

**AN ECOLOGICAL MODEL FOR HEALTH, ILLNESS
AND MEDICINE:**

**Pathogenesis and healing as self-organising processes in semiotic
biofields**

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Abstract

The dominant metaphysic in medicine, mechanistic reductionism, limits research to concepts of forceful causes acting on organisms. This entails the telos of biomedicine: to identify, isolate and control pathogens and pathological entities. Bio-psycho-social models developed in response to the need to grasp interrelated causes in multimorbid pathology have been limited by a lack of an adequate complexity-based ontology and epistemology for understanding pathogenesis and guiding treatment. A complex processes paradigm for understanding organisms and the causes of illness and healing is presented, focusing on the contribution of biofield theorists in understanding formal dynamics, and of biosemioticians in understanding telic causes according to the selective sensitivity and interpretative responses of need-feeling, anticipatory organisms. This semiotic biofield ontology forms the basis of the ecological model: in which symptoms are understood to be responses of the organism to its perceived needs, and healing is understood to involve processes that resolve or transform need states. The recognition and use of these causes in non-biomedical therapies is explored, and the common ontological grounds of these theories and therapies are reconciled in terms of semiotic biofields and their causal processes. The implications of this paradigm for transforming healthcare are discussed, including development of methodologies for assessment of pathogenesis based on the patient's experience rather than multiple disease categories and causes, and non-forceful interventions to promote self-healing while avoiding the defensive responses generated by forceful interventions.

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Declaration

I declare that this thesis:

- i. contains no material which has been accepted for the award to the candidate of any other degree or diploma, except where reference is made in the text of the thesis;
- ii. to the best of my knowledge, contains no material previously published or written by another person, except where due reference is made in the text of the thesis; and
- iii. where the work is based on joint research or publications, discloses the relative contributions of the respective workers or authors.



..... Date: 14/12/2018

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Introduction

A quiet revolution has been occurring in science in diverse fields such as ecology, meteorology, economics, and evolutionary biology. In these sciences, the behaviour of whole complex systems over time is of central interest, and as technology has progressed to enable researchers to gather and process vast quantities of data over time, it has become both possible and necessary to make the complexity of whole systems accessible to study. This project is claimed to be more than just the application of new technologies to problems in science, rather it has been described as the construction of a new paradigm in science; one which attempts to grasp the behaviour of systems as wholes, rather than investigating the constituent elements of entities. Meteorologists can now make long term, accurate forecasts based on probabilities calculated from many data points recorded over time, to reveal underlying patterns or weather cycles that pertain to many spatio-temporal levels, from daily, local events to cycles that affect entire seasons globally, to models that assess probabilities for climate change over the next century. However, it should not be assumed that advances in technology can ever allow us to quantify every variable and predict the weather with certainty. Indeed, ubiquitous unpredictability in nature is an invisible "elephant in the room" of science. As the physiologist A. Szent-Gyorgyi observed:

As soon as I revealed that in any living system there are more than two electrons, the physicists would not speak to me. With all their computers they could not say what the third electron might do. The remarkable thing is that it knows exactly what to do...¹.

For researchers and theorists in the fields of "general systems theory", it has become increasingly obvious since the conception of this project in the late 1920's that the behaviour of these systems is not reducible to natural laws describing matter in motion². As such the analytical procedure that requires parts to be first isolated from each other and then related according to linear causal pathways is inadequate to understand the behaviour of dynamic systems³. Perhaps because nonlinearity and unpredictability are nowhere more apparent than in the most complex systems of all, living organisms, it is from the biological sciences that some of the most robust alternative ontological and epistemological stances to mechanistic reductionism have derived⁴. Yet, as this research will show, mainstream health practices have adapted poorly to this "new" paradigm, lacking the ontological and epistemological theory that is needed to grasp the dynamics of complex systems and take advantage of new approaches.

In naming this a revolution, not just a common methodology for processing and interpreting large amounts of data, it is necessary to identify profound laws or core foci of theory and research that are novel and contrast with existing paradigms, and which lead to novel and important outcomes, finally maturing as a coherent structure for scientific

¹ A Szent-Györgyi. Teaching and the Expanding Knowledge. *Science* 146 (1964): p. 1278-1279; cited in: L Bertalanffy *General System Theory*. (Penguin Press, London, 1971) p. 5.

² L Bertalanffy, *General System Theory*, p.5-7

³ Non-linear mathematical modelling and the phenomenon of spontaneous order arising in complex systems is introduced in the context of evolutionary biology by Stuart Kauffman in *The Origins of Order: Self-Organisation and Selection in Evolution*. (Oxford University Press, New York, 1993)

⁴ The work of Terence Deacon, Jesper Hoffmeyer, Francisco Varela, Brian Goodwin, Richard Levins and Richard Lewontin among others is discussed in Chapter 4

practices⁵. Across the diverse fields mentioned above, common, non-trivial parameters have emerged to guide research; that is, they have developed and matured in an empirical, data-driven manner, in response to the availability of the data and the need to organise and interpret this data in ways not available previously. Thus has evolved the ontology and epistemology of the science of wholes, of processes over time, and of unpredictability: the science of complex systems. When fully revealed, it stands in stark contrast to the science of analysis and control of parts; the mechanistic model that continues to dominate science today.

Yet this is a quiet revolution, in the sense that in many ways, researchers in all fields of science are already grappling with the problems of complexity. In the most basic sense, these problems concern organisation and order in the management and comprehension of large quantities of data, a problem that even those who are largely concerned with the reduction of complexity to simpler, constituent elements cannot escape. As such, some of the concepts and methodologies to be addressed in the proposed research are already familiar, at least in kind if not in terminology, to scientists and providers of health services. For example, many health professionals providing direct care to patients spend half or more of their time managing information about their patients, a growing problem requiring solutions to organise data more efficiently. In 2013, the computer systems designer Matthew Darling, noticing that the nurses caring for his critically ill daughter were struggling to keep up with their paperwork, researched the problem and found that the nurses spent on average 65% of their time on administrative tasks rather than patient care, prompting a project in conjunction with Deakin University, Melbourne to develop technology to streamline processes for staff to manage multiple demands as efficiently as possible. This technology has reduced non-care related time by 15-30%⁶.

Other concepts and methodologies in complexity science may seem quite unexpected and controversial, particularly those that embrace the unpredictability and creativity of complex systems. It is the intention of the proposed research to explore the more profound implications of complexity science for living systems, bring together divergent concepts and propose a coherent model and praxis for health sciences. Indeed, conceptual differences between the status quo in health sciences and the proposed model are emphasised to highlight the profoundly revolutionary nature of the complex processes approach.

One core focus of research into complex systems concerns the self-organising properties of these systems. This research can be broken down to the study of the dissipation and constraint of energy in complex systems⁷, the study of the interplay of order and chaos that maintains systemic coherence but allows for novelty and adaptation⁸, and understanding relationships between different spatio-temporal levels within the system and between systems

⁵ T. Kuhn, *The Structure of Scientific Revolutions*. (Chicago, University of Chicago Press, 1962) p.84-85

⁶ This technology has been trialled in three Australian hospitals, and has reduced administrative time by 15-30%. M. Botti, et al. 'Evaluation of the fidelity and usability of the SmartWard system in the delivery of acute nursing care' Epworth/Deakin Centre for Clinical Nursing Research. *Annual Report*. (2013-2014) p-16

⁷ T Deacon. *Incomplete Nature: How Mind Emerged from Matter*. (W.W.Norton & Co, New York, 2013) esp chapters 5 and 6; and I Prigogine & I Stengers. *Order out of Chaos: Man's New Dialogue with Nature*. (Bantam Books, New York, 1984) esp. chapters 5 and 6

⁸ Sole, R. V & Goodwin, B. (2001) *Signs of Life: How Complexity Pervades Biology*. (Basic Books, 2001); S Kauffman, *The Origins of Order: Self-Organisation and Selection in Evolution*

embedded within each other⁹. Some research trajectories focus on the particular self-organising dynamics of living systems, such as *autopoiesis*; the self-organisation of living systems in congruence with their environments¹⁰, *bio-semiosis*; the study of communication via signs in biological systems¹¹, and the role of metaphor and narrative in the self-organisation of systems¹². These latter two fields of study are examples of how contemporary approaches in the science of complex processes refer to a tradition of studying dynamic processes in the philosophies of nature that emerged from the Radical Enlightenment of the 18th and 19th centuries.

Perhaps the most critical basic concept is that of *non-linear causation*. In self-organising systems, change is not simply dependant on the nature and action of external forces or causes. Rather, the system reacts to external forces in unpredictable ways, sometimes amplifying effects, sometimes mitigating effects, and sometimes creating novel or *emergent* effects. It is more accurate to think of living systems as *responding* to causes rather than merely *reacting* to them. The science of complex processes is the study of non-linear causative dynamics underlying stability and change.

In examining theories of holism and dynamism in nature, the case for a mature, coherent structure of knowledge and practice in the contemporary science of complex processes can be greatly strengthened. From Aristotle's theories of potentiality and becoming, to Hegel's dialectical dynamics and Peirce's semiotics, these insights into the primacy of process, relationship and activity in nature can be tested and validated as research methodologies reveal the everchanging, self-creating world these thinkers have described. These philosophers can be understood to stand in opposition to the dominant Cartesian/Newtonian "mechanistic" worldview of inanimate matter being acted on by external forces, of cause producing effect in predictable, if complicated, *linear* relationships. The mechanistic paradigm comprises the scientific and social background against which the current revolution of complexity science is playing out. In a sense, this revolution is the child of the mechanistic worldview, as the technologies that have emerged from the success of this program to reduce the natural world to parts that can be controlled, predicted and manipulated are now making possible the development and maturation of a science that perceives the world in a radically different way, with powerful and perhaps critical consequences for understanding, and thriving in, this world.

The successes of modern medicine have relied heavily upon the reductive, mechanistic approach to disease, employing methodologies of analysis, isolation and control to discover both the causes of disease and the causes of cure. Yet despite the object of study of medical science being the most complex system known to us: ourselves; the scientific paradigm devoted to grappling with complex phenomena is almost completely unknown to

⁹ A Gare *Nihilism, Inc. Environmental Destruction and the Metaphysics of Sustainability*. (Eco-logical Press, Como, 1996) S Salthe. *Evolving Hierarchical Systems: Their Structure and Representation*. (Columbia University Press, New York, 1985)

¹⁰ H Maturana and F Varela. *Autopoiesis and Cognition: The Realisation of the Living*. (Dordrecht, D. Reidel, 1980)

¹¹ J Hoffmeyer, Origin of Species by Natural Translation. In *Translation*, S Petrilli (Ed) (New York, Rodopi, 2008) pp. 329-346

¹² Gare, *Nihilism Inc*, 1996, D Hutto, Philosophy of Mind's New Lease on Life: Autopoietic Enactivism meets Teleosemiotics. *Journal of Consciousness Studies*, 18:5-6. (2011) pp. 44-64

medicine. The complexity of living systems is certainly acknowledged in health sciences, but is often viewed as a problem to be broken down and simplified. Unpredictability is viewed in terms of unknown causes to be isolated and nuisance variables to be controlled. The aim of interventions is to exert control over functioning, a task which requires a vast and ongoing expenditure of energy. This approach rests on the assumed validity and necessity of essentially linear causal processes in nature, whilst neglecting or attempting to subjugate unpredictable non-linear causal processes.

Applying the concepts of complex processes to the understanding of health and disease has the potential to open up important new avenues of research, and transform therapeutic practices in profound ways. These include interventions that are designed to recognise and support autopoietic processes, that is to say self-healing through intrinsic self-organising processes. These interventions require only low energy "prompts" to the living system, a process known as bio-semiotic causation. The proposed research will argue for the importance of embracing the complexity revolution in the health sciences, and will investigate some of the means by which health researchers and service providers might do so.

As regards the relationship between a self-organising process (ecological) model and a mechanistic model of medicine, the comparisons and insights developed here are intended to show that the relationship is not merely oppositional or complementary. While predominantly mechanistic models exclude, devalue or mismanage self-organising processes, a self-organising, living-process model integrates mechanical causes and effects within a context of organismic agency. Any mechanical difference, movement or energy gradient, gross or minute, may prompt a cascade of activity in a living system (organism, species or society) that may transform the form and behaviour of that entity. Or it may not make a difference to that entity. Biosemiosis means that the biological effects of mechanical causes will always have a non-predictable variance, and that this variance reflects the degrees and ways in which differences can make a difference to the sensing, interpreting, distinction-making organism¹³.

Very little research currently exists that treats individual human beings as complex, self-organising systems in themselves in terms of health practices. Drawing on research from evolutionary and molecular biology, and sociology (social field theory) it is the particular aim of this thesis to propose a model integrating the insights from these fields in application to the patient as person.

Overview

Part One: The Metaphysics of Medicine. Chapter 1 describes the metaphysical assumptions of mechanistic materialism to show the ways these assumptions underpin the biomedical model and therefore contemporary health practices. The limitations of this approach are discussed. Chapter 2 outlines the development of bio-psycho-social models in an attempt to address these limitations, especially those concerning treatment of multi-morbidity. It is argued that BPS models have been only partly successful due to an incomplete grasp of self-organising dynamics. Chapter 3 introduces key concepts in philosophy of natural processes and Chapter 4 introduces those of complexity-oriented biology, emphasising self-generated formal dynamics and telic constraints as biosemiotic processes in sensitive living fields. Section Two introduces and develops the Ecological Model. Chapter 5 explores the potential for the concepts discussed in Chapters 3 and 4 for transforming health practices according to an ecological model of human beings as complex, sensitive, self-organising systems. Based upon this ontology, living is conceived as a sequence of adaptive responses to felt needs,

¹³ A complete definition of biosemiosis is given on page 79

including the production and resolution of symptoms. Pathogenesis is conceived as a need state that has become entrained and non-adaptive. It is proposed that conceiving pathogenesis this way can simplify understanding of patients' pathology without reducing this to forces acting on patients. The focal level of pathogenesis is the individual as a level of self-organisation within broader social systems, including that of healthcare services. In Chapter 6, multimorbid pathology is explored as the development of a fragmented field organization comprising compensations for unmet needs, and the potential for this view to explain paradoxical and other variations in responses. Chapter 7 proposes that healing involves transformation of problem spaces via increased awareness of such spaces, including self-observant attentional processes, and the potential for patient sensitivity to salient biosemiotic prompts to reconfigure pathogenic forms toward edge-of-chaos functioning. Chapters 8 and 9 concern the comparison of the model to existing therapies that claim holistic ontologies as the basis for assessment and non-forceful interventions supporting self-healing. Supporting empirical evidence for the model is presented and supporting theory for holistic approaches is discussed. Chapter 10 summarises the key points of this research, elaborates a theory of causal processes in semiotic biofields, and discusses the further implications, applications and limitations of the ecological model.

SECTION ONE: THE METAPHYSICS OF LIFE

CHAPTER 1

The Mechanistic Paradigm in Health

To understand the importance of the alternative paradigm of self-organising processes, it is necessary to contrast this with the dominant perspective on causation in science: that of inanimate matter being acted on by external forces, of cause producing effect in a predictable, *linear* fashion, in the manner of machines, such that output is always proportional to input. Linear causation is a supporting pillar of the metaphysic of mechanical materialism that guides human culture and practices, including science as a whole and medicine in particular. This metaphysic has a long history in Western civilisation¹ and is best exemplified by the conception of the mechanical laws of the cosmos proposed by Isaac Newton (1642-1727,) and of the living world and human beings by Rene Descartes (1596-1650) and Thomas Hobbes (1588-1679). The mechanical metaphors for nature they described three centuries ago permeated social, economic and scientific practice, and persist today, having evolved only superficially from Newton's clockwork universe to contemporary information-processing machines. Science is an enterprise premised on discovering the causal connections between distinct natural phenomena in order to explain the perceived regularities of the world, and the mechanistic world view is largely responsible for the empirical, logical-positivist and analytic-reductive theories dominant in science today.

