 486 – 500.

[21] Forstner, C (2005) Max Planck Institute for the History of Science: Preprint 303: Dialectical Materialism and the Construction of a New Quantum Theory: David Joseph Bohm (1917 – 1992). tURL: 6c8yump.

[22] Kaku, M (1995) Hyperspace: A Scientific Odyssey through Parallel Universes, Time Warps, and the Tenth Dimension. Oxford UK: Oxford University.

[23] Georgescu-Roegen, N (1971) The Entropy Law and the Economic Process. Cambridge MA: Harvard University; Zimmermann, H J (1988) Fuzzy Set Theory and Its Applications. Boston MA: Kluwer Nijhoff.

[24] Kantrowitz, M, Horstkotte, E and Joslyn, C (1997) Carnegie Mellon University School of Computer Science: Answers to Questions about Fuzzy Logic and Fuzzy Expert Systems (FAQ Version 1.27); 10. What is the Relationship between Fuzzy Truth Values and Probabilities? (2 November 1994). tURL: 65fhpsh; Klir, G (1991) Generalized Information Theory. Fuzzy Sets and Systems. Volume 40, pp 127 – 142; Kosko, B (1990) Fuzziness versus Probability. International Journal of General Systems. Volume 17, Number 2 – 3. pp 211 – 240.

[25] Rajashekaran, S and Vijayalksmi, G A (2004) Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications. New Delhi IND: Prentice Hall.

[26] Priest, G (1990) Dialectic and Dialetheic. Science and Society. Volume 53, pp 388 – 415; Priest, G (1998) To Be and Not to Be: That is the Answer: On Aristotle on the Law of Non-Contradiction. “Philosophiegeschichte und Logische Analyse”. Volume 1, pp 91 – 130; Hirsch, M W, Smale, S and Devaney, R (2003) Differential Equations, Dynamical Systems, and an Introduction to Chaos. San Diego CA: Academic; Priest, G, Beall, J C and Armour-Garb, B (editors) (2004) The Law of Non-Contradiction: New Philosophical Essays. Oxford UK: Oxford University.

[27] Jemmer, P and McNamee, J (2005) From the Discrete to the Continuous: Relationships and Results in Single-species Population Models. Mathematical and Computer Modelling. Volume 41, pp 71 – 98.

[28] Thom, R (1975) Structural Stability and Morphogenesis: A General Outline of a Theory of Models. Reading MA: Benjamin.

[29] Ockenden, J R and Hodgkins, E A (editors) (1974) Moving Boundary Problems in Heat Flow and Diffusion. Oxford UK: Oxford University.

[30] Sardar, Z and Abrams, I (2004) Introducing Chaos. London UK: Icon.

[31] Adams, D (1988) Dirk Gently's Holistic Detective Agency. London UK: Pan Macmillan.

[32] Marx, M H (editor) (1961) Psychological Theory. New York NY: MacMillan.

[33] Abraham, F D (1992) Chaos, Bifurcations, and Self-organization: Dynamical Extensions of Neurological Positivism and Ecological Psychology. Psychoscience. Volume 1, Number 2, pp 85 – 118; tURL: 6dxpx6m.

[34] Dilts, R (1998) The Article of the Month: NLP and Self Organization Theory. tURL: 6f7qyqn; Dilts, R (1998) The Article of the Month: Motivation. tURL: 69ar8rh; Dilts, R (1998) The Article of the Month: Pragmagraphics. URL: Pragmagraphics. tURL: 5vlysd5; Dilts, R (1996) The Article of the Month:

Darwin's “Thinking Path”: Strategies of Genius and “Somatic Syntax”. tURL: 5wlsuz2.

[35] Skinner, J E, Martin, J L, Landisman, C E, Mommer, M M, Fulton, K, Mitra, M, Burton, W D and Saltzberg, B; Basar, E (editor) (1990) Chaos in Brain Function – Chaotic Attractors in a Model of Neocortex: Dimensionalities of Olfactory Bulb Surface Potentials. Berlin GER: Springer.

[36] Barnsley, M F; Peitgen, H-O and Saupe, D (editors) (1988) The Science of Fractal Images – Fractal Modelling of Real World Images. New York NY: Spinger.

[37] Freeman, W J; Basar, E (editor) (1990) Chaos in Brain Function – Nonlinear Neural Dynamics in Olfaction as a Model for Cognition. Berlin GER: Springer.

[38] Mpitsos, G J; Basar, E and Bullock, T H (editors) (1989) Brain Dynamics – Chaos in Brain Function and the Problem of Nonstationarity: A Commentary. Berlin GER: Springer.

[39] James, W (2009) Principles of Psychology (Volumes 1 and 2). Ann Arbor MI: University of Michigan Library.

[40] Hebb, D O (2002) The Organization of Behavior: A Neuropsychological Theory. London UK: Psychology.

[41] Sanger, T D (1989) Optimal Unsupervised Learning in a Single-layer Linear Feedforward Neural Network. Neural Networks. Volume 2, Number 6, pp 459 – 473.

[42] Rasband, S N (1990) Chaotic Dynamics of Nonlinear Systems. New York NY: Wiley.

[43] Strogatz, S H (2000) Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry and Engineering. Jackson TN: Perseus.

[44] Kugler, P N, Shaw, R E, Vincente, K J and Kinsella-Shaw, J (1990) Inquiry into Intentional Systems (Part I: Issues in Ecological Physics). Psychological Research. Volume 52, Numbers 2/3, pp 98 – 121.

[45] Weiner, N (1961) Cybernetics or Control and Communication in the Animal and the Machine. Cambridge MA: MIT.

[46] Loye, D (1983) The Sphinx and the Rainbow: Brain, Mind and Future Vision. Boulder CO: Shambhala.

[47] Masling, J M, Bornstein, R F, Poynton, F G, Reed, S and Katkin, E S (1991) Perception without

Awareness and Electrodermal Responding: A Strong Test of Subliminal Psychodynamic Activation Effects. Journal of Mind and Behavior. Volume 12, Number 1, pp 33 – 47.

[48] Abraham, F D, Abraham, R H and Shaw, C D (1990) A Visual Introduction to Dynamical Systems Theory for Psychology. Santa Cruz CA: Aerial.

[49] Mandell, A J; Davidson, R J and Davidson, J M (editors) (1980) The Psychobiology of Consciousness -- Toward a Psychobiology of Transcendence: God in the Brain. New York NY: Plenum.

[50] Cole, M and Cole, S R (1989) The Development of Children. New York NY: Freeman.

[51] Sabelli, H; Sabelli, H and Synnestvedt, J (editors) (1990) Personalization: A New Vision for the Millennium -- Personalization, a New Vision beyond Individualism and Socialism. Chicago IL: Society for the Advancement of Clinical Philosophy.

[52] Bütz, M (1992) The Fractal Nature of the Development of the Self. Psychological Reports. Volume 71, pp 1043 – 1063.

[53] Paar, D W (1992) Introducing Confusion to Create Change. The Psychotherapy Patient. Volume 8, Issues 1/2, pp 93 – 102.

[54] Conforti, M (1994) Morphogenetic Dynamics in the Analytic Relationship. Psychological Perspectives. VOlume 30 (Fall/Winter 1994), pp 12 -- 21.

[55] Goerner, S J (1994) Chaos and the Evolving Ecological Universe: A study in the Science and Human Implications of a New World Hypothesis. New York NY: Gordon and Breach.

[56] Combs, A; Abraham, F D and Gilgen, A R (editors) (1995) Chaos Theory in Psychology – Psychology, Chaos, and the Process Nature of Consciousness. Westport CT: Greenwood.

[57] Fogel, A; Kelso, J A S, Mandell, A J and Shlesinger, M F (editors) (1988) Dynamic Patterns in Complex Systems -- Dynamic Systems in Human Development: The Inhibition of Attention to Mother in Early Infancy. London UK: World Scientific.

[58] Smith, L B; Abraham, F D and Gilgen, A R (editors) (1995) Chaos Theory in Psychology – Stability and Variability: The Geometry of Children's Novel Word Interpretations. Westport CT: Greenwood.

[59] Prigogine, I and Stengers, I (2003) Order out of Chaos: Man’s New Dialogue with Nature. New

York NY: Bantam Doubleday Dell.

[60] Thelen, E; Kelso, J A S, Mandell, A J and Shlesinger, M F (editors) (1988) Dynamic Patterns in Complex Systems – Dynamical Approaches to the Development of Behavior. London UK: World Scientific.

[61] Cairns, R B (1990) Towards a Developmental Science. Psychological Science, Volume 1, pp 42 – 44.

[62] Pribram, K H (1991) Brain and Perception: Holonomy and Structure in Figural Processing. Hillsdale NJ: Erlbaum.

[63] Hull, C L (1966) Principles of Behavior: An introduction to Behavior Theory. New York: Appleton-Century-Crofts.

[64] Voeks, V W (1954) Gradual Strengthening of s-r Connections or Increasing Number of s-r Connections. Journal of Psychology. Volume 39, pp 289 – 299.

[65] Estes, W K; Koch, S (editor) (1959) Psychology: A Study of a Science (Volume 2: General Systematic Formulations, Learning, and Special Processes) – The Statistical Approach to Learning Theory. New York NY: McGraw-Hill.

[66] Maturana, H R; Garvin, P (editor) (1969) Cognition: A Multiple View – The Neurophysiology of Cognition. New York NY: Spartan.

[67] Varela, F; Klir, G (editor) (1979) Principles of Biological Autonomy (North Holland Series in General Systems Research). New York NY: Elsevier.

[68] Carpenter, G A, Cohen, M A, Grossberg, S, Kohonen, T, Oja, E, Palm, G, Hopfield, J J and Tank, D W (1987) Technical Comments: Computing with Neural Networks. Science. Volume 235, Number 4793, pp 1227b – 1228.

[69] Schwalbe, M L (1991) The Autogenesis of the Self. Journal for the Theory of Social Behavior. Volume 21, Number 3, pp 269 – 295.

[70] Kurzban, R (paraphrased); Stephenson, A (2010) Why Everyone (Else) is a Hypocrite (RSA London: 17 March 2011). RSA Journal: Events: Preview 5. Winter 2010, p 9.

[71] Poincaré, H; Halstead, G B; Gould, S J (editor) (2010) The Value of Science (Essential Writings of Henri Poincaré). New York NY: Modern Library.

[72] Jemmer, P W (2010) Enchant Newcastle Part 1: The Magical Nature of Natural Language. Newcastle UK: NewPhilSoc. tURL: isbn9781907926013.

[73] Jemmer, P W (2010) Enchant Newcastle Part 2: Lingwizd'ry: The Craefty Science of Language. Newcastle UK: NewPhilSoc. tURL: isbn9781907926020.

[74] Jemmer, P W (2010) Enchant Newcastle Part 3: Technoglossy and the Linguistic Labyrinth. Newcastle UK: NewPhilSoc. tURL: isbn9781907926037.

[75] Jemmer, P W (2010) Enchant Newcastle Part 4: Mathesis and the Metaphysical Maze. Newcastle UK: NewPhilSoc. tURL: isbn9781907926044.

[76] Jemmer, P W and Yoeli, J (2010) Enchant Newcastle Part 5: Anti-philosophy as "Wiseloving". Newcastle UK: NewPhilSoc. tURL: isbn9781907926051.

[77] Jemmer, P W (2010) Enchant Newcastle Part 6: Psycho-chaotic Semiotics and Psycho(a)logical Autopoiesis. Newcastle UK: NewPhilSoc. tURL: isbn9781907926068.

[78] Jemmer, P W (2010) Enchant Newcastle Part 7: Language: Lies, Laughter and Evolution. Newcastle UK: NewPhilSoc. tURL: isbn9781907926075.

[79] Jemmer, P W (2010) Enchant Newcastle Part 8: Linguistic Logomyths. Newcastle UK: NewPhilSoc. tURL: isbn9781907926082.

[80] Jemmer, P W (2010) Enchant Newcastle Part 9: Lingua Dei Nomina Creationis. Newcastle UK: NewPhilSoc. tURL: isbn9781907926099.

[81] Jemmer, P W (2010) Enchant Newcastle Part 10: Vis Voces Magicaeque Verborum. Newcastle UK: NewPhilSoc. tURL: isbn9781907926105.

[82] Jemmer, P W (2010) Enchant Newcastle Part 11: ReCreating OurSelves in Gods' Images. Newcastle UK: NewPhilSoc. tRUL: isbn9781907926112.

[83] Jemmer, P W (2010) Enchant Newcastle Part 12: A Shaman of Becoming I'll Be Newcastle UK: NewPhilSoc. tURL: isbn9781907926129.

[84] Author Unknown (2007) LucidQuest Methods: The Four Main Brainwave States. tURL: 65stely.

[85] Bandler, R (quoted); Hall, L M (2007) The International Society of Neuro-Semantics: Meta-States as Advancing NLP into the New Millennium: Meta-states makes NLP Conscious. tURL: 6k8fraz.

[86] Orme-Johnson, D W and Haynes, C T (1981) EEG Phase Coherence, Pure Consciousness, Creativity, and TM-sidhi Experiences. International Journal of Neuroscience. Volume 13, Issue 4, pp 211 – 217.

[87] Abraham, F D, Bryant, H, Mettler, M, Bergerson, W, Moore, F, Maderdrut, J, Gardiner, M, Walter, D and Jennrich, R (1973) Spectrum and Discriminant Analyses Reveal Remote Rather than Local Sources for Hypothalmic EEG: Could Waves Affect Unit Activity? Brain Research. Volume 49, pp 349 – 366.

[88] Bressler, S L, Coppola, R and Nakamura, R (1993) Episodic Multiregional Cortical Coherence at Multiple Frequencies during Visual Task Performance. Nature. Volume 366, Issue 6451, pp 153 – 156.

[89] Anderson, C M and Mandell, A J; MacCormac, E and Stamenov, M I (editors) (1996) Fractals of Brain, Fractals of Mind – Fractal Time and the Foundations of Consciousness: Vertical Convergence of 1/f Phenomena from Ion Channels to Behavioral States. Amsterdam NED: Benjamins.

[90] Hanlon, H; Pribram, K H and King, J (editors) (1996) Learning as Self-organization – Topographically Different Regional Networks Impose Structural Limitations on Both Sexes in Early Postnatal Development. Hillsdale NJ: Erlbaum.

[91] Abraham, F D (1997) Nonlinear Coherence in Multivariate Research: Invariants and the Reconstruction of Attractors. Nonlinear Dynamics, Psychology, and Life Sciences. Volume 1, Number 1, pp 7 – 33.

[92] Hoffman, K (2000) Trance Workbook: Understanding and Using the Power of Altered States. New York NY: Sterling.

[93] Grove, D, Wilson, C and Dunbar, A (2010) Emergent Knowledge: Philosophy: History and Principles of Emergent Knowledge. tURL: 5wgrqhd.

[94] Tompkins, P and Lawley, J (1997) Less is More: The Art of Clean Language (Version 2). Rapport Magazine. Issue 35 (February 1997); tURL: cg47m7.

[95] Battino, R (2005) Metaphoria: Metaphor and Guided Metaphor for Psychotherapy and Healing. Carmarthen UK: Crown House.

CHAPTER 4: PSYCH(A)OLOGY

4.0 Introduction

The filtering and mapping processes of human information-processing produce states which represent attractors in the embodied mind-brain's phase space. First, experiences and processes are represented as signs and signways and then further linguistic symbolizations aid us in describing and manipulating these modelled aspects of reality. Linguistic representation using metaphor is ubiquitous and involves the use concrete and physical experiential descriptions to express abstract concepts. Each human reality is played out primarily in an individual's unique, internal metaphoric psychescape in which the particular topology depends on the individual's personal developmental history. Human beings are seen as complex open systems, subject to multiple initial conditions, whose behaviour is thus inherently chaotic. Chaotic psyches, combined with chaotic environments, produce chaotically indeterminate behaviours. Emotion, experience, memory, and reason act as strange attractors which define the chaotic psychescape. Modern individuals' internal anxiety interacts with their external chaotic environments to instigate a process of psychic shattering which can help to precipitate them despairingly towards self-annihilation. The crucial educational and therapeutic understanding is that individuals can learn to change their states, at will, to become creative and empowered. The experience of creative confusion by individuals stuck in the attractor basin of a deleterious process can push them into regions of highly unstable chaotic activity. In general, strategies are designed to Deep-changes (using neuro-linguistic and psycho-chaotic techniques) actually modify the attractor topology by iteratively destabilizing links between destructive attractors, and stabilizing links between creative attractors. The therapist's role is retrospectively to read and direct fundamentally hidden, chaotic patterns in the client's presenting behaviour. The overall process engenders a fundamentally novel symbolic way of thinking.

4.1 Neuro-Linguistic Pragmagic

Now, we turn to NLP, which unites the three elements "neuro" (dealing with properties of mind and brain), "linguistics" (the use of "language" in its most general sense of the theory of communicative modalities), and "programming" (the postulation that behaviour is regulated by neural and linguistic patterns). NLP suggests that we think of all incoming human sense-data as being pre-processed by the senses, which act as "filters," as do beliefs, values, interests, occupations, and preoccupations. This initial "filtering" or "pre-processing" prevents the organism from being consciously overwhelmed by the magnitude of the information contained in the sense-data. The filtering produces a "map" of the "most important" features of "external reality," encoded as "internal representations" accessible to "consciousness," which then proceeds to respond to the "map" and not to "reality" itself. Particularly in the *meta*-mapping process of forming *linguistic* descriptions of our own “maps,” the initial “real” information can be fundamentally modified as it undergoes deletion (we are selective); distortion (we change our imagined views of our experiences); and generalization (we extrapolate from particular cases). We thus arrive at the important admonitions of Korzybski and Watts, namely, that “The map is not the territory” – and that “The menu is not the meal” [0], [1]. In the NLP picture, the hugely creative “subconscious” still retains silent and consciously unaware access to (or indeed “is”) all of the sense-data, memories, thoughts, and imaginings, massively-overlayered and vastly-distributed as the transform-connection-weights throughout the mind-brain’s neural networks.

Over time, the always-ongoing filtering and mapping processes produce “states,” which represent attractors in the embodied mind-brain’s phase space. O’Connor and McDermott define a “state” as the totality of emotion, feeling, imagining, libido, memory, energy, and thought, constellated around a particular cognitive-behavioural modality [2]. Hayes goes on to comment on the state-based learning of patterns, skills, or knowledge, in terms of the evolution of neural pathways based on the filtered transform-information encoded in the mind-brain as neural network connection-weights [3]. He notes in particular the variation in the speed of acquisition, and the stability, of different cognitive-behavioural pathways whilst in different states, ranging from those which are practically instantaneously-learned, easily-triggered, and exactly-repeatable, to those which need considerable practice to master, significant repetition to memorize, and a great expenditure of time energy to execute successfully. He gives as examples (which might in fact fall into either of the previous categories), the cognitive-bevavioural processes involved in having an orgasm, “doing” a phobia, solving quantum-mechanics problems, and tying one’s shoelaces. We can also imagine the existence of identity-level and cultural-level attractors such as chiefs, classes, tribes, states, religions, and worldviews [4]. SOT combines elements of Cybernetics and Gestalt Psychology to offer a “new paradigm for perception and change” [5]. In this paradigm, states as considered as self-organized mind-brain patterns organized around attractors called “anchors” which are “fired” to access the state. The attractive “strength” of an anchor is defined in terms of its “width” (which measures ease of access to the state) and its “depth” (the intensity of the state accessed). For example, “inspirational” or “phobic” states are generally very intense but very uncommon (with a “narrow and deep” attractor); whereas states of doubt, or of irritation, are common but weak in their affect (with “wide and shallow” attractors). We could also imagine “wide and deep” attractors as well as “narrow and shallow” ones. Individual’s particular “attractor topology” depends on their personal developmental history. The crucial educational and therapeutic understanding is that individuals can learn to change both their present state, and other learned sates, at will [2].

In order to do this we must first establish a cognitive “*meta*-perspective” in order to be able to survey the attractor topology and take steps to change it [5]. In this context, cognitive change can be described as occurring either at a “surface” or at a “deep” level. The relationship between deep- and surface-structure is “fractal” in that simple underlying deep-structures can manifest as very complex surface-structures. Surface-changes (such as “ignoring negative emotions” or “remaining optimistic”) move cognitive functioning to a different part of the already-existing attractor topology. Deep-changes (such as those brought about by NLP techniques) actually modify the attractor topology. Deep-change iteratively destabilizes existing attractors and introduces new ones in their place, thus "unveiling," or allowing access to, new states. The processes is cyclical, self-referential, and "fractal," and akin to Freudian "associative correction," since the outcome of each iteration impacts on the process that is causing the change itself, and thus shifts the nature and the location of the incipient attractor. Dilts here defines "pragmagraphics" as a methodology for "describing the structure of meaning" [6]. It encompasses the pragmatic effects of *extra*-linguistic factors such as beliefs, context, and personal history that effect the interpretation of communication in terms of the way in which experienced information is represented in an individual's internal map. The pragmagraphic strategy is applied to an individual's representation of a given action, image, memory, thought, or dialogue as follows. First, one isolates the most important experiential characteristics associated with the representation; then, one determines the defining submodalities used in the storage, punctuation, and recall of the representation; and finally, one explores the way in which changing the submodalities of the representation changes the individual's repertoire of cognitive, behavioural, and emotional responses and reactions [6]. In NLP terminology, the "submodalities" of a particular representation are crucially implicated in the description of attractor topology. The particular submodalities of a given representation are seen as acting like the holographic "reference beam" such that altering this reference (changing the submodalities of the representation) changes the hologram's resulting "interference pattern," thereby concealing, revealing, emphasizing, or modifying various aspects of the image (state) [6]. We might, for example, be very attracted by the image of a luscious, newly-baked, brown, wonderful-smelling chocolate cake covered in fresh cream; but repulsed by the image of an old, green, furry, decaying cake covered in mould [5]. In recovering from the destabilization of an attractor on changing its submodalities, psycho-chaotic trans-derivational search (PC-TDS) across the phase space of available attractors can occur, and this can lead to new anchoring. In this context the phase space is thought of as comprised from a vast array of mutually, chaotically self-interacting fractal "aleostates" [7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17], [18]. The role of the therapist is to guide clients' PC-TDS through the metaphoric psychescape, in order that they anchor in more resourceful and ecological aleostates. This general pragmagraphic strategy is utilized explicitly in a variety of contexts in NLP, as described next.