Referred to as the father of modern philosophy, Descartes' view of the world was of matter in motion. By defining matter as extension he reduced the world to mathematical principles and motion to merely change in position, explaining and legitimising the control of matter by external force². A Cartesian ontology requires that causes are always properties of subjects and effects always properties of objects, with the former having ontological primacy³. According to this view, there is no inherent growth, change or development in physical nature. Descartes defended the aim of science as a practical project of human mastery over nature, a project which requires the discovery of the smallest possible set of independent factors to explain and ultimately control complex phenomena. For Descartes, mind or soul was immaterial and did not operate according to physical laws, instead mind belongs to a separate realm of experience and knowledge⁴. The Cartesian dualism of mind and matter left unresolved the question of how the activities of the mind could effect action in the material world, paving the way for later biomedical theories to reduce mind to neurochemical matter in motion.

Newton, claiming an empirical and inductive method, was critical of Descartes' rationalist approach to the material world, but nevertheless elaborated on a similar view of the world as running according to mechanical principles. Newton's success with his three laws of motion seemed to prove the absolute nature of space and time and the universality of

¹ Comprehensively detailed by Gare, *Nihilism Inc*, 1996; discussed in the introduction to R Levins & R Lewontin *The Dialectical Biologist*. (Cambridge, Mass. Harvard University Press, 1985) and L Bertalanffy, *General Systems Theory*, 1971

² Gare, *Nihilism Inc*, p.128

³ The Cartesian view of causation predominates in biology according to R Levins & R Lewontin *The Dialectical Biologist*. (1985) especially chapter 1.

⁴ F Copleston, *Modern Philosophy from Descartes to Leibnitz*. (Doubleday, New York, 1985) p. 123-4

the laws and forces that governed the motion of particles. This view of inert particles being acted upon by external forces according to universal laws reduced motion to linear cause and effect relations, much like one billiard ball hitting another and causing it to move in a straight, predictable line. For Newton, science should be a process of observing these immutable laws in action, revealed to us through the logic of mathematics. Newton's mechanistic universe remained the dominant paradigm in physics until the advent of Einstein's relativistic physics, and it remains dominant in many areas of science today, including social, political, economic and even biological sciences⁵. The impact of Newtonian physics on our conception of our everyday world can hardly be overestimated, and continues to underlie our relationship with nature, including ourselves, as objects to be quantified and controlled, an ontology that reduces living things to inert matter.

The social and political implications of mechanistic materialism were elaborated by Hobbes, who drew upon the ideas of Descartes and Newton amongst others in the formulation of his philosophy of society, and the world, as comprising a vast machine running according to natural laws of particles in motion, making all human behaviour comprehensible and controllable according to mechanical principles. His mechanistic naturalism culminated in his political treatise *Leviathan* (1651). This described human society as a collection of individuals motivated by selfish interests, that therefore must be governed by the imposition of order to prevent the disintegration of society into chaos and conflict⁶. In contrast to Descartes, Hobbes believed that even thought and sensation were reducible to matter in motion, and by way of analogy with Newtonian physics, he believed that human beings, like inanimate matter, will act in a uniform way unless acted upon by an external force⁷.

Empiricism and positivism

The perspective that human beings are reducible to particles in motion, acted upon by external forces and motivated by appetites and aversions, was further developed by other mechanistic thinkers such as the empiricists John Locke (1632-1704) and David Hume (1711-1776), who further legitimised the view of humans as objects that can and should be controlled and manipulated⁸. Their work provided the theoretical basis for positivism, an approach which underlies much of the program of modern science, including medical science, as we are familiar with it today.

Locke argued that all knowledge comes from experience, the human mind being a “tabula rasa” (blank slate) which is written upon by the action of imperceptible particles emanating from external objects via our senses to the brain, a process now termed his “Causal Theory of Perception”⁹. Locke argued that “real” or primary qualities exist within the objects themselves, including bulk, number, figure and motion, and secondary qualities that consist of impressions on our senses, including colour and smell, that according to him do not exist within objects but nevertheless are caused by them on our senses and brains. Thus Locke

⁵ A Gare, *Nihilism Inc*, chapter 6; and R Solomon, *Introducing Philosophy*. (Harcourt Brace, Orlando, 1993) p. 470

⁶ A Gare, *Nihilism Inc*, pp. 135-137; and F Copleston, *Modern Philosophy from Hobbes to Hume*. (Doubleday New York, 1985) Chapter 2

⁷ T Hobbes, *Leviathan*, (Hafner, New York, 1926) Chapters 1 to 6

⁸ A Gare, *Nihilism Inc*, pp. 138-139

⁹ R Solomon, *Introducing Philosophy*, pp. 154-157

described a purely mechanical theory of causation, with the mind consisting of a brain passively receiving input from reality, he also argued that only those properties of objects that are materially quantifiable (i.e. mathematically measurable) are “real”, whilst those properties that are impressed on our senses are neither objectively real nor created by our own senses.

Hume likewise argued that knowledge is only reliable if it is based on sense impressions derived from experience. Anything we attempt to infer from our impressions is unreliable and cannot be said to exist beyond our imagination. For Hume, there is no causal relationship or connection between events because such connections themselves cannot be observed. We only make assumptions about cause and effect based on our observations that one type of thing is regularly followed by another other, but all we are observing is a correlation between two separate things. Hume accepted that assumptions are an inevitable part of human psychology, and argued that they derive from how we have been conditioned and reflect our passions and imagination rather than reality. According to Hume, our assumptions and beliefs are both conditioned and resistant to change, and thus inert and predictable rather than dynamic and creative¹⁰.

The work of empiricists such as Locke and Hume further strengthened the worldview that posits a reality consisting of independent objects (or events) exerting forces on each other, and that both objects and forces can be said to really exist because they have properties that produce sense impressions that can be measured. Cause and effect relations can and should be reduced to conjunctions between events, and the analysis of these relations should have nothing to do with the further inference of any properties, qualities or potentials of the causal relation or the objects themselves. Any such claims regarding reality are unreliable. This approach to the understanding of reality was hugely influential in the development of the scientific methodology reliant on developing falsifiable hypotheses and the systematic observation of material data to test them, a methodology known since the nineteenth century as logical empiricism or positivism¹¹.

For positivists, any claim about reality that is not empirically verifiable, preferably by measurement of some form of independent, external objects, is unacceptable and meaningless¹². While positivists accept that some claims to reality can be beyond our present means to verify, for a proposition to be meaningful it should include the means by which it could be confirmed or disconfirmed, postulated as a falsifiable hypothesis. This requires that humans should have the capacity to recognise and test what is assumed to be an “objective” reality consisting of forces and objects that exist independently from the interaction or interpretation of observers. In their endeavour to explain the world in objective and predictable terms, empiricists and positivists view the complexities of the world as phenomena that are yet to be reduced to their basic cause and effect relations. Effectively, positivists are primarily interested in discovering the “pure” effects of a given cause independently of other possible causes, because their worldview legitimises and prioritises

¹⁰ S Mumford & R Anjum, *Causation: A Very Short Introduction*. (Oxford University Press, Oxford, 2013). Chapter 2

¹¹ P Edwards and A Pap, *Introduction to the Philosophy of Science*, (Free Press of Glencoe, 1967), chapter 10

¹² So claimed the leading English proponent of logical positivism, A J Ayer, *Metaphysics and Common Sense*, (London: Macmillan, 1969) pp. 117-140

this approach as the only way to reliably understand reality. Thus, the scope of scientific enquiry tends to be limited to phenomena that can be isolated and measured “piece by piece”.

A familiar example of this approach is the randomised controlled trial (RCT) commonly used in medical science. A typical RCT experimental design randomly assigns subjects to either a treatment group or a control group, without the subjects knowing to which group they have been assigned. The sample size should be large enough to ensure a reasonably even distribution with regards individual differences in both groups, to control for variations that might affect results. The treatment (e.g. a drug) is administered to only the treatment group, while the control group receives placebo. After a given period of time, any changes in the treatment group relative to the control group are measured and statistically analysed for evidence that these changes are over and above those that might be expected to occur by chance. The changes can then be said to have been caused by the treatment, although scientists are generally careful to avoid inferring direct causal qualities such as “curative” to a treatment. Traditionally, RCT researchers generally adopt the empiricist view of causation inherited from Hume, such that causation is not claimed to be more than correlation. More accurately, an RCT can be described as a “counterfactual dependency test” in that it seeks to find evidence that in the absence of the treatment, subjects tend not to improve¹³.

The RCT design highlights a central causal assumption of the mechanistic worldview derived from Hume: the independence of cause and effect relations. The RCT is designed to bring together two events: a treatment and a subject, while mitigating as much as possible any phenomena not related to the pure cause and effect relation between the given standardised treatment and the statistically averaged subject. It is not a design that attempts to embrace the complexity of multiple interrelated causes and non-linear causal relations. This independence underlies the claim of the mechanical worldview to the possibility and desirability of “objective” knowledge, uncontaminated with unreliable inference regarding causation. While interpretations of test results are offered, they tend to be strictly limited to observations of quantifiable data obtained in the controlled conditions of the laboratory.

There are two diametrically opposed trends challenging these assumptions. The first is a nod to complexity: a trend in medicine that recognises the difference between the efficacy (pertaining to laboratory results) and effectiveness (the translation of these results to the outside world) of a treatment. This trend can be described as a recognition that a reductive approach under controlled conditions in a laboratory is not sufficient to understand causal processes in a complex world, but efforts to grapple with measuring effectiveness remain limited by the metaphysical straitjacket of reductionism for want of a coherent methodological alternative.

Secondly, the legacy of Newtonian mechanical causation, wherein material objects connect and “push” each other in a direct linear cause and effect relation, remains strongly influential in biological and social sciences. This influence is reflected in the RCT terminology of “dependent” and “independent” variables, which implies a more direct causal connection than conservative empiricism would allow. With the rise of genetic science in biology and medicine since the mid-20th century, direct causal connections between genes and biology, especially disorders, has been increasingly assumed to the point of becoming the medical dogma of genetic determinism, despite clear evidence of complex correlations

¹³ S Mumford & R Anjum, *Causation*, p.61

between environment and genes¹⁴. This trend towards direct causation has been strongly disseminated in the media, contributing to lay beliefs about causes and cures for disorders.

It is worth briefly mentioning here an example of non-mechanistic causation in order to highlight the extremely limited nature of causation defined as contingent but independent events, reducible to quantifiable data derived from sense experience¹⁵. Aristotle described causation in his *Metaphysics* according to four categories of intrinsic and extrinsic properties of objects which could account for both general and unique phenomena. These categories include: the material cause with reference to the matter of which an object is comprised, the efficient cause as regards the forces that have shaped the matter, the formal cause as regards the design to which the matter conforms, and lastly (and most controversially for modern science) the final or end cause (*telos*) which refers to the purpose of the object: what it is about or for¹⁶. Efficient causation more or less translates to Newtonian mechanical theories of causation. The latter two categories, and especially that of final cause, imply the actualisation of potential and the inference of purpose, which are not reducible to linear cause and effect relations, measurable data or falsifiable hypotheses. With the exception of some approaches in biology concerning organism function and disposition, which are nevertheless reductive, *telos* is considered an unreliable if not meaningless concept according to this worldview.

Positivists reject metaphysics altogether, on the grounds that general propositions about the nature of reality rest on a priori assumptions that cannot be verified by sense experiences and are therefore meaningless¹⁷, while mechanistic materialism has achieved such broad acceptance that it has become difficult for science to conceive of any reality other than that based on inert matter reacting to external forces¹⁸. However, the assumption that all phenomena can be reduced to merely matter in motion, explicable with pure measurement and without further inference or interpretation, is a fundamental proposition in itself, one which is defined by its own purpose to explain reality mechanistically and to deny creativity and novelty, and especially purpose, in nature. For this reason, mechanistic reductionism is described as a worldview or metaphysic itself in this thesis.

Mechanistic Medicine: The Biomedical Model

The legacy of mechanistic materialism continues in the positivist reductionist tradition in science, which prioritises the regular, quantifiable and universal over the unpredictable, novel and chaotic, in its purpose to equate understanding of nature with control over nature. Ironically, this project has emphatically removed any role for purpose in nature itself, making mechanistic causation the only valid explanation for change of any form of matter, including living systems. This has largely limited medical science to a mechanistic conception of living things which governs what observations are made and how they are evaluated, whether in diagnosis, intervention, experiment, trial, or assessment¹⁹. In general, only efficient causal

¹⁴ Identified and critiqued in R Lewontin, *Biology as Ideology*. (New York: Harper Perennial, 1991) and R Lewontin, S Rose, & L J Kamin, L. J. (1984). *Not in our Genes*. (New York: Pantheon, 1984) chapter 2

¹⁵ Non-mechanistic approaches to causation are explored further below, following the sections dealing with the projects and problems of the reductionist approach in medicine.

¹⁶ R Solomon, *Introducing Philosophy*, p. 86

¹⁷ P Edwards and A Pap, *Introduction to the Philosophy of Science*, chapter 10

¹⁸ Gare, *Nihilism Inc*, p. 164

¹⁹ The limitations of this conception are discussed in the context of nursing and general practice in the following: N Cooper and C Stevenson, 'Health research' in Cooper, N, Stevenson, C & Hale, G (eds) *Integrating Perspectives on Health*. (Buckingham, Open University Press 1996); pp 123-134; K Stange 'The problem of fragmentation and the need for integrative solutions'. *Annals of Family Medicine*. (2009a) 7, 2, 100-103; J P

mechanisms for pathogens acting on patients are valid in pathogenesis. While the concept of function is central to physiology, it nevertheless is assumed to depend causally on matter in motion. The object of medical research and practice is to effect change by means of mechanical intervention: that is, by the employment of forces acting on patients and their pathogens. In short, in mainstream medicine, there is a mechanistic conception of humans as machines with parts that may become faulty, and then need to be "fixed"²⁰, just as the Hobbesian cure for disorder was the imposition of order.

Instead of an examination of their positivist, reductionist epistemology and ontology, medical texts tend to offer a linear view of medical history reflecting the belief that contemporary medical practice is simply the culmination of centuries of progress in controlling disease²¹. Those outside the fields of physiological medicine have termed this approach *the biomedical model* to signify the causal belief of its adherents that all diseases and physical disorders are explained by physiological disturbances which result from injury, biochemical imbalances, genetic dysfunction, or infection²² and that all bodily functioning can ultimately be explained according to the mechanics of cellular biology²³.

Historically, the only significant blip in the linear view of biomedical advance has been the 19th century "seed" versus "soil" debate between the pathogen theory of disease, originally championed by Louis Pasteur, and the physiological dysfunction theory of disease proposed by Pasteur's contemporary Claude Bernard, who argued that the internal functioning of the body was the key to understanding disease, while microbes were insignificant²⁴. By the early 20th century, this debate had largely been settled by awarding to the pathogen camp the varieties of infectious disease, and to the physiological camp, disorders of homeostatic regulation.

With regards infectious disease, restoring health concerns the ability of the immune system to recognize and destroy pathogens, while interventions usually include anti-pathogenic agents such as antibiotics. A detailed analysis of theories of immune system functioning is well beyond the scope of this research, however a typical textbook explanation of immune system function describes it as involving many specific and non-specific defences which are regulated by multiple organs and the brain. Specific immune responses are reliant on the "priming" of the immune system to recognize antigens, which must be encountered

Sturmberg, J. P. and C M Martin 'Complexity in health: Yesterday's traditions, tomorrow's future'. *Journal of Evaluation in Clinical Practice*. (2009) pp. 543-548

²⁰ N Cooper and C Stevenson, 'Health research', pp. 123-134

²¹ E.g. that offered in the introduction to health psychology text by M Caltabiano & E Sarafino, *Health Psychology: Biopsychosocial Interactions an Australian Perspective* 2003

²² G L Engel, The need for a new medical model: a challenge for biomedicine. *Science*.196(4286) (1977) pp.129-36.

²³ L Wolpert. *How We Live and Why We Die: The Secret Lives of Cells*. (London: Faber and Faber 2009)

²⁴ According to D S Goldstein 'Computer models of stress, allostasis, and acute and chronic diseases.' *Annals of the New York Academy of Science* 1148: (2008) pp. 223-231

directly by lymphocytes: “the “antigen challenge”²⁵. Failures of immune responses are caused by either inability to recognize antigens, or by overwhelm by antigens.

With regards chronic disorders involving systemic physiological processes, the maintenance of health is usually described according to models of homeostatic regulation²⁶. Originally proposed as the main mechanism of physiological regulation by Walter Cannon in 1929, the mechanisms of homeostasis are thought to govern the ongoing maintenance of vital physiological variables including blood pressure, blood sugar, body temperature, respiratory rate and many more, within a fixed range of ideal functioning. Indeed, the regulation of nearly all physiological processes has been explained according to this model, with some researchers even applying it to psychosocial variables²⁷. While there is controversy surrounding the definition of homeostasis, it is widely accepted to be a model of negative feedback operations, and is often compared to the operation of a thermostat in a house. The model includes a set point for the regulated variable that represents the ideal state, which is compared with the set temperature for the thermostat. As stressors perturb the variable, causing it to deviate from its ideal state, “effectors” are activated to correct the deviation and return the regulated variable to its ideal state, at which point the effectors are inactivated. This can be compared with a change in ambient temperature which triggers the heating system to come on, then the system shuts itself off again when the thermostat reaches the desired temperature.

Homeostatic regulation has several key assumptions. These include the notion of an ideal set point, the presence of a central regulator that co-ordinates and controls the activity of associated effectors and prevents antagonistic effects, and the linear relationship or proportionality between perturbation and response²⁸. Models of homeostasis recognise that effectors can be antagonistic to each other, just as thermostats may trigger both heating and cooling functions to keep the house at the set point temperature. It is also accepted that regulatory systems may include many different types of effectors, and that different regulatory systems can also affect each other. Physiological disorders, encompassing chronic disease as varied as depression and obesity, are explained either as broken links in the negative feedback mechanism: in the activation of homeostatic regulators or in the activation of the central controllers, or as overload of the mechanism caused acutely with overwhelming stressors or chronically with wear and tear²⁹

An important consequence of the mechanical view of immune response and physiological regulation is the assumption that a biological “part”, when “broken”, requires an external action or intervention to be fixed, just as a machine, when broken, cannot fix itself. Accordingly, biomedical technicians, including doctors, have an overwhelming tendency to act on the environment/patient, that is to intervene to take control of

²⁵ E Marieb, *Human Anatomy and Physiology*, (Benjamin Cummings, Redwood, 1987), p-684

²⁶ D S Ramsay and S C Woods ‘Clarifying the roles of homeostasis and allostasis in physiological regulation’, *Psychological Review*, 121 (2) (2014) 225-247

²⁷ *Ibid*, p. 226

²⁸ D S Ramsay and C S Woods, S. C. ‘Clarifying the roles of homeostasis and allostasis in physiological regulation’, p. 226-7

²⁹ L M Romero, M J Dickens, and N E Cyr, ‘The Reactive Scope Model - a new model integrating homeostasis, allostasis, and stress’. *Hormone Behaviour*. (2009) 55(3) pp. 375-89

physiological processes and patient behaviours rather than to collaborate with or empower patients to manage or overcome limitations to their health. Medical practitioners are the experts who take charge and control with their skills and knowledge, they are not the students of the patient, seeking to understand the experience and conditions of the people whose suffering they seek to relieve³⁰. This approach reveals the underlying, if generally unacknowledged, positivistic values in the reductionist biomedical model for objectivism, activism, and instrumentalism³¹.

The complexity of disease processes is broken down or reduced according to the Cartesian doctrine to find the smallest set of independent factors or causes for each dependent effect. The research methods underpinning this enterprise, (RCT)s, employ a methodology designed to counter the complex interrelationships between variables via their isolation and control, so that the effect of the independent cause on the dependent variable is identified, although strictly speaking this causal connection is no more than a counterfactual dependency test, as described above. This methodology forms the basis of reliable knowledge for accepted "evidence-based" practice³²

The mechanistic methodology means that patients are also treated as collections of related parts that should be assessed and treated separately, each with its own diagnostic protocols and its own targeted intervention, often by a specialist service provider with expertise in a given field of medicine. Medical research is likewise organised into divisions according to discrete disease entities, and aims to discover and control the basic or "root" causes of each separate disorder, offering explanations of states and processes associated with health and illness, and with life itself, in terms of cellular biology, cellular chemistry, and genetics³³.

A fragmentary approach to diagnosis and intervention

The biomedical model, in its attempts to uncover the basic causes and mechanisms of ill-health, has found ever-increasing complexity in biology. Biomedicine tightly coheres to a mechanistic control metaphor, yet in response to this complexity it has become increasingly fragmented, compartmentalising its fields of study according to currently held views of categories of disorder (e.g. oncologist), intervention (e.g. radiologist), or population (e.g. paediatrician). A diabetic patient with multiple complications may be simultaneously treated by a general practitioner, a cardiologist, a neurologist, a dietician, a health psychologist, a dermatologist and so on.

The Cartesian dualist perspective justifies this fragmentary ontology of wholes, particularly the separation of body from mind. With the rejection of Descartes' conception of mind as non-physical soul, psychological (and emotional) pathology is now understood in the biomedical model to be caused by a dysfunctional brain, including "imbalances" or insufficiencies of neurotransmitters like dopamine and serotonin. Psychological and

³⁰ T R Egnew, 'Suffering, meaning, and healing: Challenges of contemporary medicine'. *Annals of Family Medicine*, 7,2, (2009) pp. 170-175 and T R Egnew, 'The meaning of healing: Transcending suffering'. *Annals of Family Medicine*, 3, 3, (2007) pp. 255-262

³¹ I.K. Zola, 'Medicine as an institution of social control'. *Sociological Review*, 20(4), (1972b). pp. 487-504

³² W Hansen, *Smart Medicine*. (New York: Palgrave MacMillan, 2011) Chapter 1

³³ L Wolpert, *How we live and why we die*: Chapter 1

emotional symptoms are reduced to criteria for diagnosis of brain dysfunction, and targeted for symptomatic control.

Models for psychiatric diagnosis such as the *Diagnostic and Statistical Manual* for psychiatric disorders of the American Psychiatric Association (DSM) reflect this treatment of disease entities classified according to symptoms. Differences exist between researchers regarding how categories should be established, and to what extent disorders should be considered according to a continuum model rather than as discrete categories³⁴. The various editions of DSM have attempted to adjust to these changes in perspectives regarding psychological and biological causes of psychiatric/psychological disorders³⁵, but have largely remained within the fold of biomedical reductionism³⁶. The categorisation of discrete disease entities and the fragmentation of healthcare has resulted in the commodification of health services³⁷. In *Smart Medicine*³⁸, an examination of current and future trends in medicine in the United States, William Hansen M.D. describes the trend for moving away from the traditional approach in twentieth century medicine, wherein a primary care physician would manage and oversee his or her patient throughout every aspect of care, which in an era of comparatively fewer and simpler medical technologies could be considered a "more holistic, less fragmented, and less expensive" approach³⁹, towards a twenty-first century assembly line approach in which automated processing is needed to allocate and deliver multiple specialist technologies and "streamline the flow of patients through the health system"⁴⁰. Hansen describes the increased adoption of standardised protocols and routines comprising "best practice", these being based on causes of disorders derived from RCT's in each compartmentalised field.

These trends mean patients are identified as consumers of medical products according to diagnoses of discrete disease entities, and the focus on understanding the individual patient's illness further diminishes⁴¹. Indeed, the focus of healthcare distances even further from the human being to the level of cellular biology, which Wolpert confidently states is the

³⁴ T Millon, R F Krueger, and E Simonsen, *Contemporary directions in psychopathology: Scientific foundations of the DSM-V and ICD-11*. (New York, Guilford Press, 2010)

³⁵ eg "rationalist", "empiricist", and "pragmatic": Zachar, P. & Kendler, K. S. 'Philosophical Issues in the classification of psychopathology'. In T Millon, R. F. Krueger and E Simonsen (eds) *Contemporary directions in psychopathology: Scientific foundations of the DSM-V and ICD-11* pp. 128-129

³⁶ this topic is examined in greater detail in the next chapter: The Biopsychosocial Model (see below).

³⁷ K C Stange 'The problem of fragmentation and the need for integrative solutions'. *Annals of Family Medicine*. 7, 2, 2009a, pp.100-103

³⁸ W Hansen, *Smart Medicine*. (New York: Palgrave MacMillan, 2011)

³⁹ *Ibid*, p.112

⁴⁰ *Ibid*, p-123

⁴¹ KC Stange, 'The problem of fragmentation and the need for integrative solutions'. pp. 100-103

"future of medicine"⁴², despite also admitting that general models of cellular dysfunction-based causal chains can be fully described for only very few illnesses.

The Placebo Effect

Both the ubiquitous nature and epistemological inadequacy of mechanistic assumptions are highlighted by the treatment by researchers and practitioners of the phenomenon known as the placebo effect. Other than suggesting a “neurobiological basis for clinical improvement” as a “mechanism for the placebo effect”, a White Paper published by the Program in Placebo Studies⁴³ states that the phenomenon remains inexplicable and largely ignored as a therapeutic intervention. Some have argued that the “placebo” effect is simply a misattribution of spontaneous remission⁴⁴. The controversial and neglected status of the placebo effect reflects a deeper problem in medicine: that mechanistic science is unable to explain the power of belief in a curative substance, or any other socio-psycho-environmental factors posited to be related to placebo, to effect recovery or improvement. Indeed, there is no explanation for the ability of organisms to heal themselves, spontaneously or otherwise⁴⁵. As Egnew puts it:

The confusion concerning healing in medicine is evidenced by the lack of consensus about its meaning. Science values operational definitions. Yet, medicine promotes no operational definition of healing, nor does it provide any explanation of its mechanisms, save those describing narrow physiological processes associated with curing disease⁴⁶.

In sum, the biomedical model assumes knowledge of disease and cure to have evolved in linear fashion in line with positivist scientific explanations of the mechanisms of human disease. These mechanisms attempt to reduce the processes of pathology and healing to cause-and-effect relationships, however this reductionist approach has resulted in an overwhelmingly complex and fragmented picture of human functioning. The biomedical model attempts to manage this complexity by compartmentalising research and interventions, and searching deeper and deeper for the basic mechanisms of disease. The subject of its research and practice is the disorder, not the human being. Human experience and other non-physical aspects of health and illness are problematic for a Cartesian dualist ontology, which prioritises diagnosis in terms of discrete categories based on physical entities, and considers qualities of mind to be epiphenomenal symptoms of physical dysfunction. In practice, people are treated as fragmented collections of disorders moving along an assembly line of healthcare specialists, while treatments consist of interventions aimed at malfunctioning parts, with the purpose of isolating and controlling causes, and removing symptoms. Despite efforts to recognise the phenomena of self healing, standards for measuring health and healing continue to be based on the absence of symptoms of physical illness⁴⁷. The emphasis

⁴² Wolpert, *How We Live and Why We Die*, p-1

⁴³ Informed Medical Decisions Foundation; John. D. Stoeckle Centre for Primary Care, Massachusetts General Hospital; Program in Placebo Studies, Harvard Medical School. ‘Placebo effects in patient guidelines, practice and patient choice.’ White Paper, Robert Wood Johnson Foundation, 2014, pp.6-7

⁴⁴ R Hrobjartsson and P C Gotzsche ‘Is the placebo powerless? An analysis of clinical trials comparing placebo with no treatment’. *New England Journal of Medicine*, 24;344(21), (2001) pp.1594-602

⁴⁵ a biosemiotic view of the placebo effect is developed further below, especially under the subheading “attention and the placebo effect” in Chapter 7

⁴⁶ T R Egnew ‘The meaning of healing: Transcending suffering’. *Annals of Family Medicine*, 3, 3, (2005) p.256

⁴⁷ T R Egnew, ‘The meaning of healing: Transcending suffering’, p. 257

on treating parts and controlling symptoms is reflected in the areas of medicine's greatest successes: the pharmaceutical control of infectious diseases, and the removal of dysfunctional parts by surgical intervention.

Limitations of the reductionist approach in medicine

Despite the successes of the biomedical model, the prevailing methods of controlling illness have serious limitations. Researchers and practitioners agree that while biomedicine has succeeded in controlling infectious diseases, at least where infrastructure allows, chronic illness is far from being controlled, and indeed is increasing⁴⁸. This failure is generally viewed as simply a matter of needing further research to uncover cellular or genetic causes, and accessing the resources needed to control these causes more effectively, but not as a limitation of the biomedical approach as such⁴⁹. Thus, the limited success in treating chronic disease gives rise to perhaps the most widely recognised limitation of biomedicine: the consumption of a vast amount of resources and energy in medical research and intervention. These are enormously expensive industries, both in terms of time and physical resources⁵⁰. In 1997-8 health care expenditure in Australia accounted for 8.3% of GDP, an annual increase of 3.6% per person since 1960, and healthcare expenditure had increased to 9.8% of GDP in 2013-14⁵¹.

Measures to manage health costs are uncomfortably juxtaposed against ever increasing costs of new technologies and treatments, to which health care consumers claim rights. These same consumers have an insatiable appetite for consumption, given the ubiquity of pathogenic entities, the increased life span of consumers, and the increase of chronic, effectively incurable conditions from which they suffer. These chronic conditions are acknowledged to result from a multiplicity of pathogenic causes, and comprise a multiplicity of symptoms, while each cause and symptom must be isolated and managed in an ever-growing consumption of energy. Despite the investment in healthcare, chronic illness continues to increase, while biomedical treatment struggles to keep pace let alone cure. Hanson argues that despite the proliferation of specialists, there is little evidence that high consumption of healthcare services results in improved health in the population, at least in the United States⁵². Gains in longevity can be more readily explained by improved nutrition and sanitation and reduced environmental hazards rather than medical intervention. A survey of cancer treatment in the US in the early 90's found that in the previous fifty years, no significant gains had been achieved in reducing mortality from cancer: rates remained at around 50%, despite enormous resources poured into research and treatment over the

⁴⁸ K C Stange, A science of connectedness. *Annals of Family Medicine*. 7, 5, (2009c) 387-395

⁴⁹ N Cooper and C Stevenson 'Health research'. In N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health*. Buckingham, Open University Press (1996) pp. 123-134

⁵⁰ The growing (and ultimately unsustainable) cost of healthcare is discussed in J P Sturmberg and C M Martin 'Complexity in health: Yesterday's traditions, tomorrow's future'. *Journal of Evaluation in Clinical Practice*. (2009) pp. 543-548, also in the introductory and concluding chapters of W Hanson *Smart Medicine*, and in an Australian context by M Caltabiano and E P Sarafino *Health psychology: biopsychosocial interactions. An Australian Perspective*. (Milton, Qld. John Wiley & Sons, 2002)

⁵¹ Australian Institute of Health and Welfare, *Australia's Health 2016* (Australia's health series no. 15, 199, Canberra, 2016) pp. 36-45

⁵² W Hanson, *Smart Medicine*, pp 124-126

decades⁵³. These findings are consistent with the trend of increasing rates of chronic disease including cancer in Australia⁵⁴ Despite the hyperbole disseminated in the media regarding new drugs and new approaches, the belief that medicine alone can one day cure cancer is argued to be an illusion, albeit an extremely powerful one⁵⁵.

The current trajectory in healthcare, driven by reductionist, fragmentary approaches, is economically and socially unsustainable⁵⁶. The fragmented approach to healthcare is reinforced by yet another factor: the establishment of disease industries based on the consumption of services rather than models of care that improve health. This means that in addition to the increased pressure put on health services by an aging population with multimorbid conditions, medical service providers actively engage in practices that encourage further consumption. While some have argued that this is motivated by profits, this research argues that the problem is ultimately ontological and epistemological. Kurt Stange, editor of the *Annals of Family Medicine*, in the first of a series of editorials critiquing the problems of “fragmented” care, states:

...our healthcare system doesn't deliver healing. It doesn't deliver relationships. Increasingly it delivers commodities that can be sold, bought, quantified, and incentivized. While the whole—whole people, whole systems, whole communities—gets worse. While governments, health care systems, and individuals spend more and more on healthcare, for less and less value⁵⁷.