For example, the NLP "Fast Phobia / Trauma" treatment (NLP-FFTC) seeks actively to destabilize the initial sensitizing images in order to allow subsequent associative correction to equilibrium around a new, and more positive, attractor. "Eye-movement Desensitization and Repatterning" (EMDR) uses rapid eye movements to "scramble" the "frozen" patterns of post-traumatic stress in a similar fashion. Similar comments are apposite for the NLP techniques of "Submodality Chaining," "Swish Pattern," and "Threshold Pattern," for example [5]. Pragmagraphics is also concerned with the representation of "minimal pairs" or "similar opposites" such as anxiety / excitement, anger / determination, and appreciation / flattery [5]. It seeks to delineate the difference that makes the difference" between the members of the pairs, in order to facilitate creative change, for example, from a state of anxiety to one of excitement, both of which are experienced kinæsthetically in the “midline” chest-stomach region [5]. In general, Pragmagraphics strategies are designed to destabilize and weaken links between destructive attractors, and to stabilize and strengthen links between creative attractors [5]. In general, this is achieved using a “Swish,” which de-intensifies one submodality set, whilst at the same time intensifying another, thus altering the magnitude and direction of the flux between different internal representations, and hence changing the behavioural response [5]. Maguire describes, from an NLP perspective, the simple steps required to determine and to install lasting deep-change in terms of the mantra “goal – sensitivity – flexibility” as follows [19]. First, we must have a very clear and detailed representation of a clearly-defined and easily distinguished goal or outcome-state using all the available modalities and submodalities. Next, it is important to exercise considerable sensory acuity and mental alertness in order to calibrate the initial state and to gauge responses as modalities are changed and submodalities are tweaked. And finally, there must be sufficient behavioural flexibility and availability of responses to allow the therapist to experiment widely until the exact desired results are obtained for the client. The actual process of determining and to installing lasting deep-change is enshrined in the NLP “Test-Operate-Test-Exit” (TOTE) strategy-generation *meta*-strategy [6]. At the heart of creative communication is “rapport,” based on the extension of the neural-network Hebb Rule to the idea of “mirroring” another person’s physiology and behaviour [5]. Dilts describes the ability accurately to model the deep structure attractor topology that generates the fractal surface structure behaviour patterns as an example of “code congruence” [6]. Such congruence is an example of “universality” whereby the solution of a simple problem allows the solution of a congruent but much harder problem; this overcomes the problems inherent in attempting to account for the surface behaviours in all their complexity [4]. Deep-structure modelling also overcomes the problems of accounting for the vagaries of context, conditions, and circumstances that attend attempts to model surface structures [6].

4.2 Psycho-Chaotic Semiorcery

Next, we consider PCS, which unites the three elements “psycho” (dealing with the psyche as seat of human individuality and creativity), “chaotic” (using “chaotics” in its most general sense of the theory of fundamental natural complexity-from-simplicity), and “semiotics” (the process of “making meaning” through the generation, interaction, and manipulation of symbols of any kind). The motivation for emphasizing the interplay between these three particular features is the recognition that the human life-experience is at least as accidental, contingent, and mutable, as it is meaningful, essential, and fixed [20], [21], [22]. Singer [23] reminds us that all human individuals constantly and unfailingly face a world that more often appears to be incomprehensible and unpredictable, than it appears to be an ordered and rule-governed system. The progress of life appears in general far more magical, artistic and symbol-governed than it does rational, scientific, and logic-governed. Duke [24] and Mandel [25] explain that humans are subject to deterministic chaos through their sensitivity to initial conditions coupled with their embodiment of recursive symmetry. Michaels [26] sees people as complex open systems, subject to multiple initial conditions, whose behaviour is thus inherently chaotic. Chaotic human psyches, combined with chaotic environments, produce chaotically indeterminate behaviours [27]. Indeed chaos is so basic to human life that its effects extend from control of mundane "supermarket dynamics" on the one hand [28] to the complex psychobehavioural nexuses which can cause people on occasion to writhe on the ground, speaking in tongues, on the other [29]. The babbling babe is born into chaos; it eats and grows to create complex order and to decrease entropy; and when its life ends and it collapses back to chaos we symbolize its passing with a precise, symbolic ritual [29], [30]. We can thus either choose to ignore the prevailing chaos, or to embrace it as fundamental to existence.

The fundamental chaos of human existence is figured psychologically by the emergence of the seamless, irreducible unconscious, which underlines constant, syncretic psychic self-generation and self-organization within an unfixed and dynamic milieu, embodied by the figure of the *anti*-genealogical rhizome, as discussed in depth above. Emotion, experience, memory, and reason act as "strange attractors" which define the chaotic dynamical landscape of human behavioural functioning. Such behaviours are "*meta*-stable" in that they can persist in *quasi*-stable "norm" states for varying periods of time, before bifurcating suddenly to "abnormal" states when perturbed [24]. Bütz [31] points out that the extreme sensitivity to initial conditions and to perturbations means that apparently unimportant "sensitizing events" can magnify or "self-organize" in the psyche to reach catastrophic proportions. He gives a depressing psychological reading of modern-day life which might be summed up in the equation "*psychic chaos = anxiety*" [31], [32]. Modern individuals' internal anxiety interacts with their external chaotic environments to instigate a process of psychic shattering which helps to precipitate them despairingly towards self-annihilation [30]. This Baudrillardian [33] shattering is particularly potentiated by the "*White Noise*" [29] of the modern information society [34] which serves as the ever-present background for the "chaotically determined psychology of death" [30].

The mental symbol-space in which this constant self-(re)(dis)organization occurs is called the *phaneron* or psychescape, which consists of the entire holistically-interacting ensemble of internal mental representations, constructed and experienced in any possible symbolic fashion [35], [36]. The *phaneron* therefore includes all representations of "real" external phenomenal perceptions [35], as well as all representations of "constructed" internal constellations (such as emotions, imaginings, memories, or thoughts) [36]. In the broadest possible sense, then, the *phaneron* is composed of "signs" [37], expressed in representational modalities called "signways" [38]. These mirror closely the functioning of the "submodalities" and "modalities" used in NLP to describe representational systems. The processes of successive, self-recursive abstraction, symbolization, and re-symbolization involved in forming these signs and signways mean that all language, perception, thought, and knowledge is fundamentally analogical or metaphorical [39]. Metaphors work by comparing entities which differ in most respects by highlighting a particular crucial similarity in a way which can often be suite startling. Metaphors are ubiquitous and often use concrete and physical experiential descriptions to express abstract concepts, ideas, and processes [40]. For Grove, metaphors "carry" valuable, hidden and highly abstract symbolic information embedded within apparently simple superficial physical and conceptual representations. Moreover the psycholinguists Lakoff and Johnson stress that metaphor transcends rhetoric and poetry, motivates the human conceptual system, frames all of human "reality," and controls human acting, perceiving, and thinking [41]. Indeed the anthropologist Bateson goes so far as to make the equation "*metaphor = life*" since integrated human psychic functioning would unravel without metaphor [42]. Grove would claim that each human reality is played out primarily in an individual's unique, internal magical metaphoric psychescape [43], [44]. The features of ubiquity and startling communicative efficacy inherent in metaphors, coupled with their potential for self-referentiality and alogicality, offer an obvious route towards creative PC-TDS.

However, we conjecture that language inefficiently implements a linear-processing "operating system" on the massively-parallel, rhizomatic neural-network "architecture" of the mind-brain [7], [8], [9], [10], [11], [12]. In particular, linguistic representations of the signs and signways aid us in describing and manipulating experiences and processes. Nevertheless we must always remember that our raw experience is non-linguistic and that "reality leaves a lot to the imagination" as we unconsciously and consciously "talk to ourselves" and make languaged representations of "reality" [45]. First, experiences are represented as signs and signways. Then the signs undergo a further process of abstraction as we attach linguistic "labels" in order to describe and to manipulate them, and this distances us even further from the experiences themselves [2]. Over time the labels become so strongly representative of the initial experiences that we tend forget these entirely (along with other, non-linguistic symbolic representations) and remember only the labels. It is the linguistic representations, the "words," which we mistakenly take to be the actual experiences themselves, and which we allow to influence our thinking, emotions, and behaviours. This means that our conscious, superficial, logical, linear reasoning, using entrenched language-patterns, tends to become "stuck" when applied to problems originating in the unconscious, deep, metaphorical, nonlinear domain of *phaneronic* representation [46], [47], [48], [49], [50].

Psychosemiotics links psychology and semiolgy in its study of the ways in which humans consciously create, comprehend, change, learn, manipulate and utilize these signs and signways [37]. It also addresses the hugely important and yet mostly unconscious and emotional influence of signs and signways on processes such as learning, memory, and motivation, which are estimated to comprise at least 90% of the mind-brain's cognitive load [38]. Fundamental to psychosemiotics is the understanding that human meaning is made metaphorically through a dense and elastic, open and nonlinear alogical web of rhizaleosemiotic connotations in the chaotic neural nets of the language-brain [30]. This is a dynamic, evolving semiotic process, subject to various biological and cultural constraints [38]. Rhizaleosemiotic conceptualization within the *phaneron* is thus constantly balanced on a knife-edge between order and disorder, since when viewed at a certain resolution all ideas appear relationally embedded in a single conceptual matrix; and yet when viewed at a different resolution they appear unattached, free-floating, and fragmented. The disordered, analogical psycho-chaotic-semiotic "diagram" contains the seeds of potential emergent order. This order is described as "rhythm" and it arises spontaneously as the overarching dynamic modulation of the "in-between" spaces of both the ordered and the disordered states. This rhythm is expressed as the "figure" of the "organless body" which is an objectively indeterminate zone, subject to the processes of deformation, dissipation, and isolation. Within this zone, sensation-conceptualization is rhizaleosemiotic and leads to a "haptic vision" in which the place of the figure and the ground coalesce. The rhizome, as the *phaneronic* "image of thought," enables continuous, creative and non-judgemental differentiation of otherwise frozen and static individual identities [51].

We come to ask, therefore, how it might be possible to use these ideas therapeutically in order to create and access lasting creative states of self-organizing growth, not through wilful "illogicality" and a denial of linear logic, but rather through the empowering "magical" utilization of alogical, nonlinear metaphor. We might follow Monk in summing up the philosophical foundations of psychosemiotic therapy as a paradoxical attempt to "show the unsayable" [52]. It is not possible to "demonstrate the unutterable" scientifically using the direct, literal language of explanatory and predictive theory. Instead, this must be done using indirect, poetic metaphor. Wittgenstein described the "something more analogous to poetry" necessary to impart therapeutic insight as "*Übersicht*" [53]. This term is glossed as meaning a "perspicuous representation" which aids understanding by allowing one to create and to discover "intermediate cases" and thus to "see connections" [53]. Such understandings are commonly experienced through art, music, or poetry, but their importance has become marginalized in "scientistic" culture, even though they are grasped more immediately and personally that scientific evidence and proof [52]. The cognitive-conceptual space of the *Übersicht* is the overarching symbolic totality of the *phaneron*. Psycho-chaotic semiosis leading to *Übersicht* begins, in Peirce's view, when we become conscious of previously-unconscious "erroneous expectations" based in our current representations and models [54]. Here, Bühler [55] emphasizes the need to *overcome* homœostasis, in order to engender creativity, whether this be artistic, cultural, scientific, social, spiritual, or technological. For her, this is the way that humans individually and collectively generate values and meaning, and therefore stasis is a sign of stagnation, illness, and death. This idea is confirmed by modern experiments which indicate chaotic variability in the biophysical systems of all healthy individuals [56], [57], [58].

This sudden realization of error sets in motion Peirce's "experimental learning cycle" within the *phaneron* as discussed in detail in Jemmer [59]. In summary, psycho(a)logical creativity arises from interplay of three effects within this cycle -- the "principle of fallibilism," namely that "knowledge is never fixed or finite" [37]; the "principle of surprise," whereby "experience is our only teacher" [38]; and the application of "abductive reasoning" which generates novel ideas in response to the surprise, to which inductive and deductive reasoning can then be applied [38], [60] in an "everwidening cyclical process" [37]. In terms of the experimental learning cycle, the initial step in achieving a new and truly creative perspective is to utilize "neuro-linguistic fractals" to engender psychosemiosis through which self-referential, and therefore potentially chaotic, (language) patterns gain "magical" transformative power in making new, empowering mental meanings [6], [13], [14], [15], [16], [17], [18]. Dimitrov, for example, explains that certain correctly-chosen linguistic patterns can act as “dynamical signs” which stimulate several simultaneous “creative crises” in the psychescape, setting of a “chain reaction” of “emergent meanings” [61]. From the perspective of natural cognitive semiotics, signs and their signways grow dynamically in an “ongoing dialectic of development” [37]. Gough describes the process of learning about the unknown through spontaneous generation of new symbolic ideas and associations [62] as “rhizosemiotic play” [63]. This is a mode of intellectual discovery which can in fact investigate the “immanence-plane” that supports the “preconceptual-fields” in which growing concepts are embedded [63]. New ideas are born as a result of “diffracting” old concepts through a rhizaleosemiotic “cat’s cradle” [64], [65]. These novel thinkings are used in the construction of knowingly artefactual “*meta*-fictions” which allow the interrogation of multiplex, chaotically-evolving interpretations of “reality” [66] in a narrative of unfolding knowledge [67]. These creative “antics” engendered by art, humour, and paradox result in the formation of dynamic, experiential networks, rather than static tracings [63].

Let us now turn to a discussion of the utilization of chaos (through Parr’s paradoxical “creative confusion”) in bringing about therapeutic psychosemiotic change [68]. We find for example that various mystico-philosophical traditions see “self-looping contradictory statements” and unusual physical movements as containing an occult “orgasmic power” [61]. Exposure to this power suddenly displaces the mind from its conventional, limiting meaning-attractor state towards the “boiling zone” at the edge of chaos, from which it might be able to self-organize into a revelatory state with the “explosion” of utterly new meaning-attractors [4], [61], [69]. For instance, Zen Buddhist Masters use carefully-chosen words and expressions to engender “*satori*” (a climactic state of spiritual enlightenment) [61]. As an example of this, we might observe the exchange “What is Buddha?” – “The mind Buddha is” – “What is the mind?” – “Is not Buddha the mind” ([4], slightly modified). This alogical interrupt of the conventional question-response feedback loop sets up a quite distinct, unconventional, self-referential semiotic-chaotic “movement” in the conceptualization of truth and falsehood [4]. In general, the experience of creative confusion by individuals “stuck” in the attractor basin of a deleterious process can push them into regions of highly unstable chaotic activity. This potentially opens up unfamiliar and ostensively unrelated phase portraits for exploration (with the expenditure of conscious effort), thus allowing bifurcations to new attractors to occur [70]. Hyatt reminds us that the importance of absurdity, chaos, nonsense, and paradox lies is in their ability to derail and to complement, but not to replace, linearity [71]. The mechanisms of creative confusion bypass rational predictability, bring to mind novel features, and engender exciting new understandings. In the therapeutic milieu we find that at a particular point in the utilization of creative confusion the process itself “takes over” as both the therapist and the client are guided by the forthcoming unconscious information towards significant and discoveries and lasting changes [44]. The end-result of such creative confusion, coupled with conscious effort, might well be the surprising, transformative, and liberating discovery of novel, mature, and fulfilling psychobehavioural processes [44]. However, depending on the nature of the therapeutic milieu and of the therapeutic alliance, psycho-chaotic semiosis might also result in the pathological substitution of debilitating and destructive cognitive-behavioural patterns. Further outcomes might also be the experience of hope in anticipation of possible positive results; of discomfort whilst expending energy in executing the search; or of fear on acknowledging potentially less favourable results. An ideal therapeutic way to "steer" the individual toward the exploration of potentially positive, but as-yet unknown, outcomes is to use the non-invasive and content-free tools of NLP such as those described above, in conjunction with "clean language," in order to trigger highly unconstrained and yet safe and ecological PC-TDS [44]. Tompkins and Lawley explain that such favourable therapeutic conditions can engender a deeply transformative and almost sacred process whereby limitation and fear are miraculously resymbolized into resourcefulness and joy [44].

4.3 Rhizaleosemiotics

Let us now go on to investigate the Psycho-chaotic Semiorcery and Neuro-linguistic Pragmagic which can be used creatively to guide the Psycho(a)logical Autopoiesis of human thinking and personality. First, we recognize that symbolic communicative messages are ambiguous: they are part of creative, changeable codes. This is true both of the means of articulation, and the form of the content. Secondly, such messages can be highly self-referential, both in form and in content, and this feature leads to chaotic evolution in personal psychic individuation. This playful chaos is seen, for example, in the fact that the elements of psycho-linguistic tautologies arising in one particular context, at one stage of development, may well be extrapolated along different connotative chains as development progresses, resulting in quite different conceptual structures (and even contradictions), in the different contexts experienced at later developmental stages. Changes in content relate functionally to, and are influenced by, changes in basic modes of expression and vice-versa. The field of "Aleolinguistics" aims to investigate and describe how changes in the conceptual model of the world, and changes in modes of expression, express mutual influence as an individual's imposed and self-subcreated language grows "chaotorganically" (as discussed in detail in: Jemmer, P (2011) (Re)(De)(Con)structing Lacan: Mathemegenesis for a Rhizaleosemiotic Calculus. Swansea UK: NewPhilSoc Publishing; Published June 2011; ISBN 978-1-907926-13-6). Here, the prefix "aleo–" is derived from the Latin verb "alēre," which signifies continuous interactive growth, coupled with mutation, in a system; it seems to fit well a process of long-term psycho-linguistic maturation. There are also echoes of the Latin noun "āleæ" which means "dice" or "chance-games," although we remember here that in the proper technical sense, "chaotic" events are not at all random, but rather are fully deterministic as discussed in detail in Chapter 2. Aleolinguistics, together with Rhizomatics and Semiotics provides a "Rhizaleosemiotic" framework in which to investigate and develop chaotic human creativity and individuation.

Once initiated, the process of subconscious, rhizaleosemiotic evolution sees to enliven and multiply into a nexus of interdependent events. At various crucial stages, or cusps, remarkable bifurcations in the psychic system are seen to occur, whereby divergent and often conflicting forms or "gnomes" arise and branch off. These may die off, or they may go on to coexist in harmonious or conflicting juxtapositions, either of which may be helpful or deleterious in different circumstances. These multiple psychic representational structures constantly (re)(inter)connect, forming a rhizomatic Gestalt workingsystem, the Ego-state eclectic, which is far more complex than the sum of its parts, and we then see the move towards integration and Ego-state individuation. The Ego-state eclectic may be thought of as being multiplex in a series of historically discernible time phases or aleostates and multiplex in all of its gnomes. The initial formative stages are glossolalial: that is, all the subconscious rhizomatic nexal, or deep-level interconnectivity develops quite naturally, without the necessity of the individual’s consciously interacting with the system.

Generally, in rhizaleosemiotic evolution meanings (re)(de)(con)structively blend and interweave between aleostates and gnomes revealing an underlying levelling process or “synapsis.” Sometimes previously dormant modes are awakened to emerge again in a self-reordering process of “taxis.” Yet again, surprisingly novel and inconsistent modes can be generated through “ekplesis.” Here once again we emphasize the tensions between cooperating and competing transformative processes which simultaneously “construct – destroy – restructure – reconstruct – deconstruct – redestroy – redeconstruct” in the neverending chaotic-semiotic dialetheialectic of meaning-making. It is important that the psycho(a)logical self-subcreational system is appropriately open to receive new semantic modes without unduly disturbing those already existing. Yet it must in some senses also be closed to modes thrown out during its development which would otherwise thereafter be left as blocks, blind-spots, fixations, and split-off aspects that are disjointed from the Gestalt, as in neuroses and psychoses. It is through this creative, chaotic “open closure” that internal inconsistencies are reconciled, their redundancies pruned, and saliencies retained, whilst the system still remains generative and does not become static. The relative degrees of openness or closedness give different degrees of “friction” in rhizaleosemiotic individuation through Neuro-linguistic Pragmagic and Psycho-semiotic Semiorcery, the mechanisms of which have been explored in detail above.