A second limitation concerns the invasive and potentially dangerous nature of treatments aimed at control, which can result in both iatrogenic disease caused by physician error and undesirable side effects of the medicines and treatments themselves. These range from major surgical error resulting in death, to the slow erosion of cognitive faculties wrought by neuroleptics, to the compromised functioning of bowel flora following a course of antibiotics, to the development of dependency on pain relief medication for sufferers of chronic pain. It is very difficult to estimate the extent of harm caused by medical treatments, given the extremely broad nature of the problem, however it is likely both doctor error and adverse reactions to treatment are underestimated⁵⁸. An Australian study concluded that outpatient adverse drug events are common but routinely underreported, and they account for 2-4% of hospital admissions, and 30% of hospital admissions for those over 75 years of age⁵⁹. A

⁵³ G R Weiss, *Clinical Oncology*, International edn. (Englewood Cliffs, NJ: Prentice Hall, 1993)

⁵⁴ From 2003 to 2011, rates of cardiovascular disease fell slightly while those for cancer, neurological disorders, mental illness and other chronic diseases increased (adjusted for population increase and effects of aging population) reported in Australian Institute of Health and Welfare, *Australia's Health 2016* pp. 54-57

⁵⁵ S Kinghorn and R Gamlin 'Cancer care: conventional, complementary or consensus'. In N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health*. (Buckingham, Open University Press, 1996) p. 183

⁵⁶ K C Stange, Ferrer and Miller, 2009, and K Sturmberg and Martin, 2006

⁵⁷ K. C. Stange 'The problem of fragmentation and the need for integrative solutions', p. 100

⁵⁸ A L Bhasale, G C Miller, S E Reid and H C Britt, H Analysing potential harm in Australian general practice: an incident monitoring study. *Medical Journal of Australia*. 169 (2) (1998) pp. 73-6, and S N Weingart, R McWilson, R W Gibberd and B Harrison Epidemiology of medical error. *British Journal of Medicine* 320 (7237) (2000) pp. 774-77

⁵⁹W. B. Runciman, E. E. Roughead, S. J. Semple & R. j. Adams 'Adverse drug events and

careful observational study found that nearly half the inpatients in surgical units at a Chicago teaching hospital experienced an adverse event, defined as one when an inappropriate medical decision was made⁶⁰. Nearly 18% of these iatrogenic events were considered serious. Dr Peter Gotzsche, co-founder of the Cochrane Collaboration, one of the world's leading institutes for assessing medical research, claims that iatrogenic disease from both "correctly" and erroneously prescribed medications is the third biggest cause of death in developed nations after heart disease and cancer. Gotzsche, in a scathing critique of the pharmaceutical industry, blames the promotion of commodified healthcare by the industry for financial gain⁶¹.

The magnitude of iatrogenic disease cannot be explained by human error or greed. Multimorbidity (the co-occurrence of multiple medical disorders) is now the norm in primary care patients, yet because reductionist RCT research excludes multimorbid cases, evidence-based medicine is not helpful and is known to be harmful for a high proportion of patients⁶². Drug interaction effects tend to be poorly researched, as are the long-term consequences of treatments. It is often only when treatments have been in use for many years that adverse effects become apparent, as recent studies on the adverse effects of long-term use of common antidepressants have shown⁶³. Finally, given that virtually every medical treatment involves side effects, this limitation can be considered ubiquitous⁶⁴.

It is now generally accepted that the incidence of multiple antibiotic resistant microbes, another serious threat to health, has resulted primarily from over-use of these medicines. These problems are of course openly acknowledged, and much research is devoted to reducing unwanted effects of treatments, which often involves yet further treatment. But the mechanistic paradigm constrains health professionals and patients alike to

medication errors in Australia.' *International Journal for Quality in Health Care* 15, 1, (2003) pp. 49-59

⁶⁰L. B. Andrews, C. Stocking, T. Krizek, L. Gottlieb, C. Krizek, T. Vargish & M Siegler. 'An alternative strategy for studying adverse events in medical care'. *The Lancet* 349, 9048, (1997) pp.309-13

⁶¹ P C Gotzsche *Deadly Medicines and Organised Crime: How Big Pharma has Corrupted Healthcare*. (London, Radcliffe, 2013)

⁶² M Fortin, J Dionne, G Pinho, J Gignac, J Almirall and L Lapointe. 'Randomized controlled trials: do they have external validity for patients with multiple comorbidities?' *Annals of Family Medicine* 4(2), 2006 pp. 104-108, K C Stange and R L Ferrer. The paradox of primary care. *Annals of Family Medicine*. (2009) 7, 4, pp. 293-299, M E Tinetti, S T Bogardus Jr. and J V Agostini Potential pitfalls of disease-specific guidelines for patients with multiple conditions. *New England Journal of Medicine*. 351(27) (2004) pp. 2870-2874.

⁶³Long term iatrogenic effects of antidepressants (Selective Serotonin Re-uptake Inhibitors) include increased depression: J R. Vittengl. 'Poorer Long-Term Outcomes among Persons with Major Depressive Disorder Treated with Medication', *Psychotherapy and Psychosomatics* (2017) pp 11-18, and increased mortality: M M Maslej, B M Bolker, M J Russell, K Eaton, Z Durisko, S D Hollon, G M Swanson, J A Thomson, B H Mulsant and P W Andrews 'The mortality and myocardial effects of antidepressants are moderated by pre-existing cardiac disease: a meta-analysis'. *Psychotherapy and Psychosomatics* (2017) pp. 268-282

⁶⁴ Like Gotzsche, Illich contends that big pharma misleads both doctors and the public as regards the safety of products in *Medical Nemesis – The Expropriation of Health*. (London, Calder & Boyers, 1975)

accept negative effects as an unavoidable consequence of the many interventions necessary to control illness⁶⁵.

A third limitation of particular importance to this thesis concerns the lack of theory in medicine about processes involved in pathogenesis, let alone those that promote healing (salutogenesis). A mechanistic approach in medicine simply does not value observation of the self-organising processes of disease and healing, with limited exceptions such as the progression of specific diseases, or the regeneration of tissues. The prevailing metaphysics in health science of mechanical causation has little place for self-healing dynamics, and encourages a view of illness as a sign that the organism cannot heal itself and therefore requires the application of external forces. This means that intrinsic dynamic processes that may support or obstruct healing remain poorly understood and under-utilised in health practices. For example, while the placebo effect is well documented and accepted, very little is known about how this process could occur. Given the focus on diagnosis of disease and control of symptoms in mechanistic medicine, and the lack of attention to the nature of healing, it has been described as disease-focused rather than healing-focused, to the extent that the value of medical interventions is based on an economic model of throughput or consumption of services, rather than improved understanding and care of the patient's illness.⁶⁶

Nevertheless, attempts by the biomedical community to more effectively treat chronic and multimorbid patients include efforts to develop healthcare models that might account for multiple interrelated causes, including non-biological factors, in pathogenesis and healing. The development of these, and their limitations, are discussed in the next chapter.

⁶⁵ Ibid

⁶⁶ W Hanson, *Smart Medicine*, and J P Sturmberg and C Martin. 'Rethinking general practice Part 1: Far from equilibrium disease-centred and econometric-oriented health care in general practice/family medicine'. *Asia Pacific Journal of Family Medicine*, 5, 2, (2006) pp. 1-11

CHAPTER 2

The Bio-Psycho-Social (BPS) Model

The recognition of multiple interrelated causes of disease, and the inadequacies of reductionistic approaches to cope with these, has led to challenges to the dominance of reductionist models. The main response to the complexity of health care problems has been the development of biopsychosocial (BPS) models of health and illness, which propose to acknowledge and integrate multiple biological, psychological and social causes and treatments of the patient's disease. However, BPS models have several limitations, including a failure to overcome metaphysical dualism.

Epistemological and ontological theories of psychiatric illness exemplify the discord between physical and non-physical theories of dysfunction. The history of psychiatric diagnosis has followed a complicated trajectory from psychodynamically-informed ideas of unconscious conflicts, to developmental, evolutionary and social theories, to a nominally "atheoretical" or phenomenological position that categories of illness are based on observable phenomena and perceived dysfunctions¹. Since the second half of the twentieth century, the assumption that mental illness has a biological basis has dominated research and practice². While this view depersonalizes and demeans pathology to mere biological error, alternative psychosocial views have been mainly limited to those concerned with individualistic selfhood being acted on by forces of the socio-cultural milieu. These views tend to "define wellbeing in terms of individuals' capacities to articulate and advance their personal agendas"³. Neither approach is adequate to comprehend let alone address pathologies of social relations, such as narcissism, psychopathy, social fragmentation and hedonic over-consumption⁴.

The prevailing dominance of the biomedical position in psychiatry has not gone unchallenged, notably by the psychiatrist George Engel, who introduced the term "biopsychosocial" (BPS). Engel criticised the biomedical model as reductionist, inadequate, and inhumane, and attempted to introduce systems theory in medicine to overcome the incommensurability of the dualist position, and proposed that Bertalanffy's systems theory could be used to establish a more holistic model of healthcare. According to Engel, a system is defined as a dynamic (constantly changing) entity consisting of components that are continuously interrelated via exchange of energy, substances and information⁵. Bertalanffy's general systems theory had been received in the 1960's with much interest by the American

¹T Millon and E Simonsen 'A precis of psychopathological history' pp. 3-52 and P Zachar and K S Kendler, K. S. 'Philosophical Issues in the classification of psychopathology' pp. 127-148, both chapters in T Millon, R. F. Krueger and E Simonsen (eds) *Contemporary directions in psychopathology: Scientific foundations of the DSM-V and ICD-11*. (New York, Guilford Press, 2010)

²J Paris, 'Biopsychosocial models and psychiatric diagnosis'. In T Millon, R. F. Krueger and E Simonsen (eds) *Contemporary directions in psychopathology: Scientific foundations of the DSM-V and ICD-11*. pp. 473-483

³L J Kirmayer, 'Re-visioning psychiatry: toward an ecology of mind in health and illness'. In *Re-visioning Psychiatry: Cultural Phenomenology, Critical Neuroscience, and Global Mental Health.*, Editors: L J. Kirmayer, R Lemelson, C Cummings (Cambridge University Press, 2015), p-635

⁴T Kasser, *The High Price of Materialism*. (MIT, London, 2002) pp. 20-22

⁵G. L. Engel 'The need for a new medical model: a challenge for biomedicine' *Science* 196, (1977) pp.129-36

Psychiatric Association, but in spite of the early promise of systems theory to influence psychiatry, the trend towards the biomedical model in psychiatry continued and increased ⁶.

Critics agree that the major problems with the practical uptake of BPS models in psychiatry are that they demand expertise in many disciplines and interventions at multiple levels simultaneously, and that they do not specify specific pathways or identify sufficient risk or protective factors⁷. For psychiatrist Joel Paris, BPS models can degenerate into "meaningless mush"⁸ and the solution is to give biological factors primacy in BPS models, based on the "stress-diathesis" theory which postulates that biological vulnerability must be present to produce psychiatric disorders. In this conception of "systems theory", BPS models are relegated to the role of understanding relationships between stressors and diatheses, with the aim of reducing these to basic mechanisms and linear relationships that can predict outcomes. Phenomenological approaches in psychiatry have failed for similar reasons, where these have been used in attempts to find underlying mechanisms on which to base reliable diagnosis and treatment.

The BPS model in General and Family Practice

The dominance of the biomedical model in general practice means that "the patient seems to have gotten lost in the stampede of medical innovation"⁹. Hanson notes that an alternative model of healthcare, the more patient-centred "medical home" has been proposed to counter the dehumanising fragmentation of healthcare. A medical home model involves a primary care physician who directs a team of specialists to care for each patient, allegedly providing a compromise between the fragmented and holistic approaches to healthcare, but more ostensibly with the aim of improving communication and teamwork between providers, and therefore increasing the efficiency of healthcare delivery. For Hanson, an holistic approach simply means one that is based on the "overall" care of the individual patient, achieved via the oversight of a single healthcare provider, rather than managing patients as collections of disorders treated by relatively independent specialists. Hanson seems to favour the former approach, yet he concludes that it is likely that the economics of healthcare will favour the assembly line approach.

Other researchers have more explicitly identified and criticised the mechanistic materialism metaphysic in medicine from the perspective of general and family practice. Sturmberg and colleagues¹⁰ reviewed some 56 peer reviewed articles published since the 1970's that specifically compared a "systems sciences" perspective to the mechanistic model in the context of family or general medical practice. They identified trends over the past four decades to a more phenomenological understanding of patients' experience of illness in terms

⁶ According to J. Paris. *Prescriptions for the Mind*. (Oxford University Press, 2008) Chapter 2

⁷ J Paris 'Biopsychosocial models and psychiatric diagnosis'. In T Millon, R. F. Krueger and E Simonsen (eds) *Contemporary directions in psychopathology: Scientific foundations of the DSM-V and ICD-11*. (2010) pp. 473-483, J A Wasserman, 'On art and science: an epistemic framework for integrating social science and clinical medicine'. *Journal of Medicine and Philosophy* 39 (3) (2014) pp. 279-303, and J Fulton 'Nursing: Biopsychosocial care?' In N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health*. Pp.36-46

⁸ J Paris 'Biopsychosocial models and psychiatric diagnosis' p. 476

⁹ W Hanson, *Smart Medicine*, p. 203

¹⁰ Reviewed in J P Sturmberg, C M Martin and D A Katerndahl 'Systems and complexity thinking in the general practice literature: An integrative historical narrative view'. *Annals of Family Practice* 12, 1, (2014) pp. 66-74

of social, cultural and family contexts¹¹, to an emphasis on the relationship between patient to physician and how this can affect the experience of health and illness and treatment outcomes¹², to the functioning of healthcare clinics as self-organising systems within larger community systems¹³, and ultimately to developing dynamical theories of health and illness processes in patients as subsystems embedded within larger systems¹⁴.

An important trend in general and family practice emerging from these attempts at developing a systems perspective on health is the adoption of BPS models which claim to incorporate insights from a complex systems approach. These models recognise multiple physical, psychological and social causes in disease etiology, and that these causes are interrelated. Some of this research has led to useful insights into the variability of disease presentations and responses to interventions that challenge dominant reductive models of diagnosis and treatment, and suggests radically different trajectories for research and practice compared with traditional approaches¹⁵. These insights are detailed in Chapter 5.

In the main, however, attempts to integrate diagnosis and treatment approaches in general practice according to BPS models have had limited success. One reason for this is that BPS models are hampered by their inheritance of biomedical reductive empiricism. In both psychiatry and general practice, the assumption that linear causal pathways, those that isolate basic causes responsible for predictable effects, are required for any useful understanding of pathology has not been successfully challenged by proponents of systems theory, at least as it is conceived in BPS models. A typical perspective is that espoused by Borrell-Carrio et al, who propose that for general practitioners, BPS models, which they identify as a “complex systems” approach, are useful in assisting physicians to be mindful of patients’ psychological and social contexts, including their relationship with their physician, but a linear approximation of their pathology based on a “structural” model of necessary physiological causes remains the basis of treatment¹⁶. Others argue for the value of considering the personal meaning of illness and the transformational nature of healing for

¹¹While systems thinking has strongly influenced BPS theory, cultural views of illness are changing slowly. See G I Burkett ‘Culture, illness, and the biopsychosocial model’. *Family Medicine*. 23, 4, (1991) pp. 287-291 and I R McWhinney ‘Changing models: The impact of Kuhn’s theory on medicine’. *Family Practice* 1, (1984) p. 3-8

¹² The doctor-patient relationship is widely assumed to be critical to the success of a BPS approach: F Borrell-Carrio, L Suchman and R M Epstein, R.M. ‘Biopsychosocial models 25 years later: Principles, practices and scientific inquiry’. *Annals of Family Medicine*, 2, 6, (2004) pp.576-582 also T R Egnew, Suffering, meaning, and healing: Challenges of contemporary medicine. *Annals of Family Medicine*. 7,2, (2006) pp.170-175 and L W Miller, R R McDaniel, B F Crabtree and K C Stange, ‘Practice jazz: understanding variations in family practices using complexity science’. *Journal of Family Practice* 50, 10, (2001) pp.872-878

¹³L W Miller et al ‘Practice jazz: understanding variations in family practices using complexity science.’

¹⁴ D Kernick ‘Can complexity theory provide better understanding of integrated care?’ *Journal of Integrated Care*. 11, 5, (2003) pp. 22-29 and I R McWhinney, ‘The importance of being different: William Pickles Lecture 1996. *British Journal of General Practice* 46,7, (1996) pp. 433-436 and K C Stange, R L Ferrer and W L Miller ‘Making sense of healthcare as adaptive-renewal cycles’. *Annals of Family Medicine*. 7, 6, (2009) pp. 484-487

¹⁵ J P Sturmberg and C M Martin *The Handbook of Systems and Complexity in Health*. (New York, Springer. (2013)

¹⁶ F Borrell-Carrio, L Suchman and R M Epstein, R.M. ‘Biopsychosocial models 25 years later: Principles, practices and scientific inquiry’.

patients, however this conception of healing is considered salient to psychological or “spiritual” well-being only, as a separate domain to physical disease and the success or failure of physical cure¹⁷. This conception of “holistic” healing in fact perpetuates the basic dualist fragmentation of mind and body.

Challenges to reductionism in general and family practice have also been hampered by the misapprehension that the alternative is to adopt vitalistic theories of holism. Most studies comparing reductionist medicine with holism equate holism with redundant concepts in medicine, or to practices and beliefs that lie outside scientific methodology¹⁸. In general, medical researchers and clinicians tend to be at best highly tentative, and at worst defensive, if not explicitly disparaging, with regards holistic models of health care associated with “alternative” or traditional medicine¹⁹. Of course, there are valid grounds for criticism of alternative health practices, particularly with regards the lack of rigorous and coherent research and applied methodologies. This issue is explored further in Chapters 7 and 8.

The BPS Model in Health Psychology

Proponents of the BPS model in health psychology position themselves in opposition to the reductionistic biomedical model on the grounds that there exist multiple interrelated causes of illness. The discipline of health psychology originally arose from predominantly practical concerns about healthcare management rather than concerns regarding causal theories²⁰. These concerns include the increasing rate of death from preventable causes²¹ and the increasing expense of healthcare, which suggested a stronger focus on disease prevention and healthy lifestyle²², a solution that entails a broader view of health and disease than that offered by the biomedical model. Caltabiano and Sarafino propose the BPS model can offer this broader view. Their definition of a BPS model is that “health and illness influence and

¹⁷ T R Egnew ‘Suffering, meaning, and healing: Challenges of contemporary medicine’ (2009) and T R Egnew, ‘The meaning of healing: Transcending suffering.’ (2005)

¹⁸These views have remained largely unchanged over the last thirty years. See F Borrell-Carrio, L Suchman and R M Epstein, R.M. ‘Biopsychosocial models 25 years later: Principles, practices and scientific inquiry’ and E L Erde ‘Professionalism’s facets; ambiguity, ambivalence, and nostalgia’. *Journal of Medicine and Philosophy* 33 (1) (2008) pp. 6-26, also L Kopelman and J Moskop ‘The holistic health movement: a survey and critique’. *Journal of Medicine and Philosophy* 6 (2) (1981) pp. 209-35

¹⁹This bias has hampered further research according to J A Wasserman ‘On art and science: an epistemic framework for integrating social science and clinical medicine’. *Journal of Medicine and Philosophy* 39 (3) (2014) pp. 279-303, but the effectiveness of alternative medicine can already be reliably assessed as inferior according to L Wolpert’s introduction in *How we live and why we die: the secret lives of cells*. The benefits of alternative medicine are attributed to the placebo effect and the compassion of the therapist according to B G Charlton ‘Holistic medicine or the humane doctor?’ *British Journal of General Practice*, 43: (1993) pp. 475-7 and S Forster and C Stevenson ‘Holistic thinking: Personhood and the BPS model’ in N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health* pp. 135-145

²⁰Discussed in the introduction to M Caltabiano and E P Sarafino *Health Psychology: Biopsychosocial Interactions. An Australian Perspective*. (Milton, Qld. John Wiley & Sons, 2002)

²¹ G. Danaei, E. L. Ding, D. Mozaffarian, B. Taylor, J. Rehm, C. J. L. Murray, M & Ezzati, M. ‘The preventable causes of death in the United States: Comparative risk assessment of dietary, lifestyle and metabolic risk factors’. *PLOS Medicine* 6,4, (2009), e1000058

²² D Nutbeam, M Wise and S Leader ‘Achieving better health in Australia in the next five years’ *Medical Journal of Australia*. 159, (1993) pp. 503-4

result from the interplay of biological, psychological and social aspects of people's lives. Integrating these concepts involves complex and technical material..."²³.

As described above, the roots of the BPS model can be found in the development of theories of psychosomatic disease, which grew from a collaboration between psychoanalysts who claimed the reality of psychically caused phenomena such as conversion disorder, and medically trained psychiatrists with a biologically oriented view of disease causation. Health psychologists claim that these early and poorly defined alliances developed over time into more elaborate theories of interrelationships between causes of illnesses²⁴. For example, in the early 70's, the new field of behavioural medicine, aligned with behavioural psychology, had succeeded with classical and operant conditioning in modifying behaviours associated with illness and health such as overeating²⁵, while research in physiological psychology had demonstrated that psychological events such as emotions could influence blood pressure, and further that people can control their physiological systems when given biofeedback²⁶.

In his 2002 text, Sarafino defines the role of health psychologists as the promotion and maintenance of health; the prevention and treatment of illness; the discovery of etiologic correlates in the detection of illness, including personality factors; and the evaluation of health policy. He states that the overlap between psychosomatic medicine, behavioural medicine and health psychology, all of which adopt forms of BPS models, lie in their common goals and interests, and he acknowledges that important differences remain as practitioners trained in different fields confront the difficult question of how to understand the complex interplay of the various factors.

Caltabiano and Sarafino elaborate their "holistic" definition of health, drawing from the 1946 WHO statement that health is more than the absence of illness, and also from the health continuum model of medical sociologist Aaron Antonovsky²⁷ to propose that health is: "a positive state of physical, mental and social well-being, not just the absence of illness, that varies over time along a continuum". At either end of this proposed continuum are *states* (my emphasis) of health and illness. They propose that "destructive processes" produce the signs, symptoms and disabilities of disease, while medical interventions return health status to the

²³ M Caltabiano and E P Sarafino *Health Psychology: Biopsychosocial Interactions. An Australian Perspective* p.3

²⁴ Z J Lipowski 'What does the word psychosomatic really mean? A historical and semantic Inquiry'. In M J Christie and P J Mellett (eds) *The Psychosomatic Approach: Contemporary Practice and Whole Person Care*. (New York, John Wiley, 1986)

²⁵ The success of this approach largely depended on targeting specific behaviours of the patient, according to the review of research in E P Sarafino *Health Psychology: Biopsychosocial interactions*. (New York, John Wiley, 1996)

²⁶ Notably the work of the highly influential behaviouralist and physiological psychologist N E Miller, whose research was predominantly laboratory-based, using both human and animal subjects. For a review see N E Miller "Biofeedback and visceral learning". *Annual Review of Psychology*. 29: (1978) pp. 373–404.

²⁷ A Antonovsky *Unraveling the Mystery of Health: How People Manage Stress and Stay Well*. (San Francisco: Jossey Bass, 1987)

mid-range of the continuum, or "neutral" status. Adopting a healthy lifestyle can shift health status past the neutral point towards increasing wellness along the continuum²⁸.

This conception has not resulted in an unambiguous systems model for BPS approaches. The confusion regarding causation in health is reflected in Caltabiano and Sarafino's position that while levels of systems reciprocally affect each other, the examples given in text suggest that physical or genetic levels are causative, such that an injury causes emotional distress and social isolation, or genetic factors cause a chain of events to contribute to weight problems. Other examples include coping and adapting to physical trauma and chronic illness, and the general effects of "stress" and social support on health generally. The effects of stress on health are considered according to a transactional model of causation which examines the real or perceived discrepancy between the demands of a situation and resources available to cope with it, such that the discrepancy becomes the cause of ill-health. This weak conception of multiple causality does not depart substantially from linear causation. Consequently, Caltabiano and Sarafino cannot offer an explanation regarding how multiple causes affect each other. Instead, it appears this is up to practitioners in different fields, each with their own approach, to work it out for themselves²⁹.

Surprisingly, given the acknowledgement of "personality" factors in health, personal agency as a causative factor in health is not strongly emphasised in health psychology. Health psychologists do acknowledge that a healthy lifestyle, for example improved nutrition and sanitation, is largely responsible for the decrease in illness due to infectious diseases such as tuberculosis and influenza in the early 20th century, over and above direct medical interventions, and that the adoption of a healthy lifestyle has a relationship to personality factors³⁰. In the context of life-span development, health psychologists acknowledge that maturation of cognitive processes allows people to understand and assume responsibility for their own health care. They also acknowledge that values play a role, in that they assume that the more people value their health, the more likely they are to take care of it. Nevertheless, Sarafino³¹ seems to assume that intervention must be necessary to return a person in a state of ill-health to neutral health status, while the role of personal agency is largely limited to adopting lifestyle changes according to the instructions of experts.

Research methods in health psychology suggest an even more explicit reductionist leaning in that the primary subject of research is not the person but the disorder, isolated and manipulated via the experimental method. Sarafino supports the preference in health research for controlled studies to provide precise measurements and establish cause and effect relationships, even as he acknowledges these methods are inappropriate for investigating the lifestyle factors of the individual person that are the particular concern of treatment based on

²⁸ M Caltabiano and E P Sarafino *Health Psychology: Biopsychosocial Interactions. An Australian Perspective* p.5

²⁹ This conclusion is offered more explicitly as an inevitable limitation to BPS models in the concluding chapter by C Stevenson and N Cooper 'A reconciling framework' in N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health* pp.146-158

³⁰ M Caltabiano and E P Sarafino *Health Psychology: Biopsychosocial Interactions. An Australian Perspective* p.11

³¹ The emphasis is on education and intervention to build resilience and pro-active health behaviours, rather than on identifying and supporting patients' strengths, in E P Sarafino's *Health Psychology: Biopsychosocial interactions*.

BPS models. To fill this research need, Caltabiano and Sarafino describe non-experimental methods such as correlational, quasi experimental, retrospective/prospective, and longitudinal studies, with the caveat that these are insufficient to establish causal relationships, clearly giving them second class status in research. Least desirable are the single-subject case studies, which are described as of limited use because the information gleaned from an individual subject is not generalisable to others³². This can only be a limitation if the aim of research is to understand disorders rather than persons. While generalisable factors are undoubtedly of great value in understanding health and illness, neglect of the individual, who remains the subject of treatment, can lead to a fragmented view of persons and potentially the assembly line approach described above. This lack of emphasis on personal information in understanding illness and health, and on personal agency as a causative factor in illness and health, is also apparent in other proponents of the BPS model.

In support of the efficacy of the health psychology approach to BPS interventions, a literature review on the effects of psychological intervention on post-surgical recovery and cardiac rehabilitation³³ found patients in treatment groups (supportive counselling, relaxation, hypnotherapy, or systematic desensitisation) spent on average 2.4 fewer days in hospital compared to control groups, with 85% of comparisons showing treatment groups enjoyed improved outcomes such as reduced pain and complications.

Based on widespread evidence of cost savings in healthcare, many have argued that health psychologists should assume a greater role in treating patients, and also be responsible for training medical professionals to be responsive to psychological needs of patients to ensure more holistic model is adopted in acute health settings³⁴. Yet twenty years on, psychologists remain scarce in acute health settings, a situation that Sarafino attributes to continued dominance of the biomedical model, and to the difficulty of establishing BPS models in general. He argues that the compartmentalised nature of biomedical practice and the uncritical assumptions regarding causation tend to perpetuate the biomedical model, and that the benefits of BPS healthcare tend to be undervalued because they can be very broad and long term and are not reducible to dollars saved³⁵. Sarafino's points are valid, but inherent conceptual problems in the BPS model also weaken attempts to construct an effective response to the problems of the biomedical model. Ultimately, the problem lies in the challenge of constructing a robust and comprehensive non-reductionist view of causation in health.

Cognitive-Behavioural Psychology

While not strictly speaking a bio-psycho-social approach, the mechanism of action in Cognitive-Behavioural Therapy (CBT) is explained in terms of cognitive restructuring and behavioural learning, and draws theoretically from both behavioural and cognitivist theories.

³² M Caltabiano and E P Sarafino *Health Psychology: Biopsychosocial Interactions*. pp.33-45

³³ including 34 controlled experimental studies; See E Mumford, H J Schlesinger and G V Glass 'The effects of psychological intervention on recovery from surgery and heart attacks: an analysis of literature'. *American Journal of Public Health*, 72, (1982) pp. 141-51

³⁴ M Caltabiano and E P Sarafino *Health Psychology: Biopsychosocial Interactions esp* Chapter 15, J E James, Healthcare, psychology, and the scientist-practitioner model. *Australian Psychologist*, 29, (1994) pp. 5-11 and J C Richards Training health psychologists: a model for the future. *Australian Psychologist*, 27, (1992) pp.87-90 also H R Winefield 'Health psychology for medical students'. In M. A. Jansen and J Weinman (eds), *The International Development of Health Psychology*. (Chur, Switzerland: Harwood Academic Publishers, 1991)

³⁵ M Caltabiano and E P Sarafino *Health Psychology: Biopsychosocial Interactions* pp.625-630

Cognitivism, a dominant perspective in psychology since the mid-20th century, proposes that there are neurological structures corresponding to every behaviour, including cognition, and that alterations in these structures cause alterations in behaviour. Cognitions are treated as causal objects in dysfunction, and are the target of therapy, as stated by Aaron Beck:

Although there have been many definitions of cognitive therapy, I have been most satisfied with the notion that cognitive therapy is best viewed as the application of the cognitive model of a particular disorder with the use of a variety of techniques designed to modify the dysfunctional beliefs and faulty information processing characteristic of each disorder³⁶

Hence “cognitive restructuring” as a form of therapy.

Cognitivism underlies information-processing computational models of mind, which posit that mind comprises neurological structures that process sensory input (“information”) to produce the output of behaviours, including cognition. This is also the dominant perspective in neurobiology³⁷. Despite its acknowledgment that behaviour and cognition are somehow experientially if not ontologically, linked, cognitivism retains a dualist perspective. On the one hand, mental computation occurs rapidly and automatically at an unconscious level, using symbols or representations, that we are not (and cannot be) consciously aware of. This means that cognitive representations are based on a pre-given reality and are projected into conscious experience. Cognition is the process of recovery of this pre-given world. Note that this approach treats information as an independent, external cause from the outside world. On the other hand there is conscious experience, but this is no more than the product of computation. From a cognitivist perspective, conscious experience cannot be attributed with any causal efficacy³⁸

But how then do these unconscious representations arise if not by some causal power of conscious experience of reality? In other words, how can the computations of our unconscious information processing be reliably about the world as we experience it, if this experience is just a product of computation? This amounts to a mind-mind problem like the mind-body problem that occurs whenever a non-relational reductionist ontology is assumed. Despite its attempts to link mind and behaviour, cognitive-behavioural psychology is limited by the same reductionist assumptions of biomedical models.

The BPS Model in Nursing and Social Work

The practical limitations of the BPS model are further elaborated by Cooper, Stevenson and Hale, the editors of a collection of essays written by academics and practitioners in the fields of psychiatric nursing and medical sociology, in response to concerns with the model raised by their students.

Cooper et al argue that attempts to introduce notions of complexity and diversity in explanations of health have simply added more levels of treatment to the biomedical model rather than directly challenging its assumptions, failing to offer a coherent model for health

³⁶ A T Beck ‘Cognitive Therapy: past, present and future.’ *Journal of Consulting and Clinical Psychology*, 61 (2) (1993) p. 194

³⁷ F Varela, E Thompson and E Rosch *The Embodied Mind: Cognitive Science and Human Experience*. (MIT Press, 1991) p.44

³⁸ F Varela, E Thompson and E Rosch *The Embodied Mind: Cognitive Science and Human Experience* (MIT Press, 1991) p.52

care or research³⁹. They agree with Sarafino that Engel's concept of interrelated systems has been readily accepted by academics as a comprehensive and holistic approach, but view discrepancies in its interpretation and application, dependent on the academic discipline and professional orientation of its practitioners, as a serious and even insurmountable limitation to BPS approaches.