4.4 Psych(a)ological Mathemagic

Baudrillard [72] and Moses [73] note that the closer humanity appears to approach the overthrow of death through the utilization of science, the more frightful are the anomalous repercussions it seems to visit on itself through technology. And the repercussions are “psychic” rather than “material” [73], in accord with Heidegger’s theorizations [74], [75]. First, the modern tendency to scientific reductionism can easily lead us to fall into to an existential “interpretative trap” when faced with life’s chaos [76]. Once ensnared, we then expect that an “unbearably beautiful” ordered “answer” is always guaranteed to emerge from the chaotic labyrinth of lived experience upon sufficient critical reflection. And of course, in general, such answers are not “magically” forthcoming, no matter how hard we contrive to find them. We can thus come to seek “protection” from “psychological anxiety” in unending riddling whose cyclical “symbolic exchanges” one believes will vitiate one’s death-paranoia [76]. The second, unexpected, consequence of the ascendency of reductionism is the reactive emergence of a need to "re-orient" and to "re-ground" beliefs, ideologies, and values [77]. This goes hand-in-hand with a tendency to "re-mythologize" [77] and to project the human lack of coping-ability onto a "sense of awe" in the "elemental and wilful rhythms" of "cosmic force" [29].

However, Postmodernism has given us a gift of "sublime incomprehensibility," namely the understanding that "being exceeds knowledge" [78]. This recognition acknowledges that both future-telling and even present-explicating are made impossible to any level of specificity in the measure that the "plurality of details" implicit in the onset of any event is unknowable [79]. The ambiguous and apparently fortuitous unfolding of historical narrative can thus be described in terms of a "sublime" causal web too massive and intricate to be comprehended by the "unitary subjective mind" [79]. Lyotard reads this "sublimity" as meaning that reason is circumscribed, that knowledge is partial, that control is limited, and that ungovernable "difference" and "otherness" are fundamental to human life [80], [81]. The human lifeworld of absurdity, accident, ambiguity, and death is not at all fully factual and lawful, but rather it is catastrophic and viral [76]. Indeed we come to learn that life can only be properly described "fractally" through satirical irony which takes in contradictions, fissures, oppositions, revisions, and disorganization [72]. The predicted perpetual perfection of comedy and romance, and the tragic ideal of submission to overarching cosmic laws, both give way to the understanding that existence is doomed to eventual entropic heat-death and frozen-in chaos [78]. Important art attempts to address these issues by "presenting the unrepresentable" [82]. The only appropriate dramatic register for this tale of human imperfection and of cosmic dissolution is farce. However, within this dramaturgical framework the characterization of behaviours or events as embodying either complex order or catastrophic disorder depends critically on one's point of view. It is left to the actors and spectators [83] to discern their own "*Rules of the Game*" [84] and so to become co-creators of reality in determining the "meaning" of what they perform and observe. If they do not exercise this self-determination, then a magical play of apparently lucid ideologies and fabricated cultural conventions can conspire to provide inescapable reasons which oblige them to act against their own deepest beliefs [85]. In this context we note that disasters (both real and imagined) cause psychologically equivalent effects on their victims through the (dis)information that they unleash [86], [87]. Both the actual, and the constructed, act as bifurcation points for the breakdown of old psychological states and the emergence of new ones [30]. Indeed, such catastrophes are necessary to disrupt the "brain fade" caused by the unending modern information-flux [29], and when viewed from a distance they serve to allow access to "*jouissance*" on the part of the viewer [88].

We must also always bear in mind that human phenomenological and experimental perception of "reality" is intrinsically finite and limited [70]. It thus automatically falls short of the infinitesimal spatiotemporal resolution implicit in the deterministic mathematical models of the calculus. We are further forced to acknowledge the relativity of reference-frames, the historiological openness demanded by chaology, and the interactional indeterminacy required by quantum mechanics [89]. Human psychology and psychic growth can only therefore be fully comprehended and appropriately encouraged by adopting an attitude of openness to the contextualized (re)(de)(con)struction of the particular individual rather than by enforcing decontextualized, generalized, and impersonal psychological models [90]. The blend of psychology and chaology in psych(a)ology is able to build models of experience and behaviour in terms of complex, nonlinear dynamical systems, and to provide a framework within which to attempt to model, to comprehend, and to predict the influence and outcome of apparently erratic, emergent, causal interactions [91], [92]. The modern motivation towards psych(a)ology is explained by Ward [30] as arising from a desire to explain and interpret accident, chance, and coincidence in human life. Psych(a)ology is seen as providing a coherent epistemological basis for psychology [93] by furnishing a mathematical methodology well-suited to modelling complex processes, and a universal language sufficiently simple to explain and communicate modelled predictions [70]. Iwakabe, however, urges some caution as to the usefulness of "mathematical analogies" in therapy, pointing out that their over-extension may in fact result in misleading "erroneous metaphors" [94]. Lonie investigates the possible role of psych(a)ology in providing a new paradigm for psychotherapy with respect to several factors [95]. She cites the importance of perceptual schemata [96], of representational "moments" [97], of computational infotheory models [78], and of the identification of changeable repeat-behaviour patterns [98]. All of these are accommodated naturally within the framework of psych(a)ology. From this viewpoint "*das Unheimliche*" (German – "the {chaotically} uncanny") of the Freudian unconscious [99] is not hallucinatory but rather represents occult information that exhibits a chaotic metaphorical and "mathemagical" structure whose context and meaning await discovery [30]. Lonie conjectures that the therapist's role is retrospectively to "read" fundamentally hidden, chaotic patterns in the client's presenting behaviour. Together, client and therapist can interpret these structurally and thematically, in order to help map out the otherwise unfeasibly complex mytho-philosophical metaphoric psychescape [95]. Furthermore, the humorous interpretation of chaotic psychology allows new understandings of psychic inadequacies and restrictions to emerge.

4.5 "Lingwiz'ds of Being" and "Shamans of Becoming"

Bearing all of this in mind, we come to ask how we might site neurolinguistic / psychosemiotic therapy on a continuum ranging from art, through philosophy, to science. Here, we can imagine that art, philosophy, and science offer three different but *equi*-potent creative organizational modalities whose pragmatic worth is in providing tools to answer "how?" and "why?" questions [100]. Art deals in qualitative "percepts" (sensations) and "affects" (emotions); philosophy creates "concepts;" and science quantifies with respect to "functives" (fixed reference-points). The true task of psychosemiotic therapeutic dialogue is not to arrive at immutable, "true" and "scientific" interpretations [100] merely by chipping away at what is already explicit and obvious, and by regurgitating old ideas [20]. Instead, its real purpose is the "philosophical" unearthing of novel ideas with which to understand our current thought-processes, and the generation of "artistic" skills through which to refine and to change these concepts where necessary, through a consideration of implicit and overlooked details. Tompkins and

Lawley summarize the whole process of psycho-chaotic semiosis and the attendant psycho(a)logical creativity as engendering a fundamentally novel “symbolic” way of thinking which differs as significantly from process thinking, as process thinking differs from content thinking [44]. Psych(a)ology (following the lead of postmodern chaos-spirituality) acts on these symbolist understandings to “re-enchant nature” by reintroducing the magic and mystery previously banished by mechanistic and reductionist science [101], [102]. In fact, the “emergent behaviour” and “self-organization” seen in complex open systems is now often described creatively in metaphorical, animistic terms by various authors [103], [104], [105]. This “mysticism,” together with what is seen as the over-liberal, inaccurate, and “corrupted” use of restricted scientific vocabulary by the uninitiated, has sparked “science wars” [106], [107] between the “rationalist” Scientists on the one hand [108] and their enemies the “superstitious” [109] and “nonsensical” [110] Romantics on the other. And yet here we should recall the science itself, and psychology in particular, exists as a chaotic attractor of meanings, subject to the self-reflective and self-organizing bifurcations of “paradigm shifts” [70], [111]. It is such shifts which often reveal the hidden, unifying, deep-level commonalities that underlie the multifarious, ostensive, surface-level differences within and between ideas, models, and disciplines. Thus the dialectical interplay of opposing ideas leads not to the hegemonic dominance of a single ideology, but rather to the establishment of an ever-evolving, gylanic matrix of concepts [112].

Therapists, as “*Lingwiz’ds of Being*” – “*Shamans of Becoming*” – “*Mages of Meaning*” – “*Knack-smiths of Reality*” – “*Essendi Incantatores*” – “*Šamánes Faciendi*” – “*Techneglossists*” – “*Μάγοι της Σημείωσης*” – “*Dewiniaid o'r Ystyr*” – thus seek to bridge the gulf between the exegesis of languaged “*textus receptus*” and the celebration of experiential “*joie de vivre*” by finding the hidden narrative code or subtext in apparent psychic randomness [7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17], [18]. In framing such speculations, they assert their (and their clients’) creative independence from the dominant controlling cultural, political, religious, and scientific discourses, although not necessarily with the intent of bringing about their violent downfall [30]. Such persons seek to discover the “courage to be” [70], [113] through self-affirmation and self-creation [114] and by the generation of future-projections designed to enhance choice [115]. This allows them to discover an attitude of compassion, empathy, and sensitivity which percolates from the individual, through interlinked socio-cultural networks, and eventually influences the very “complex contextual reality” at the heart of comprehended existence itself [70]. Societies comprised of people who make these discoveries will be more complex, fulfilling, and interesting on both the individual and on the collective scale. These understandings are of crucial importance in therapy in general, and particularly in providing appropriate liberating metaphors for the magical psycho(a)logical creative changes brought about through hypnosis.

4.6 Summary

The union of the linear dynamical systems used in perception and the nonlinear dynamical systems necessary for self-organization produces the mind-brain's overall landscape of far-from-equilibrium chaotic attractors. Over time, the always-ongoing filtering and mapping processes of human information-processing produce states which represent attractors in the embodied mind-brain's phase space. Such deterministic-chaotic systems show behaviour which is highly complex and essentially unpredictable. The modulating parameters for a particular dynamical system in general have a critical effect on the system's behaviour. Chaotic human psyches, combined with chaotic environments, produce chaotically indeterminate behaviours, although this can be a positive existential feature. Metaphor transcends rhetoric and poetry, motivates the human conceptual system, frames all of human reality, and controls human acting, perceiving, and thinking. This chaotic nonlinearity of the human mind-brain means that slight changes in language-patterns can cause large changes in internal imagery; and that small changes in internal imagery can cause large changes in mental models and *meta*-awareness. The overall process of neuro-linguistic programming under psycho-chaotic semiosis, and the attendant psycho(a)logical creativity engender a fundamentally novel symbolic way of thinking which differs as significantly from process thinking, as process thinking differs from content thinking.