Within the nursing profession, various BPS models have been developed in response to the particular demands and domains of nursing, such as practical task aspects of nursing, patient adaptation and self-care, and health promotion, none of which can be addressed by the standard biomedical model. BPS models in nursing range from a predominantly biological/physiological orientation⁴⁰, to those that include spiritual and philosophical aspects of experience in an attempt to recognise that holism entails an entity that is greater than the sum of its parts⁴¹. However, despite the popularity of BPS approaches since the early 1970's, nurses struggle to use BPS models effectively. It has been argued that holistic approaches in nursing, like those of health psychologists, are undermined by the continuing dominance of mechanistic medicine⁴² but this is not the only limitation. John Fulton investigated the experiences of student nurses trained in BPS approaches, and found that many nurses identified a lack of resources sufficient even for physical care, let alone addressing psychological or social needs. However, at both an individual and an organisational level, he found that nurses also constructed boundaries to limit their emotional involvement with patients, due to an anxiety that involvement could lead to distress and undermine professionalism. This suggests that despite receiving training in psychology and sociology, nurses are underprepared and undersupervised for the delivery of psychological and social interventions. Improvements in BPS care were observed on wards where nurses were exposed to senior staff as role models for the delivery of psychosocial care, however the limitations of available time and energy, and the extent to which nurses, or other healthcare providers, can be expected to become proficient and confident in the delivery of various BPS interventions, remain⁴³.

The multiple resources demanded by BPS interventions have been addressed more successfully by adopting a person-centered teamwork approach. A case study supplied by Pauline Pearson, a "health visitor" performing the role of healthcare assessor and co-ordinator in people's homes, describes how within the eclectic role of a health visitor she was able to examine the complex needs of individuals within a community over a period of many years, discovering areas of lack in her skills, knowledge and resources, and eventually finding a form of integration by consulting closely with a team of GP's, social workers and nurses. Her role evolved to include providing an overall brief of an individual, usually within a family unit, then forwarding the brief to other members of the team according to their specialised skills and resources, while regularly reviewing treatment approaches as a whole and emerging outcomes across a number of measures. The strength of this approach, Pearson

³⁹ Especially the introductory and concluding chapters: see C Stevenson and N Cooper 'A reconciling framework' in N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health* pp.146-158

⁴⁰ Roper, N, Logan, W. W. & Tierney, A. J. (1980) *The elements of nursing*. Edinburgh, Churchill

⁴¹ Rogers, M. E. (1970) *An introduction to the theoretical basis of nursing*. Philadelphia, PA. FA Davis

⁴² P Aggleton and H Chalmers Nursing research, nursing theory and the nursing process *Journal of Advances in Nursing* 11, 2 (1986) pp. 197-202

⁴³ J Fulton 'Nursing: Biopsychosocial care?' In N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health* pp. 36-46

argues, is that there is no need for an a priori integrated model of treatment, rather holistic treatment evolves within the constraints of collaboration between team members, with one team leader who has the necessary background experience in the complexity of presentations of patients, and knowledge of available resources to draw upon for interventions⁴⁴. In this model, the biomedical level of explanation is not dominant, indeed no level is assumed to be dominant. The only assumption appears to be that of the necessary experience of the team leader in assessing complex needs, drawing on relevant resources, and evaluating outcomes across a variety of domains. In this approach, both *boundaries* between various patient needs and related care providers, and *connections* between needs and between care providers are managed.

In comparison, when the dominant approach is biomedical in nature, and a GP functions as a gatekeeper, or fund holder, team-based approaches have been deemed ineffective due to the physician undermining the authority and expertise of other providers⁴⁵. Despite identifying the crucial role of experienced, and non-control-oriented, oversight in effective BPS care, Pearson views her position to be "marginal" in primary health care, due in part to the restrictive requirements of concrete outcome measures, difficult to achieve in terms of long-term gains in health, but necessary to secure expensive resources. Social work-oriented approaches adopt a loose clustering of practices around assumptions of values such as self-determination and respect for the person, and subjective measures of suffering and wellbeing. These assumptions in turn are influenced by dynamic variables in the moral and cultural domain, a position which, while offering a challenge to the bias towards positivist and reductionist approaches, is perceived to lack a sound theoretical base for practice⁴⁶.

When the medical instrumental urge to control and remove disease causes is entirely removed from practice, and the practical tasks of person-centered nursing predominate, as in palliative care, the BPS model has developed more freely and fully to adapt to the problem space of individual health care. The holistic response in palliative care has been summarised thus:

- Dying is not a symptom but a process, and people need more than just physical care
- Needs include emotional, spiritual and social, and vary from person to person
- The process of dying is not necessarily negative (pathological) but can be positive and enriching, thus dying can be accepted and even supported rather than inevitably struggled with.
- The reciprocal role of individual and social environment (i.e. family) is important in coping well with dying⁴⁷

In support of the importance of keeping health-care person-centered to justify claims to holism, grief counsellor Hale argues that BPS models eventually become problematic due to their general assumptions about illness or health processes, which are ultimately social

⁴⁴ P Pearson 'Health visiting: a profession for all seasons'. In N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health* pp.23-35

⁴⁵ J MacIntosh and R Dingwall 'Teamwork in theory and practice', in R Dingwall and J McIntosh (eds) *Readings in the Sociology of Nursing*. (London: Churchill Livingstone, 1979) pp.118-134

⁴⁶ P Hardiker and M Barker *Theories of Practice in Social Work*. (Academic Press, 1981) pp.87-91

⁴⁷ B Biswas 'The medicalisation of dying: a nurse's view', in D. Clark (ed) *The future for palliative care: issues of policy and practice*. (Buckingham: Open University Press, 1993) p.135

constructs, becoming inflexible explanatory models consisting of "truth claims", and losing the ability of models to capture and respond to the unique experience of the individual. To counteract this problem, she advocates a more phenomenological position of "not knowing" such that the therapist remains open to the experience of the patient. But for Hale, the notion of a model for healthcare should be rejected altogether, claiming that models necessarily involve the reification of social constructs and the loss of the real diversity of lived experience⁴⁸.

Likewise, Forster and Stevenson⁴⁹ deny that BPS models can be accepted as anti-reductionist or holistic, even in theory. They point out that according to BPS models, different levels of functioning are acknowledged but continue to be treated as separate parts, to be understood, studied and treated separately. Patients are treated according to the knowledge and ideals of practice of expert health professionals, who neither reflect on their position of inquiry, nor consult with patients about their own perceptions or experiences of illness and health. The result is that patients are ultimately understood and defined according to their diagnoses, reducing them to collections of medical labels. These practices perpetuate the power hierarchy in medicine described by Foucault⁵⁰ which is sustained by the exclusivity of professional discourse.

Cooper and Stevenson suggest that the only way to overcome the irreconcilable philosophical positions raised by examination of approaches to BPS models is by agreement on what constitutes good research, yet how this is to be achieved is not clear⁵¹. Moon et al emphasise the relation between theory and research, arguing that all inquiry positions exist along a continuum with positivism at one end, and constructivism, taking the opposing view that reality, and knowledge of reality, is constructed individually and collectively by social actors, at the other end of the continuum. Methodologies based on the different positions are not neutral but tend to be self-affirming and self-sustaining, and the self-sustaining processes of knowledge production ensure that the same kind of knowledge is always produced. Quantitative methods are strongly associated with positivist approaches, while qualitative methods are associated with constructivist approaches⁵². Cooper and Stevenson suggest the adoption of a dialectical process by which positivist and constructivist approaches can co-exist and enhance each other, arguing that good research can be determined not by the correct choice of inquiry method, but by reflexive practices of the researcher. They emphasise that research of any kind involves the researcher's contribution to the phenomena studied, and

⁴⁸ G Hale, G 'The social construction of grief'. In N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health* pp.110-119

⁴⁹ S Forster and C Stevenson 'Holistic thinking: personhood and the biopsychosocial model'. In N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health* pp. 135-145

⁵⁰ The roots of medicalisation of deviance in psychiatry in particular are examined as economic interventions supporting social power games in M Foucault *Madness and Civilisation: A History of Insanity in the Age of Reason* (Random House, New York, 1965) and *Psychiatric Power: Lectures at the College de France 1973-1974* (Picador, 2008)

⁵¹ N Cooper and C Stevenson 'Health research' In N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health* pp.123-134

⁵² S M Moon, D R Dillon and D H Sprenkle 'On balance and synergy: Family therapy and qualitative research' *Journal of Marital and Family Therapy*, 17, (1991) pp. 173-178.

reflecting on the choice of research method and inquiry position can add meaningful context to the research findings.

Overall, Stevenson and Cooper argue that Engel's proposition to overcome the reductionist/holist dichotomy by superimposing systems theory on BPS models has failed. They state that systems theory is limited to recognising that change in one level of a system can influence and effect change in other levels, and that health professionals working within BPS models do not, and perhaps cannot, explore the relationships between levels to any great extent. Cooper et al. argue that a theory should be integrative, predictive, and capable of organising knowledge coherently, and the BPS approach does not, and cannot, fulfil these requirements. Interdisciplinary tensions in BPS models, due to different causal explanations in various fields of healthcare, are incommensurable, and that it is not possible to "add" a concept of holism to BPS models in any way to improve understanding and treatment of patients. Indeed, Cooper et al. reject not only the viability but even the desirability of establishing a coherent model, arguing that attempts to do so lead only to another version of reductionism. They argue that people inevitably must simplify the complexity of wholes for reasons of economy and comprehensibility, and critique claims of holism by alternative health practitioners on the grounds that these holistic models are thinly disguised reductionism, quoting alternative medicine skeptic B G Charlton: "By explaining the complex in terms of the simple, holistic medicine is guilty of being reductionist in the extreme..."⁵³

Despite recognising apparently fatal flaws in BPS models as attempts at holistic approaches, Stevenson and Cooper conclude by suggesting that health practitioners should settle for the practical tools of BPS models for assessment and intervention, and as a reflexive dimension in research, whilst "appreciating" the holistic nature of people⁵⁴. The role of holism is, at best, limited to a philosophical position of practitioners, to encourage them to be more reflexive and flexible in their approaches, and to apprehend the experience of their clients. This conception relegates holism to little more than a nice idea with little practical application.

From the mechanistic perspective taken by most researchers, BPS models evoke the tension between what can be considered "sound" theory, generally assumed to be biomedical and reductionist in nature, yet unable to grasp the complex interrelationships between factors; and the more amorphous, eclectic and "atheoretical" practices, capable of grasping complexity in the sense of acknowledging multiple causes, but either inevitably incoherent or doomed to ultimate regression to new forms of reductionism. According to this view, the only challenge to reductionism is multiplicity and reflexivity with its attendant problems of confusion and conflict when attempts are made to translate multiple approaches into practical applications. At base, these problems arise not just from differing perspectives on the relative relevance or influence of different domains in life, whether biological, psychological, or social, or even from differences in relative power between biomedical practitioners and humanist or "holistic" practitioners, but from inadequate theories of causation. Both

⁵³ B G Charlton 'Holistic medicine or the humane doctor?' *British Journal of General Practice*, 43: (1993) p. 475

⁵⁴ This summarises the conclusions reached by C Stevenson and N Cooper 'A reconciling framework'. In N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health* pp. 146-158

reductionist and multiple-approach positions tend to seek linear, mechanistic chains of causation, albeit with differences in emphasis.

Limitations of BPS models

The failure of BPS approaches to effectively confront the problems of reductionist biomedicine, despite claims to a system approach, can be understood as a failure to depart from a Cartesian ideology of mechanical causation characterised by a set of reductionist ontological commitments, namely that any system is comprised of intrinsically homogeneous and functionally isolated parts. This ideology entails that wholes consist either of sums of parts, or sums of parts with added properties of the whole. Causes are always properties of subjects, and effects always properties of objects, such that even when "feedback" relationships within systems are recognised, the aim is to establish a model in which "there is no ambiguity about what is causing subject and what is caused object"⁵⁵

The acceptance of a Cartesian ontology means that biopsychosocial models, like biomedical models, remain unable to grasp wholes as wholes, and therefore continue to operate with a fragmented and disorder-oriented approach to healthcare. Patients can be referred to a chain of specialists, with the attendant problems of high costs and reliance on communication between specialists with varying professional orientations, or patients might be placed with a primary healthcare provider (e.g. a GP) trained to deliver care in a BPS model. However the latter approach must be limited due to the substantial knowledge and skills that are needed to address all factors in the individual's systemic interrelationships. Ultimately, either few providers must spend a great deal of time with one patient, or a team of providers must work closely together. BPS models therefore share the limitation identified with biomedical models of high cost in resources.

Despite claims to broaden understanding of patients as persons rather than disorders, most attention in BPS models is given to generalisable knowledge about persons, providing statistical probabilities on which to make decisions about the nature and likelihood of risk, responses to interventions, and recovery in a given case. Arguably, most BPS approaches emphasise social aspects of health, and as such look to population influences and effects, rather than understanding individual, or unique, presentations, to the extent that some researchers perceive the divide between biomedicine and BPS models is the divide between individual and social levels of health respectively⁵⁶. This division is misleading, as the most biologically oriented practitioners still rely on research that is designed to produce population statistics, and the most socially oriented practitioners still treat individuals. Perhaps this discrepancy between the development of the generalisable BPS model and its application to individual persons can partly account for the "bottleneck" situation described above that occurs in the delivery of treatment. Furthermore, as Caltabiano and Sarafino point out, the ethics of making decisions based on probabilities is problematic⁵⁷. If a given treatment is assigned only a 5% chance of success, should it be denied? Perhaps the patient is the 1 in 20

⁵⁵ R Levins and R Lewontin *The Dialectical Biologist*. (Cambridge, Mass.: Harvard University Press, 1985) p.269

⁵⁶ C Stevenson and N Cooper 'A reconciling framework'. In N Cooper, C Stevenson and G Hale (eds) *Integrating Perspectives on Health* pp. 146-158

⁵⁷ M Caltabiano and E P Sarafino *Health Psychology: Biopsychosocial Interactions* Chapter 9

that would respond favourably. In short, an efficient yet non-reductive means of understanding the individual is needed.

Despite the criticism by Cooper et al. that Sarafino's inclusion of systems theory in BPS models is superficial and fails to add any substantial understanding of interrelationships, they (Cooper et al.) also neglect to elaborate on systems theory. This failure leads them to conclude that holism cannot be formalised within practical models or provide useful tools of assessment and intervention, much less effectively challenge reductionism. This criticism overlooks the emphasis in holism that dynamic processes are central to understanding wholes, that the emphasis is on interconnectedness, including individually and collectively constructed meanings, and that these aspects of whole systems constitute that which makes wholes greater than the sum of parts. A holistic model must be capable of both researching general features of human behaviour, experience and functioning, and also focussing on unique experience and expressions of the individual. The methodology to achieve this must come from a theory of complex systems, as an individual person, a society, and the relationship of one to the other, are systems.

Importantly, BPS theorists fail to appreciate the importance of the ability of systems to organise themselves, and in the case of living complex systems, to organise themselves creatively and purposefully, in the sense of apprehension of their own needs and the availability of resources to meet them. Personhood is not limited to perception and experience, or even the construction of meaning, but also includes agency (purposeful action). Nowhere in the texts exploring BPS models cited in this research is the inherent self-organising property of living systems mentioned, not even in the recognition that people can heal themselves. Perhaps this omission is both ideological and pragmatic. As interventionists, health professionals are used to interacting with people at times in their lives when self-healing has apparently failed. Nevertheless, for these researchers, the dominant reductionist, instrumental mindset continues to prevail, even amongst its detractors, for lack of a comprehensive and robust alternative conception of living things as self-organising systems.

To conceive holism as hopelessly vague and impractical, or as veiled reductionism, is to deny the evidence of nature. If we can accept that in nature, living systems are indeed dynamic, interconnected wholes, and if we can accept that nature is the ultimate arbiter of efficiency and economy of living entities through the process of evolution, then the holistic dynamics of whole systems must represent the most efficient means of existing and maintaining existence possible. Or, to put it another way, life cannot be understood with any accuracy any other way than holistically. It is the attempt to separate living systems into discrete parts and causal pathways that leads to either hopeless confusion or misleading oversimplification, and results in impractical and uneconomical, and/or inappropriate and even dangerous interventions. Likewise, the Cartesian split between mind and matter which renders the domain of human consciousness incommensurate with the domain of physiological form and function cannot be justified in the light of lived human experience⁵⁸.

In sum, theory relating to dynamics of systems, including the hierarchy of different levels in a system and how these levels interact, is neglected, resulting in a model of multiple and fragmented levels, not an integrated model. The quality of information about a given individual, critical for understanding the interrelationships between biological, psychological, environmental and social factors, is compromised by the almost exclusively population emphasis on research. Despite the critical role of complex interrelational dynamics in a system, these dynamics are not the focus of theory or research. Rather, research still

⁵⁸ D Favareau 'The Evolutionary History of Biosemiotics'. In M. Barbieri (ed.), *Introduction to Biosemiotics: The New Biological Synthesis*. (Berlin: Springer, 2006) pp. 1–67.

emphasises reductive methods, based on mechanical theories of causation, in order to deal with complexity. This situation demands a shift in focus to understanding the general features of system dynamics and prioritising the application of these general dynamics to individuals with their unique presentation. Furthermore, this shift entails a non-mechanistic (non-linear) theory of causation: one that can truly embrace the notion that the whole is greater than the sum of its parts.

CHAPTER 3

Process Philosophy

Problems associated with both the biomedical and biopsychosocial models have been identified to involve a lack of understanding of the dynamics of complex living systems, without which science must rely on flawed reductionist approaches in an attempt to cope with complexity. To understand these dynamics, an alternate view of nature and reality is required. Process philosophy offers a metaphysic of nature as interrelated spatio-temporal processes rather than parts acting on each other in reversible and context free equations of matter in motion.

The history of Process Philosophy

In stark contrast to the world of inert matter in motion described by the mechanistic paradigm, nature as described by the ancient philosopher Heraclitus is in a constant state of flux or change due to the eternal tension between opposites, making the study of nature to be one of observation of the eternal processes of change, rather than of the nature and qualities of substances. Two centuries later, Aristotle attempted a systematic approach to understanding change in nature by the observation and classification of the natural world. He rejected any exact or universal laws of nature, proposing instead that metaphysical categories such as quantity, quality, substance and relation were applicable to all phenomena, but could only be investigated and understood according to the particular subject. Aristotle recognised three categories of change in nature, locomotion, the change in place later championed by mechanistic materialism, and also change in quantity (growth or diminution) and in quality (alteration). As described previously, Aristotle proposed four categories of causation; material, formal, efficient (correlating to later theories of mechanical causation) and final cause (telos) which refers to purpose in the sense of the end to which something is caused. The concept of final cause captured what was for Aristotle a crucial component in understanding the behaviour of everything that exists. Inherent purpose in nature permits the potential for becoming, as the potential of an acorn fulfils its purpose in becoming an oak tree, its final end or actuality.

While this conception of purpose invokes a predetermined end, as an acorn (circumstances permitting) cannot help but become an oak tree, Aristotle also posited inherent activity and change in nature, as natural beings exist as a process of at least partly self-caused becoming. Solomon summarises Aristotle's telic ontology: "it is not too far-fetched to say that Aristotle...viewed the universe as something like a cosmic organism, with an ultimate purpose, whose ultimate goal was thinking itself"¹. Gare comments that as regards organismic growth, Aristotle's notion of causation conflates or fuses material, formal and telic causation².

Despite Aristotle's enormous influence on natural philosophy in the medieval era, he was arguably misinterpreted as supporting the permanence of being and order rather than the primacy of becoming and therefore change. Favareau points out that the misinterpretation of Aristotle was due in large part to the loss to Western culture of the bulk of his work on nature and biology, leaving only his six books of logic to be the standard in Western philosophy for

¹ R C Solomon, *Introducing Philosophy* (Harcourt Brace New York, 1997) p.87

² A Gare, *Nihilism Inc*, pp. 317-318

a thousand years³. Favareau argues that Aristotle's formulation of human mental experience was intended to be understood according to the broader context of his formulation of the interdependent relationship of human consciousness in the world, such that "what occurs in the perceiving (system) is conceivably analogous to what holds true in that of the things themselves"⁴. This critical omission influenced philosophy, and later science, to divorce human subjective experience and consciousness from a non-conscious, unknowing nature, making human being (or becoming) an inexplicable and thus alienated exception to nature, rather than a natural being emergent from nature. The legacy of this omission was to create a vacuum in the conception of humans as natural beings that invited the eventual dominance of the Cartesian dualism of mind and matter⁵, and the modern materialist relegation of consciousness to merely an epiphenomenon of physical processes in the brain.

Arguably, Kant (1724-1804) attempted to bridge the gap between conscious mind and non-conscious matter by allowing that the human mind tended to attribute purpose and meaning to matter in order to make material phenomena explicable. For example, a biologist might seek to make the structure of the eye intelligible by attributing to its parts the overall purpose of making sight possible, but this attribution of intention is no more than a heuristic process of the human mind. Kant accepted the Newtonian model of science, that "proper" understanding of physical phenomena required physical laws describing efficient causation⁶. In the case of living organisms, biological mechanisms consist of reciprocal means-ends relations, such that the parts caused the whole, and the whole caused the parts⁷. We can only employ our "sensuous intuition", the knowledge based on the sensations given to our cognition from the external world, in order to furnish our awareness of empirical objects including living things.ch

But Kant also accepted that teleological explanations, those that employed notions of meaning and purpose, were a necessary part of human understanding, at least with regards to our understanding of living matter. According to Kant, living organisms can only be understood according to an idea of the whole. Mechanistic laws cannot answer how or why the eye is organised as it is, and he accepted that mechanistic laws are insufficient for explaining the phenomena of life. Yet teleological explanations are unscientific. This means that biological science could never be more than an accumulation of observed empirical regularities, to which our minds ascribe an overall plan or organisation, a layer of intention, as it were, that seemingly creates a whole that is greater than its parts⁸. For Kant, this extra quality of life, a conception of the "ideal" rather than the "real", has both epistemological

³ D Favareau 'The Evolutionary History of Biosemiotics'. In M. Barbieri (ed.), *Introduction to Biosemiotics: The New Biological Synthesis*. (Berlin: Springer, 2006) pp. 1-67

⁴ De Sensu vii, cited in D Favareau 'The Evolutionary History of Biosemiotics' p.9.

⁵ Descartes accorded telos solely to mind (and ultimately to God), while matter was subject to mechanical causation. R C Solomon *Introducing Philosophy*, p. 91

⁶ R C Solomon, *Introducing Philosophy*, p.218

⁷ R J Richards *The Romantic Conception Of Life: Science and Philosophy in the Age of Goethe*. (Chicago, University of Chicago Press, 2002) p.65

⁸ Ibid p.68

value and is ontologically necessary to understand living organisms, yet can never be scientifically grasped⁹.

This conception of human minds and nature raises the thorny issue of how (or why) human minds are “designed” to understand nature teleologically, and why, in accordance with the tendencies of human understanding, nature appears to function teleologically. Attempting to resolve this problem is at the heart of Kant’s work. His solution is the a priori principle of the faculty of judgement: essentially the assumption that our cognitive powers are suitable for comprehending nature¹⁰. This can be summarised as the “as if” postulation: nature appears to us *as if* so that we can comprehend it, while our consciousness appears designed *as if* to understand nature. Similarly, purpose in nature (final or telic causation) was no more than an *as if* proposition, albeit a useful one¹¹.

Thus the link Kant offers between human minds and nature consists of a shaky bridge that at best allows both minds and nature the appearance of purpose and free will, while the solid ground of mechanistic reasoning available to us can never fully answer our questions. Our mental representations of reality can never grasp extra-mental things-in-themselves. Kant himself struggled with this formulation of nature, aware of the limitations imposed by requiring mechanical materialism as the foundation of reliable knowledge, yet lacking the “courage” as Schelling accused him, of cutting the ties of Newton’s apron and fully embracing an organic conception of nature¹². Perhaps the closest Kant came was in acknowledging the efforts of his contemporary the biologist Blumenbach in developing his theories of a causal force producing organisation in organisms (*Bildungstrieb*), a cause

⁹ Ibid p.229

¹⁰ R C Solomon, *Introducing Philosophy*, pp. 273-274

¹¹ R J Richards *The Romantic Conception Of Life: Science and Philosophy in the Age of Goethe* p.68

¹² Kant’s metaphysics is argued to retain an alienation of human experience from nature, and this inspired the development of more self-creative and purposeful conceptions of nature: in R J Richards *The Romantic Conception Of Life: Science and Philosophy in the Age of Goethe* pp. 62-63 and Chapter 5 esp. pp.152-165

Blumenbach clearly proposed as teleologic (aimed at producing an end). Kant wrote to Blumenbach:

I wish to extend my thanks for sending me last year your excellent work on the formative force [*Bildungstrieb*]. I have learned a great deal from your writings. Indeed, in your new work, you unite two principles—the physical-mechanistic and the sheerly teleological mode of explanation of organized nature. These are modes which one would not have thought capable of being united. In this you have quite closely approached the idea with which I have been chiefly occupied—but an idea that required such confirmation [as you provide] through facts.¹³

Nevertheless, Kant maintained that any formative force for organisation in organisms could only arise from a pre-existing organisation, and was more akin to a mechanical rather than a telic cause, if it deserved the status of cause at all¹⁴.

Naturphilosophie

The late 18th and early 19th centuries saw a determined effort by a small group of German philosophers to propose complete systems of non-mechanistic metaphysics. This group included Fichte and his pupil Schelling. Fichte (1762-1814) agreed with Kant that our mental representations of the world appear to derive from external objects, or things-in-themselves. However, he maintained that there was no justification for believing that external objects somehow caused these representations in our minds, mechanically or otherwise. Rather, he argued that our knowledge and awareness of things, our consciousness of our experience of the external world, and our consciousness of ourselves, derives from our own being. For Fichte, *being* involved firstly our consciousness of the world around us, secondly that this consciousness is an activity, an experiencing, and thirdly, that there is an “I” (or ego) that is experiencing, over and against all that is not “I”. Furthermore, the representations of consciousness are connected in a continuous activity of thought. This self-recognising, self-reflective process of consciousness Fichte termed “self-positing”. This process was not only responsible for producing the self, but also by implication the not-self, in other words the world around us¹⁵. His metaphysic of totally subjective idealism is the direct opposite of the objective, mechanically determined world to which consciousness, creativity and purpose can only tenuously belong. Fichte’s subjective idealism was criticised by his contemporaries for denying the ontological reality of the world¹⁶.

Initially a disciple of Fichte, Schelling (1775-1854) eventually took a different approach in his challenge to mechanism in an attempt to overcome the apparent distinction between the subjective world of the self and the objective world of nature. Schelling insisted that knowledge of the world was impossible without an authentic correspondence between objects and our representations of them. Objects in nature could not be fundamentally

¹³ Kant (1790) cited in R J Richards *The Romantic Conception Of Life: Science and Philosophy in the Age of Goethe* p.71

¹⁴ *Ibid* pp.230-232

¹⁵ Fichte posited his transcendental idealism, in which even sensation is subjectively created, as a proper extension of Kantianism, with some justification according to R J Richards *The Romantic Conception Of Life: Science and Philosophy in the Age of Goethe* pp.74-79

¹⁶ Schelling (who used the term ‘subjective idealism’ to describe Fichte’s philosophy), Schiller and Schlegel objected to Fichte’s privileging of individual ego in the creation of experience. R J Richards *The Romantic Conception Of Life: Science and Philosophy in the Age of Goethe* pp.82-85

different and separate entities to human consciousness and yet be comprehensible to us. Schelling's *Naturphilosophie* replaced mechanism with organism as the metaphor for understanding the world¹⁷. In contrast to Fichte, for Schelling, nature is the creative ego's coequal: a fundamentally organic, living being, and biology is the paradigmatic science for understanding reality¹⁸. Schelling was not only influential in the development of biological science in Germany in the 19th century (promoting such concepts as *Bildungstrieb*, and inspiring the biologists Reil and Kielmeyer), he also developed theories for understanding health and disease specifically. Briefly, health is the condition in which our bodies find their place in the interactive nexus of all other natural bodies, and indeed reflect the organic whole of the universe¹⁹. Illness or death results from a disjuncture between the self and nature, which from Schelling's transcendental perspective suggests that the self brings its own illness into being²⁰. For Schelling, Newton's world of self-contained particles of matter could create itself, as could Descartes' world of mind divorced from matter, but both would be sick or dead worlds.

Schelling accepted Kant's contention that inanimate matter could not arise from mind, but rejected Kant's as-if position regarding telic causes in nature. Instead, Schelling made the concept of organism central to all nature, meaning that like the ego, nature performed its own production of itself, being both its own means in its self-creation, and its own ends in the products of that self-creation. Schelling thus made telic causes intrinsic and ubiquitous in nature, and mind primary to, and productive of, matter. All matter is therefore animate. Furthermore, in conceiving of the infinite productivity of nature, Schelling proposed that the products of nature were never fixed and final, but were "resting places" in a continuous creative evolution²¹. He is thought to be the first thinker to use the term evolution to denote species alteration²², although this process as Schelling described it was driven by the dialectics of the infinite productivity and the (temporary) finite products of nature. Furthermore, for Schelling, the concept of organism stood both behind nature and the self, driving both in the process of reflexive self-production, and also before it as a final end for evolution in nature's striving for perfection²³.

Central to Schelling's *Naturphilosophie* is the role of reflexivity: without reflection on the creativity of the ego there could be no product of this creation (the self). Likewise, without the continuous production of representations of the external world, there could be no products of nature. But Schelling did not mean to say that the external world exists only in our minds. Schelling should not be thought of as an idealist, rather he should be understood as a process metaphysician who sought to overcome oppositions between idealism and

¹⁷ A Naraniecki 'Popper's view of modern science: in the footsteps of Schelling'. *Cosmos and History: The Journal of Natural and Social Philosophy*, 10, 2, (2014) pp. 197-215

¹⁸ R J Richards *The Romantic Conception Of Life: Science and Philosophy in the Age of Goethe* p. 310

¹⁹ Ibid pp.158-159

²⁰ Ibid p. 159

²¹ Ibid p.297

²² Ibid p.299

²³ Ibid pp. 152-153

realism²⁴. For Schelling, organisms are inherently imbalanced and must engage with the world creatively to form and reform themselves. Greater imbalance is associated with greater creativity and awareness, making possible higher developments of life. His system is intended to transcend any necessary distinctions between mind and matter, human consciousness and nature. Nature itself is engaged in the reflexive process of creating itself, and the human mind is part of the organic intelligence of nature. As Schelling put it:

As a physicist, Descartes said: Give me matter and motion, and I will fashion out of them a universe. The transcendental philosopher says: Give me a nature of opposed activities, of which one proceeds into infinity and the other strives to intuit itself in that infinity, and out of this I will let intelligence and the whole system of its representations arise for you²⁵

In this way, Schelling made the reciprocal causation of self-organising processes fundamental to reality, and mechanical cause-effect relations merely abstractions of this²⁶.

Schelling's contemporary Hegel (1770-1831) can also be considered a process philosopher in that he argued that reality, and truth, come into being by means of dialectical processes, that is, the reconciling of thesis and antithesis, while the resultant synthesis becomes a new thesis to begin the process all over again. Hegel acknowledged the inevitability of contradictions or tensions between self and other, subjective and objective, mind and nature, and used the dynamic interplay between these differences as the driving force for the striving for unity. Reality for Hegel is therefore in a process of continual becoming, rather than being defined by absolutes or universal laws.