First, we recognize that symbolic communicative messages are ambiguous: they are part of creative, changeable codes. Secondly, such messages can be highly self-referential, both in form and in content, and this feature leads to chaotic evolution in personal psychic individuation. Changes in content relate functionally to, and are influenced by, changes in basic modes of expression and vice-versa. At various crucial stages, or cusps, remarkable bifurcations in the psychic system are seen to occur, whereby divergent and often conflicting forms or "gnomes" arise and branch off. The Ego-state eclectic may be thought of as being multiplex in a series of historically discernible time phases or aleostates and multiplex in all of its gnomes. The initial formative stages are glossolalial: that is, all the subconscious rhizaleosemiotic nexal, or deep-level interconnectivity develops quite naturally, without the necessity of the individual's consciously interacting with the system. Generally, in rhizaleosemiotic evolution meanings (re)(de)(con)structively blend and interweave between aleostates and gnomes revealing an underlying levelling process or "synapsis." Sometimes previously dormant modes are awakened to emerge again in a self-reordering process of "taxis." Yet again, surprisingly novel and inconsistent modes can be generated through "ekplesis." Here once again we emphasize the tensions between cooperating and competing transformative processes which simultaneously "(re)(de)(con)struct" in the neverending chaotic-semiotic dialetheialectic of meaning-making. The relative degrees of openness or closedness of the rhizaleosemiotic system give different degrees of "friction" in individuation, change, and growth.

4.7 Chapter 4 References

For brevity, all websites in this listing are referenced with a unique alphanumeric "tinyurl" address generated at http://tinyurl.com/. These were all checked and found to be available at 1800H 12 February 2011. The tinyurl referenced as "tURL: 6dxpx6m" for example can be accessed at http://tinyurl.com/6dxpx6m .

[0] Korzybski, A H S (1994) Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics. Fort Worth TX: Institute of General Semantics.

[1] Watts, A (quoted); Wilson, R A (1993) Cosmic Trigger (Volume 1: Final Secret of the Illuminati). Reno NV: New Falcon; Preface to the Falcon Press Edition (Dublin 1986). tURL: 9wr2g.

[2] O'Connor, J and McDermott, I (2001) NLP. London UK: Thorsons.

[3] Hayes, P (2002) The Psychobiology of Stress and Healing (Part 1: A Framework for Modern Psychobiology). Stress News. Volume 14, Number 2.

[4] Sardar, Z and Abrams, I (2004) Introducing Chaos. London UK: Icon.

[5] Dilts, R (1998) The Article of the Month: NLP and Self Organization Theory. tURL: 6f7qyqn; Dilts, R (1998) The Article of the Month: Motivation. tURL: 69ar8rh; Dilts, R (1998) The Article of the Month: Pragmagraphics. URL: Pragmagraphics. tURL: 5vlysd5; Dilts, R (1996) The Article of the Month: Darwin's "Thinking Path": Strategies of Genius and "Somatic Syntax". tURL: 5wlsuz2.

[6] Dilts, R (1998) The Article of the Month: Fractals and Human Behaviour. tURL: 6jels3d.

[7] Jemmer, P W (2010) Enchant Newcastle Part 1: The Magical Nature of Natural Language. Newcastle UK: NewPhilSoc. tURL: isbn9781907926013.

[8] Jemmer, P W (2010) Enchant Newcastle Part 2: Lingwizd'ry: The Craefty Science of Language. Newcastle UK: NewPhilSoc. tURL: isbn9781907926020.

[9] Jemmer, P W (2010) Enchant Newcastle Part 3: Technoglossy and the Linguistic Labyrinth. Newcastle UK: NewPhilSoc. tURL: isbn9781907926037.

[10] Jemmer, P W (2010) Enchant Newcastle Part 4: Mathesis and the Metaphysical Maze. Newcastle UK: NewPhilSoc. tURL: isbn9781907926044.

[11] Jemmer, P W and Yoeli, J (2010) Enchant Newcastle Part 5: Anti-philosophy as "Wiseloving".

Newcastle UK: NewPhilSoc. tURL: isbn9781907926051.

[12] Jemmer, P W (2010) Enchant Newcastle Part 6: Psycho-chaotic Semiotics and Psycho(a)logical Autopoiesis. Newcastle UK: NewPhilSoc. tURL: isbn9781907926068.

[13] Jemmer, P W (2010) Enchant Newcastle Part 7: Language: Lies, Laughter and Evolution. Newcastle UK: NewPhilSoc. tURL: isbn9781907926075.

[14] Jemmer, P W (2010) Enchant Newcastle Part 8: Linguistic Logomyths. Newcastle UK: NewPhilSoc. tURL: isbn9781907926082.

[15] Jemmer, P W (2010) Enchant Newcastle Part 9: Lingua Dei Nomina Creationis. Newcastle UK: NewPhilSoc. tURL: isbn9781907926099.

[16] Jemmer, P W (2010) Enchant Newcastle Part 10: Vis Voces Magicaeque Verborum. Newcastle UK: NewPhilSoc. tURL: isbn9781907926105.

[17] Jemmer, P W (2010) Enchant Newcastle Part 11: ReCreating OurSelves in Gods' Images. Newcastle UK: NewPhilSoc. tRUL: isbn9781907926112.

[18] Jemmer, P W (2010) Enchant Newcastle Part 12: A Shaman of Becoming I'll Be Newcastle UK: NewPhilSoc. tURL: isbn9781907926129.

[19] Maguire, T (1996) Reading and Writing through NLP. The Internet TESL Journal. Volume II, Number 6. tURL: 5dgec7.

[20] Deleuze, G and Guattari, F; Tomlinson, J A, Tomlinson, H and Burchell, G (translators) (1996) What is Philosophy? New York NY: Columbia University.

[21] Deleuze, G; Smith, D W (translator) (2005) Francis Bacon: The Logic of Sensation. London UK: Continuum.

[22] Radjabi, R (2008) BlogspotCom: Rouzbeh Radjabi: Rhizome Blog: January 2008: Deleuze on Bacon. tURL: 69vfkj4.

[23] Singer, J K (1990) Seeing through the Visible World: Jung, Gnosis and Chaos. New York NY: Harper Collins.

[24] Duke, M P (1993) Chaos Theory and Psychology: Seven Propositions. Genetic, Social and General Psychology Monographs. Volume 120, Number 3, pp 267 – 286.

[25] Mandel, D R (1995) Chaos Theory, Sensitive Dependence, and the Logistic Equation. American Psychologist. Volume 50, Number 2, pp 106 – 107.

[26] Michaels, M D (1989) The Chaos Paradigm. Organisation Development Journal. Volume 7, Number 2, pp 31 – 35.

[27] Guastello, S J (1995) Chaos, Catastrophe and Human Affairs: Applications of Nonlinear Dynamics to Work, Organizations and Social Evolution. London UK: Psychology.

[28] Littell, R (2006) The Visiting Professor: A Novel of Chaos. London UK: Duckworth.

[29] DeLillo, D (1986) White Noise. New York NY: Picador.

[30] Ward, B (1998) The Literary Appropriation of Chaos Theory – Psychology (PhD Thesis). Perth AUS: University of Western Australia: Department of English.

[31] Bütz, M R (1992) Chaos, an Omen of Transcendence in the Psychotherapeutic Process. Psychological Reports. Volume 71 (December 1992), pp 827 – 843.

[32] Bütz, M R (1993) Practical Applications from Chaos Theory to the Psychotherapeutic Process: A Basic Consideration of Dynamics. Psychological Reports. Volume 73 (October 1993), pp 543 – 554.

[33] Wilcox, L (1991) Baudrillard, DeLillo's "White Noise," and the End of Heroic Narrative. Contemporary Literature. Volume 32, Number 3, pp 346 – 365.

[34] Lentricchia, F; Lentricchia, F (editor) (1991) New Essays on "White Noise" – Chapter 5: Tales of the Electronic Tribe. Cambridge UK: Cambridge University.

[35] Guinard, P; Becvarov, M (translator) (2002) Critical Analysis of Peirce's Semiotics and an Ontological Justification of the Concept of the Impressional. tURL: 6b5zyfg.

[36] Peirce, C S; Hartshorne, C and Weiss, P (editors) (1931 – 1935; 1957 – 1958) Collected Papers (1.248). Cambridge MA: Harvard University.

[37] Smith, H A (2007) Digital Encyclopedia of Charles S Peirce: Psychosemiotics and its Peircean Foundations. tURL: 62hzzay.

[38] Smith, H A (2005) Peircean Theory, Psychosemiotics, and Education. Educational Philosophy and Theory. Volume 37, Number 2, pp 191 – 206.

[39] Leary, D E (editor) (1990) Metaphors in the History of Psychology. Cambridge UK: Cambridge University.

[40] Tompkins, P and Lawley, J (1996) Meta, Milton and Metaphor: Models of Subjective Experience. Rapport Magazine. Issue 36 (August 1996); tURL: 66crcqf.

[41] Lakoff, G, and Johnson, M (1980) Metaphors We Live By. Chicago IL: University of Chicago.

[42] Bateson, G (quoted); Combs, G and Freedman, J (editors) (1990) Symbol, Story and Ceremony: Using Metaphor in Individual Family Therapy. New York NY: Norton.

[43] Grove, D, Wilson, C and Dunbar, A (2010) Emergent Knowledge: Philosophy: History and Principles of Emergent Knowledge. tURL: 5wgrqhd.

[44] Tompkins, P and Lawley, J (1997) Less is More: The Art of Clean Language (Version 2). Rapport Magazine. Issue 35 (February 1997); tURL: cg47m7.

[45] Lawrence, K (2005) John Lennon: In His Own Words. Kansas City, MO: Andrews McMeel.

[46] Jemmer, P (2010) "Ego Essendi Incantator Sum" – Becoming a Lingwiz'd of Is (Part 5 of a Series of 5). European Journal of Clinical Hypnosis (in press 2010).

[47] Jemmer, P (2010) The Linguistic "Therapon" – A Toolkit for Magical Transformation (Part 4 of a Series of 5). European Journal of Clinical Hypnosis (in press 2010).

[48] Jemmer, P (2009) Enchanting the Self through Creative Psycho(a)logical Change (Part 3 of a Series of 5). European Journal of Clinical Hypnosis. Volume 9, Issue 1, pp 59 – 66.

[49] Jemmer, P (2009) Self-Talk: The Spells of Psycho-chaotic Sorcery (Part 2 of a Series of 5) European Journal of Clinical Hypnosis. Volume 9, Issue 1, pp 51 – 58.

[50] Jemmer, P (2009) Intrapersonal Communication: the Hidden Language (Part 1 of a Series of 5). European Journal of Clinical Hypnosis. Volume 9, Issue 1, pp 37 – 49.

[51] Ramière, N and Varshney, R (editors) (2006) Rhizomes: Connecting Languages, Cultures and Literatures. Cambridge UK: Cambridge Scholars.

[52] Monk, R (2005) How to Read Wittgenstein. London UK: Granta.

[53] Wittgenstein, L (1953) Philosophical Investigations. Oxford UK: Blackwell.

[54] Peirce, C S; Buchler, J (editor) (1955) Philosophical Writings of Peirce. New York NY: Dover.

[55] Bühler, C (1968) The Course of Human Life as a Psychological Problem. Human Development. Volume 11, Number 3, pp 184 -- 200.

[56] Pool, R (1989) Is it Chaos, or is it Just Noise? Science. Volume 243, Number 4887 (January 1989), pp 25 – 28.

[57] Goldberger, A L, Rigney, D R and West, B J (1990) Chaos and Fractals in Human Physiology. Scientific American, Volume 262, Number 2 (February 1990), pp 42 – 49.

[58] Goldberger A L, Findley L J, Blackburn M R and Mandell A J (1984) Nonlinear Dynamics in Heart Failure: Implications of Long-wavelength Cardiopulmonary Oscillations. American Heart Journal. Volume 107, Number 3 (March 1984), 612 – 615.

[59] Jemmer, P (2007) "De Tractatu Magicarum Linguarum": On Dealing with the Magical Spells (of Psycho-chaotic Semiotics). European Journal of Clinical Hypnosis. Issue 3, Volume 7, pp 22 – 33.

[60] Peirce, C S; Peirce Edition Project (editor) (1998) The Essential Peirce: Selected Philosophical Writings (Volume 2). Bloomington IN: Indiana University.

[61] Dimitrov, V (2000) Vladimir Dimitrov: Some of Vlad's Publications on the World Wide Web: Complexity of Human Dynamics: Strange Attractors of Meaning. tURL: 675fm2f.

[62] Richardson, L (2001) Getting Personal: Writing Stories. International Journal of Qualitative Studies in Education. Volume 14, Number 1, pp 33 – 38.

[63] Gough, N (2006) Rhizosemiotic Play and the Generativity of Fiction. Complicity: An International Journal of Complexity and Education. Volume 3, Number 1 (Semantic Play and Possibility), pp 119 – 124; tURL: 5r5xmgt.

[64] Haraway, D J (1994) A Game of Cat's Cradle: Science Studies, Feminist Theory, Cultural Studies. Configurations: A Journal of Literature, Science, and Technology. Volume 2, Number 1, pp 59 – 71.

[65] Haraway, D J (1997) Modest_Witness@Second_Millennium.FemaleMan_Meets_OncoMouse™: Feminism and Technoscience. London UK: Routledge.

[66] Waugh, P (1984) Metafiction: The Theory and Practice of Self-Conscious Fiction. London UK: Methuen.

[67] Stoicheff, P; Hayles, N K (1991) Chaos and Order: Complex Dynamics in Literature and Science – The Chaos of Metafiction. Chicago IL: University of Chicago.

[68] Paar, D W (1992) Introducing Confusion to Create Change. The Psychotherapy Patient. Volume 8, Issues 1/2, pp 93 – 102.

[69] Macy, J (1991) Mutual Causality in Buddhism and General Systems Theory: The Dharma of Natural Systems. Albany NY: SUNY.

[70] Abraham, F D (1992) Chaos, Bifurcations, and Self-organization: Dynamical Extensions of Neurological Positivism and Ecological Psychology. Psychoscience. Volume 1, Number 2, pp 85 – 118; tURL: 6dxpx6m.

[71] Hyatt, C S; Wilson, R A (preface); Regardie, I (introduction) (2006) Undoing Yourself with Energized Meditation and Other Devices. Tempe AZ: New Falcon; Hyatt, C S and Black, S J (2006) Undoing Yourself with Energized Meditation and Other Devices – Chapter 14: “Kingdom of the Beast”. Tempe AZ: New Falcon.

[72] Baudrillard, J; Benedict, J and Baddeley, J S (1993) The Transparency of Evil: Essays on Extreme Phenomena. London UK: Verso.

[73] Moses, M V; Lentricchia, F (editor) (1991) New Essays on “White Noise” – Chapter 4: Lust Removed from Nature. Cambridge UK: Cambridge University.

[74] Godzinski, R (2005) Humboldt State University: Essays in Philosophy (A Biannual Journal): Volume 6, Issue 1 (January 2005: The Philosophy of Technology): Article 9: (En)Framing Heidegger’s Philosophy of Technology. tURL: 6d8b72p.

[75] Glazebrook, T (2000) Heidegger's Philosophy of Science. Bronx NY: Fordham University.

[76] Baudrillard, J; Gane, M (introduction); Grant, I H (translator) (1993) Symbolic Exchange and Death (Theory, Culture and Society Series). London UK: Sage.

[77] Smith, C S (1995) Urban Disorder and the Shape of Belief: The Great Chicago Fire, the Haymarket Bomb, and the Model Town of Pullman. Chicago IL: Chicago University.

[78] White, E C; Peterfreund, S (editor) (1990) Literature and Science: Theory and Practice – Contemporary Cosmology and Narrative Theory. Boston MA: Northeastern University.

[79] Bernstein, S; Allen, G S and Bernstein, S (guest editors) (1994) DeLillo Cluster: “Libra” and the

Historical Sublime. Postmodern Culture: An Electronic Journal of Interdisciplinary Criticism. Volume 4, Number 2 (January 1994); tURL: 67rypdp.

[80] Sim, S; Jemmer, P (editor) (2009 Engage Newcastle (Volume 1: Café Philosophique: A Season of “The Other”) – The Other and Difference in Postmodern Philosophy and Cultural Theory. Newcastle UK: NewPhilSoc.

[81] Lyotard, J-F; Rottenberg, E (translator) (1994) Lessons on the Analytic of the Sublime (Meridian: Crossing Aesthetics). Palo Alto CA: Stanford University.

[82] Lyotard, J-F (quoted); Dhillon, P A and Standish, P (2000) Lyotard: Just Education (Routledge International Studies in the Philosophy of Education: Volume 9). London UK: Routledge.

[83] Coleman, A (1977) Chaos and Play in Borges. Circulo: Revista de Cultura. Volume 6, pp 27 – 33.

[84] Pirandello, L; Linstrum, J, Mitchell, J, Cregeen, N and Rietty, R (translators) (1985) Three Plays: “The Rules of the Game”, “Henry IV”, “Six Characters in Search of an Author”. London UK: Methuen.

[85] Hallström, P (1934) Pirandello Web: The Nobel Prize in Literature 1934: Presentation Speech by Per Hallström, Permanent Secretary of the Swedish Academy: 10 December 1934. tURL: 6kmzxv7.

[86] Baum, A; van den Bos, G R and Bryant, B K (editors) (1987) Cataclysms, Crises and Catastrophes: Psychology in Action -- Toxins, Technology and Natural Disasters. Washington DC: American Psychological Association.

[87] Messmer, M W (1988) Thinking It Through Completely: The Interpretation of Nuclear Culture. Centennial Review. Volume 34, Number 2, pp 397 – 413.

[88] Baudrillard, J (1995) Cool Memories II (1987 – 1990). Cambridge UK: Polity.

[89] Davis, J M (2001) Farce. Edison NJ: Transaction.

[90] Crawford, M and Maracek, J (1989) Psychology Reconstructs the Female. Psychology of Women Quarterly. Volume 13, pp 147 -- 165.

[91] Guastello, S J, Koopmans, M and Pincus, D (2008) Chaos and Complexity in Psychology: The Theory of Nonlinear Dynamical Systems. Cambridge UK: Cambridge University.

[92] DeAngelis, T (1993) Chaos, Chaos Everywhere is What the Theorists Think. The American Psychological Association Monitor. Volume 24, Number 1, pp 1 – 41.

[93] Gosling, J (1986) Analysis and Strategy in the Search for Unity: Epistemic Principles for Psychology. International Newsletter of Uninomic Psychology. Volume 2, pp 13 – 19.

[94] Iwakabe, S (1999) Psychotherapy and Chaos Theory: The Metaphoric Relationship between Psychodynamic Therapy and Chaos Theory. Psychotherapy: Theory, Research, Practice, Training. Volume 36, Number 3 (Fall 1999), pp 274 – 286.

[95] Lonie, I (1991) Chaos Theory: A New Paradigm for Psychotherapy? Australian and New Zealand Journal of Psychiatry. Volume 25, Number 4, pp 548 – 560.

[96] Abercrombie, M L J (1969) The Anatomy of Judgement: An Investigation into the Processes of Perception and Reasoning. New York NY: Hutchinson.

[97] Stern, D N (2004) The Present Moment in Psychotherapy and Everyday Life. New York NY: Norton.

[98] Sullivan, H S (2003) The Interpersonal Theory of Psychiatry (International Behavioural and Social Sciences Library: Volume 5). London UK: Routledge.

[99] Royle, N (2003) The Uncanny: An Introduction. Manchester UK: Manchester University.

[100] Deleuze, G; Joughin, M (translator) (1997) Negotiations. New York NY: Columbia University.

[101] McGrath, A E (2003) The Re-enchantment of Nature: Science, Religion and the Human Sense of Wonder. London UK: Hodder and Stoughton.

[102] Griffin, D R (1988) Reenchantment of Science: Postmodern Proposals (SUNY Series in Constructive Postmodern Thought). Albany NY: SUNY.

[103] Prigogine, I and Stengers, I (2003) Order out of Chaos: Man’s New Dialogue with Nature. New York NY: Bantam Doubleday Dell.

[104] Kelley, R T; McRae M W (editor) (1993) The Literature of Science: Perspectives on Popular Scientific Writing – Chaos out of Order: The Writerly Discourse of Semipopular Scientific Texts. Athens GA: University of Georgia.

[105] Lovelock, J (2009) The Vanishing Face of Gaia: A Final Warning. London UK: Allen Lane.

[106] Ross, A (editor) (1996) Science Wars. Durham NC: Duke University.

[107] Parsons, K, Long, R and Sofka, M D (editors) (2003) The Science Wars: Debating Scientific Knowledge and Technology. Amherst NY: Prometheus.

[108] Ashman, K and Barringer, P (2000) After the Science Wars: Science and the Study of Science. London UK: Routledge.

[109] Gross, P R and Levitt, N (1997) Higher Superstition: The Academic Left and Its Quarrels with Science. Baltimore MD: Johns Hopkins University.

[110] Sokal, A (1999) Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science. New York NY: Saint Martin's.

[111] Staats, A W (1991) Unified Positivism and Unification Psychology. American Psychologist. Volume 46, pp 899 -- 912.

[112] Rychlak, J F (1981) A Philosophy of Science for Personality Theory. New York: New York University.

[113] Tillich, P (2000) The Courage to Be. New Haven CT: Yale University,

[114] Abraham, F D; Sulis, W and Combs, A (editors) (1996) Nonlinear Dynamics in Human Behavior (Studies of Nonlinear Phenomena in Life Science: Volume 5) – The Dynamics of Creativity and the Courage to Be. London UK: World Scientific.

[115] Loye, D (1983) The Sphinx and the Rainbow: Brain, Mind and Future Vision. Boulder CO: Shambhala.

About the Author

I'm currently Senior Lecturer in Mathematics in the School of Computing, Engineering and Information Sciences at Northumbria University. Prior to this I studied for a BA (Hons) / MA and a Certificate of Postgraduate Study in Natural Sciences from Cambridge University, followed by a PhD (Mathematical Chemistry) from Birmingham University. I've been a postdoc in the Universities of Exeter, Oxford, and Sussex. I now teach principally in areas like chaos theory and complexity, and computational mathematics, as well as doing lots of basic "service" work with engineers and building services engineers. I have also always had a strong interest in languages and linguistics, as well as in philosophy, mythology, and creativity. The conjunction (or collision, or conflict?) of the mathematical, linguistic and philosophical enthusiasms has developed into my undergoing professional training as a psychotherapist. I am trying to use this as a vehicle to help in exploring and developing "creativity" in myself and others, for use in personal and academic self-development, as well as in teaching and mentoring. As well as my earlier work and publication in physical science, I am now actively pursuing and writing about the "creativity" ideas and publishing them in "professional media" for psychotherapy as well as "peer-reviewed" scientific journals. Currently, I am at the stage of unifying some of my previous mathematical understanding with my more recent forays into creative thinking. I have, for example, just finished work on a mathematical "dynamical systems" model for psycho-semiosis, which has led to a "chaos theory" codification for various Lacanian mathemes. I've also recently edited a volume on "The Other" for Newcastle Philosophy Society, to which I contributed a "mathemagical" paper on "The O(the)r (O)the(r)." I am editor of "*Bifrons* Creativity" (the online journal for creativity: www.Bifrons.org.uk), and have to date published a series of twelve monographs in the "*Enchant* Newcastle" series through *NewPhilSoc* Publishing.

About Newcastle Philosophy Society

Newcastle Philosophy Society (NPS) is a Registered Charity (registration number 1106082) whose mission is to support the advancement of philosophy in all its aspects, through the organization and promotion of learning, discussion and research into all things philosophical. We are not by any means a group of "professional" philosophers, though. Rather, we comprise a network of people who share a strong common commitment to the idea that philosophical principles and methods, are, and should be, completely integrated into a rounded life-experience. NPS is not anchored to any particular philosophical school, method, or ideology, and we encourage and welcome all comers and all points of view. We aim to provide real opportunities for promoting the understanding of both historical and contemporary philosophers and philosophies, of all shapes and sizes. We also strive to create chances to help nurture and encourage the up-and-coming philosophers of the future.

We see philosophy as contributing to all ways of thinking about the world. We believe that philosophical inquiry does not have to be bound by a clearly defined set of rules, but rather that it represents overall a dynamic, exploratory, experiential, experimental, tentative, complementary, incorporative, quizzical, accepting, and fun outlook on life. For us, "philosophy" is at heart the "wise loving" which overcomes the mere study of impersonal data, facts, and information as "means to an end," becoming and "end" in its own right. We feel that philosophy's true goal should include the shared and caring acknowledgement and exploration of the emotion, irrationality, and alogicality at the core of human existence.

Our "mission" (which mirrors that of the UK-wide Royal Institute of Philosophy to which we are affiliated) is to demonstrate the relevance of philosophy to everyday life, and to forge a direct link between contemporary philosophy and the widest possible participating audience. To this end, our activities focus on fundamental questions about philosophical issues of topical importance, but we aim to do this in accessible, straightforward, engaging, and entertaining ways. This audience is certainly not restricted to an academic élite, although we do have very active, self-directed "study groups" composed mostly of interested "non-experts" who get together to read and discuss, for example: What is Philosophy? – Continental Philosophy – Philosophy of Mind – *anti*-Philosophy – Exploring

Psychiatry – Political Philosophy – and Why Work? We hold special “Ideal” sessions for college and sixth form students as well as: Philosophy in Pubs – Philosophy in Film – Philosophy in Literature – and Philosophy of Consciousness. We support education and research through our journal “*Engage* Newcastle,” and are seeking sponsorship to help us to support philosophical investigations and research projects.

Much of the material in this volume has been produced after intensive, extended, stimulating, and sometimes heated) discussions with the membership of NPS (and members of the public) in the fora described above, as well as the fortnightly “*Salon*” discussion groups, the monthly “*Café Philosophique*” sessions, and the occasional “*Café Newcastle*” lecture series. Work in progress is currently being introduced by the author at the public Swansea “*Philosophy Café*” sessions which have been running since December 2010 at Swansea University and Swansea Metropolitan University.

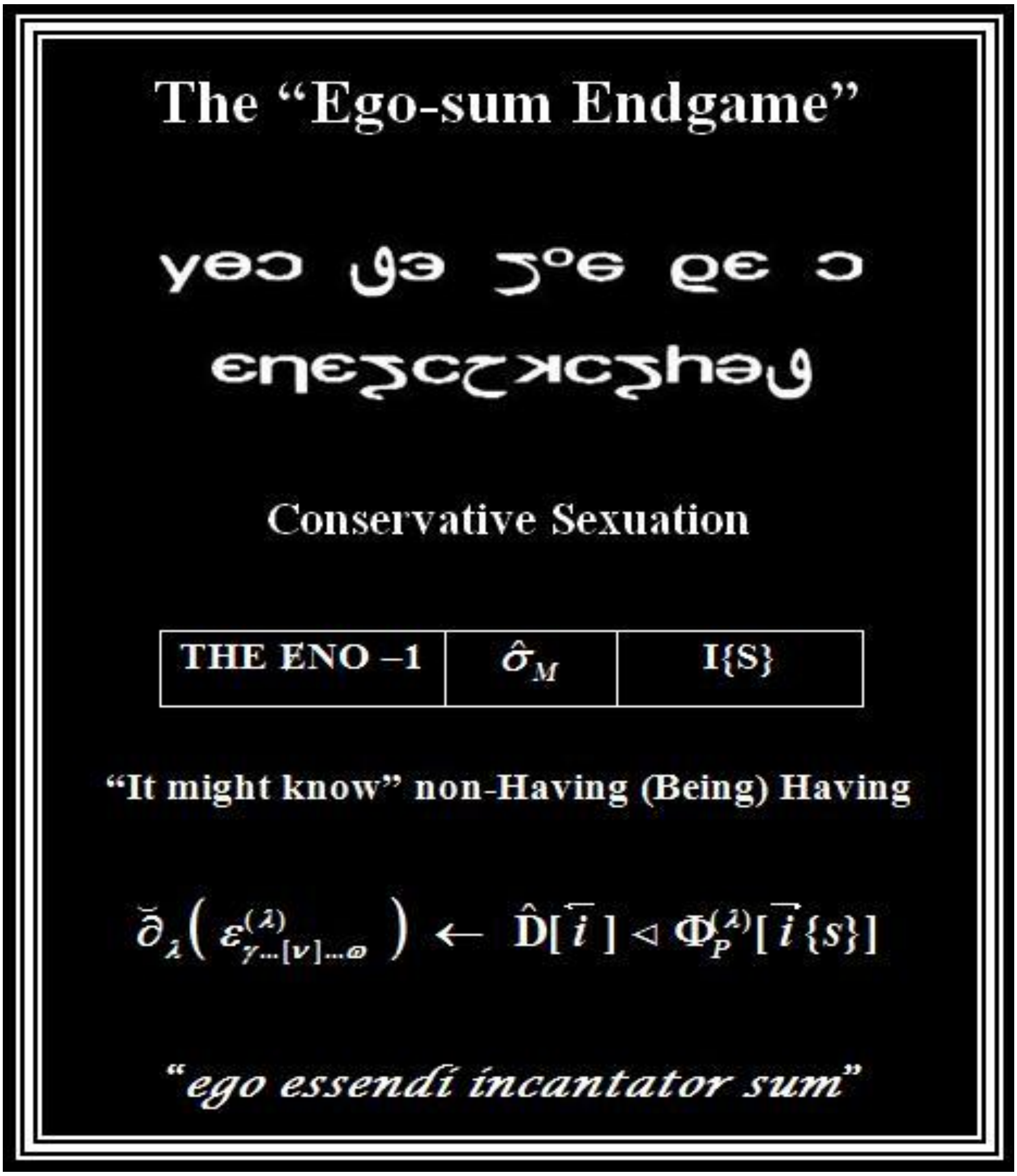
About “*Enflame* Newcastle”

“*Enflame* Newcastle” is published under the imprint “*NewPhilSoc* Publishing” by kind permission of the Board of Trustees of Newcastle Philosophy Society (2011 – 2012): Mr Richard Benjamin, Ms Laura Bowie, Ms Janet Darbyshire, Dr Roy Sturgess (Chair), Dr Sue Lord, Mr Leigh Rooney, Miss Jenny Thomas, Ms Lucille Valentine, and Dr Joel Yoeli. Where appropriate, Editorial guidance has been sought and gratefully received from the Trustees: notwithstanding this, the views contained herein are the author’s own and do not necessarily represent those of Newcastle Philosophy Society, nor of the Trustees.

“*Enflame* Newcastle” is a collaboration with “*Bifrons* Creativity” the online journal for all aspects of creativity, and further support and advice has also been readily available from the *Bifrons* Editorial Team: Dr Paul Attinello of ICMuS in the School of Arts and Cultures at Newcastle University (cultural studies, humanities, music, performance, philosophy), Dr Fin McMorran of the Institute for Design, Culture and the Arts at Teesside University (art, communication, media), Dr Ali Pickard who is Head of Quality and Student Experience in the School of CEIS at Northumbria University (information science, language, literature, media), Mr Joe McAnelly (Advantage GB Limited: humanities, psychology, psychotherapy), Ms Anna Round (formerly of Northumbria University Student Services and currently at the UK Ministry of Justice: communication, linguistics, literature, media, philosophy, sociology), Mr David Sockett (independent therapist: art, communication, literature, sociology, therapy), and Dr Cris Izura of the Department of Psychology in the School of Human and Health Sciences at Swansea University (cognitive psychology, cognitive neuroscience, languages).

The task of Referencing this work was greatly facilitated by the programming skills of Mr James Mintram, Student of BSc (Hons) Games Programming in the School of CEIS at Northumbria University, to whom I owe special thanks. Physical reproduction of these Monographs has been done courtesy of the highly professional staff of Print Partnership Reprographics, 8 De La Beche Street, Swansea, West Glamorgan, SA1 3EZ, UK; telephone: 01792 552955; FAX: 01792 552956; web: http://www.printpartnership.co.uk.

Enflame Newcastle Number 2



web:	http://www.newphilsoc.org.uk/ http://www.bifrons.org.uk	ISBN 978-1-907926-14-3 9 781907 926143 >
e-mail (General):	philoSecretary@gmail.com	
e-mail (Enflame):	philoEditor@gmail.com bifronsCreativity@gmail.com	
e-mail (Sales):	philoSales@gmail.com	