Hegel's dialectical becoming differs from Schelling's in that for the latter, the production of the self is a process that derives primarily from the activity of self-reflection, while Hegel grounds becoming in a medium of interdependent relations, such that beings are not independent from each other but can only be understood in relation to other beings. Hegel proposed three interrelated dialectical patterns of culture including: the formation of self-consciousness via the mutual recognition of self and other, the development of symbolic representation via linguistic processes, and the objectification of the world and the self via labour processes, the use of tools and artefacts, generating further needs and goals for mastery of the world²⁷. Thus, Hegel described the development of the ego from initial self-awareness to consciousness of the self and social participation through a shared reality or medium of social interactions, language, assertion of needs and choices. At each stage of development, the tensions between self and other are both preserved and reconciled as both the self and the not-self become part of the comprehension of one's identity. Like Schelling, Hegel believed dialectical becoming progressed towards an absolute truth or unity as the purpose of human life, in stark contrast to Hobbes' view of society comprising self-interested

²⁴ Gare argues that Schelling should be considered the first process philosopher. In A Gare, 'From Kant to Schelling to process metaphysics: on the way to ecological civilisation' *Cosmos and History: the Journal of Natural and Social Philosophy*. 7, 2, (2011) pp. 26-68

²⁵ Schelling (1800) cited in R J Richards *The Romantic Conception Of Life* p.102

²⁶ Schelling's process philosophy of nature presented a solution to Kant's dualisms and paved the way for later developments in theories of self-organisation in biology according to A Gare in 'From Kant to Schelling to process metaphysics: on the way to ecological civilisation' esp. p.62

²⁷ These dialectics and their interrelationships are detailed in A Gare *Nihilism Inc* pp. 355-365

individuals acting on appetites and aversions, and being acted upon by forces. Nevertheless, the acceptance of an ultimate end in his cosmology retains an overall determinism that is problematic for a metaphysics of freely creative becoming²⁸.

Bergson (1859-1941) also rejected mechanism on the grounds that it could not account for change and evolution. Bergson, like Heraclitus, Schelling and Hegel, saw reality as consisting of two conflicting forces or impulses, causing dynamic change. These impulses are on the one hand matter and intellect, which reduce reality to discrete objects and unifying laws, and on the other instinct, the creative impulse of continuously coming-into-being and diversifying. Unlike Aristotle, Schelling and Hegel, Bergson rejected any teleological explanation or ultimate end for this activity as deterministic, considering final causes a form of "inverse mechanism", replacing prior cause with destined potential. Bergson proposed instead that the telic cause in nature must be original rather than final, his *elan vital* or vital principle. This he conceived as a force constraining qualities of temporal organisation, or duration, toward the spiritual (freely mobile, adaptive, integrative) in opposition to the material (more closed and predictable)²⁹. Bergson's philosophy appealed to lay intelligentsia but was heavily criticised by his peers, and both groups misunderstood his concept of vital principle to be a mystical energy empowering free will³⁰

Others have conceptualised purpose, values and meanings as influences or constraints on becoming rather than as predestined ends or as a priori origins, and view these non-mechanical causes as critical concepts in successfully challenging the mechanistic worldview. This challenge includes examining the causal power of the values of mechanistic science itself.

Creative becoming

Since Descartes, science had banished purpose from nature, and values from itself, or at least it had presumed so. Alfred North Whitehead (1861-1947) challenged scientific materialism on the grounds that such a mathematical conception of reality not only left no room for value and meaning in scientific explanation, but also obfuscated its own inherent values and purposes, denying its own metaphysical assumptions. He argued that science is a cultural practice and as such will always reflect cultural meanings and values. Failure to recognise this can lead to what he called the fallacy of misplaced concreteness, whereby an abstract conception of the world, for example the clockwork universe metaphor of Newton, becomes mistaken for reality. Identifying this as a problem of metaphysics, Whitehead argued that

²⁸ Influenced by German Neoplatonism, Hegel's concept of creative process in Nature concerned progression by dialectical struggle toward self-actualisation of the Absolute or World-Spirit. Discussed in Gare, *Nihilism Inc*, pp. 220-221

²⁹ In privileging time over space and defining time as duration, Bergson laid the ground for his argument that free will is intrinsic to living beings, and that evolution is an interaction between the general impulse to living intrinsic to all species, and the vital impulse of individuals based on their own interests. In M Gillies, *Henri Bergson and British Modernism*, (McGill-Queen's University Press, Montreal, 1996) pp. 12-15

³⁰ However, Bergson failed to clarify, defend and develop his work in the critical contexts of popular miscomprehension and opposition from logical positivists, according to M Gillies, *Henri Bergson and British Modernism*, pp. 26-27

human experience is part of nature and therefore must be considered in any science of nature³¹.

Like Bergson, Whitehead conceived time as durational, rather than the spatialised time of physicists³². Also influenced by the quantum physics revolution, which described reality in terms of packets of energy and indeterministic probabilities, Whitehead formulated his process philosophy to reinterpret nature based on the concepts of creative becoming, organism, and event, rather than substances located in space and time³³. For Whitehead, every part of nature, living and non-living, belonged within his “organic philosophy”, and the basic unit of nature, an “actual entity”, is an atom of active process not inert matter. These units of process are moments of experience, never persisting in a state of completion but always in a process of creative becoming³⁴.

Whitehead expressed his vision of reality as a “creative advance into novelty”³⁵ that philosophers and scientists engage with in a never complete process of understanding, which necessarily includes imaginative speculation. For Whitehead, the pursuit of certain knowledge results in the degradation of understanding by devaluing speculation and imaginative thought, and worse, risked the misrepresentation of abstractions as facts³⁶.

Creative becoming as a metaphysical alternative for positing an animate rather than inert reality can offer a powerful challenge to the validity and desirability of the project of mechanistic science of controlling the world. In *Nihilism Inc*, a comprehensive comparison of the implications of the metaphysic of mechanistic materialism and that of creative becoming, Gare argues that the former has proven itself inadequate to understand and address the very serious problems facing the world: overconsumption and wastage of resources, degradation of living systems, and ultimately looming environmental catastrophe. He links this state of affairs to the overwhelming project of science to produce technology to control nature, proposing that the alternative metaphysic of creative becoming in nature is required to shift focus instead to understanding the qualities of processes in nature, and in living systems especially, that have been long neglected in the mechanistic paradigm: including unpredictability, novelty, meaning, and purpose. This last quality Gare defines as a form of

31 This contribution to process philosophy is detailed in A Gare ‘Speculative metaphysics and the future of philosophy: the contemporary relevance of Whitehead’s defence of speculative metaphysics’ *Australasian Journal of Philosophy* 77, 2, (1999) pp. 127-145

32 A Gare ‘Approaches to the question: what is life? Reconciling theoretical and philosophical Biology’ p. 75

33 H Carter ‘An introduction to process thought in five easy pieces’. In *Thinking is the best way to travel: Essays along the way*. (Authorhouse, Bloomington, 2008) pp. 173-198

34 R C Solomon, *Introducing Philosophy*, p.124

35 A N Whitehead, *Process and Reality; An Essay in Cosmology* (The Free Press, McMillan New York, 1978), p.129

³⁶ Whitehead viewed the tendency of science to pursue certain knowledge as delusory, and that one aim of philosophy should be to expose the erroneous assumptions of science concerning finality, and instead develop categorical schemes to inspire new directions in science. This methodology of speculative reason defended by Whitehead is required to overcome such problems as understanding the relationship between mind and body, and freedom and determinism according to A Gare: ‘Speculative metaphysics and the future of philosophy: the contemporary relevance of Whitehead’s defence of speculative metaphysics’ pp. 127-145

causation akin to growth, the process of realising potentialities, rather than Aristotle's final cause, the realisation of an end. Gare defines a process as

that which in Aristotle's terminology has in it its own source of movement, or in Whitehead's terminology. "that which constitutes its own becoming"... along with Whitehead I wish to stress both the durational nature of this becoming and interdependence of primary beings. But in opposition to Aristotle and Whitehead, the idea that primary beings must be actualised in some completed end is rejected. Rather, primary beings are identified with processes of becoming whether such completes itself in some definite end, or endures indefinitely.³⁷

Gare emphasises process and activity in conceiving of the nature of an entity or primary being, allowing for emergence of coherent order to define an entity as a whole, rather than relying a definition based on an entity's constituents as is attempted by reductionists. Gare recognises the significance and limitations of Hegel's three dialectical patterns of culture according to a metaphysics of creative becoming, and reconceives these in terms of the dialectics of orientation, recognition and power. Each dialectic is grounded in the "growing decentering of experience"³⁸ and each is involved in every action and moment of the creative becoming of each human life. While their dynamics constrain each other, none are reducible to the dynamics of the others. The dialectic of orientation involves people imagining and developing a perspective on the world, and an awareness of others' perspectives, enabling the transcendence of immediate experience and participation in a shared "social imaginary world"³⁹ providing the context for people to orient themselves and make sense of their own and others' experience. The dialectic of recognition describes the processes by which the development of conceptions of individual selves occur, including the affirmation of others of one's independent identity, and partly by the assertion of that independence against others. This dialectic operates in the theatre of moral order, which determines whether people's identities, roles and acts are recognised, respected, ignored or invalidated. Finally, the dialectic of power, defined as the potential and activity of maintaining existence, concerns claims and controls over forms of energy and the capacity to manipulate the physical and social world. These claims and controls include not only material resources, technologies, and means of production, but also social and political structures that establish and perpetuate social goals and values, validate or invalidate ideas and beliefs, set scientific programs and agendas, and define the nature of reality itself⁴⁰.

Metaphysics, Metaphor and Narrative

Metaphysics, the domain of philosophical inquiry into the nature of being and reality, has a long history of being devalued by mechanistic theorists, who claim that it has been rendered obsolete by science⁴¹ and who seek "objective" knowledge based on timeless and context-free truth. In doing so, they obscure the metaphysical origins of their own perspective, and the critical role of analogy and metaphor generally in making sense of reality, including the

³⁷ A Gare *Nihilism Inc* p. 315

³⁸ *Ibid* p.364

³⁹ *Ibid* p. 355

⁴⁰ *Ibid*, p.363

⁴¹ *Ibid*, p.282

development of scientific theory and practice⁴². Thomas Hobbes, introduced previously as one of the most influential mechanistic theorists, attacked the use of metaphor:

...metaphors, and senseless and ambiguous words, are like *ignes fatui*; and reasoning upon them, is wandering amongst innumerable absurdities; and their end, contention, and sedition, or contempt⁴³.

Yet Hobbes relied heavily on metaphor and analogy in his description of humans and society as automata, even in the above brief passage. In his conception of mankind as driven by self-interest, he created the metaphysical metaphor of the Leviathan, an “artificial man” or social machine that restrained the dangerous population in the role of cogs in the greater mechanism, ruled by the “artificial soul” of the omnipotent sovereign.

This thesis argues that mechanistic metaphors in science are so dominant that even amongst those who are aware of its limitations and who attempt to grasp the complexity of living systems still tend to regress to reductionist metaphors to make sense of wholes in terms of relationships between parts. That is not to say that scientists themselves are necessarily aware of the pervasive effects of the metaphysic or the ubiquity of its derivative metaphors. In fact the problem is that because the dominant metaphysic claims to be “objective”, they have difficulty identifying it as a metaphysic. In support for the need for more openly speculative metaphysics in science, the physicist David Bohm argued:

it seems clear that everybody has got some kind of metaphysics, even if he thinks he hasn't got any...(T)he practical ‘hard-headed’ individual has a very dangerous kind of metaphysics, i.e. the kind of which he is unaware... Such metaphysics is dangerous because, in it, assumptions and inferences are being mistaken for directly observed facts, with the result that they are effectively riveted in an almost unchangeable way into the structure of thought...⁴⁴

Examined or otherwise, metaphysics and the metaphors they generate appear to be a fundamental means to organise our belief structures and interpret the world. They are created and perpetuated by the interpretative processes that constitute our cultures, societies, and our very experience of reality. As such, the examination of metaphysics and their derivative metaphors as interpretive processes can provide an alternative solution for comprehending irreducible complexity in the sense of grasping their causal role for constraining conscious living systems, like scientists and societies. Metaphors are not limited to linguistic practices but are the basis on which human conceptual systems, including linguistic systems, are structured⁴⁵. They define “schemes of interpretation from context to context”⁴⁶ thus broadly defining our experience of reality, while narratives play a crucial role in “playing out” these definitions at multiple spatio-temporal levels as individuals and societies.

Paul Ricoeur (1913-2005) defined narratives as structures created by living beings in the process of perceiving, creatively configuring and reflectively reconfiguring their experience of time. According to Ricoeur, narratives are continuous processes that involve three phases: a rudimentary pre-narrative or prefiguration involving the perception of symbols

⁴² Ibid pp. 288-291

⁴³ T Hobbes *Leviathan* (Cosimo Classics New York, 2009) p. 27

⁴⁴ D Bohm ‘Further remarks on order’ In C H Waddington (ed) *Sketching Theoretical Biology: Toward a Theoretical Biology Vol 2* (Edinburgh, Edinburgh University Press, 1969) p.41

⁴⁵ G Lakoff and M Johnson, *Metaphors We Live By*, (Chicago: University of Chicago Press, 1980), p 6.

⁴⁶ A Gare *Nihilism Inc* p.358

or signs, developing into a configuration of this pre-understanding into an imagined quasi-world of characters and events linked by causal relations, which can then be applied to reveal and challenge previous conceptions of the world in the third stage of refiguration⁴⁷. The process of refiguring of a world “lays bare a new and alternate view of reality” that conceptually resembles a metaphysical shift⁴⁸. Ricoeur did not intend configuration to be understood as abstraction. Rather, throughout the narrative process, inchoate prefiguring based on symbol perception grounds interpretative processes in the historical causal relations of the “actual” world, even while higher-level meanings ascribed to symbols and their relations may be created and transformed by configuring and refiguring.

Narratives, like Whitehead’s conceptions of creative becoming and imaginative understanding, are temporal and coherent but need have no pre-determined end and no fixed formula. Gare argues that the three dialectical patterns of culture: orientation, recognition and power, are enabled by participation in narrative processes:

What is the relationship between narratives and individuals? It is essentially through narratives that individuals become more than the conditions of their existence. It is individuals who utilise the inherent reflexivity of the narrative form to question the narratives they have been enculturated by and socialised into, who consider alternate versions of these narratives, who begin to construct their lives as unfinished stories in relation to chosen versions of the stories of the communities and organisations within which they are participating, who thereby take responsibility for their own lives and the culture of their society, who are the creative agents of culture, of society and of history. Such people are ‘authentic’ authors of their own becoming⁴⁹

Gare argues for the importance of active participation in reflexive narrative making. According to Gare, while narratives are ubiquitous in human life, they can be limited or impoverished by the dominance of mechanical metaphors, which devalue and obstruct the reflexive processes that enable creativity. Indeed, the concept of narrative itself is a useful metaphor for comprehending the ontological and epistemological complexity of life in a non-reductive way. In contrast to mechanistic metaphors, narrative metaphors imply flexibility and adaptivity, they are both context-dependent yet creative, they are meaningful for the agents that create them/for the characters that inhabit them, and they can transform and evolve over time in relation to their context, including other narratives.

Ricoeur was referring to human life when he wrote “A life is no more than a biological phenomenon as long as it has not been interpreted” but he also implied that human narrative making is grounded in a more rudimentary pre-conscious perception. He argued that human action can only be configured in narrative “because it is already articulated in signs, rules and norms.” He continues: “we are justified in speaking of life as a story in its nascent state” due to the “pre-narrative quality of human experience”⁵⁰. Narrative making in its most

⁴⁷ This process is discussed in W C Dowling *Ricoeur on Time and Narrative: An Introduction to Temps et Recit*. (University of Notre Dame Press, 2011) Chapter 3 Narrativity

⁴⁸ Ibid p.15

⁴⁹ A Gare *Nihilism Inc* p.21

⁵⁰ P Ricoeur ‘Life in quest of narrative’ In D Wood (ed) *On Paul Ricoeur; Narrative and Interpretation* (Routledge London, 1991) chapter 2 p.28

basic sense may be seen as a fundamental property of all life, and not just a human abstraction.

An ontology of natural meaning

Process-oriented nature philosophers attempt to lay the groundwork for a conception of reality that makes creativity and meaning central to an understanding of life. This project should make possible a new conception of biological science that overcomes the present incommensurability between quantifiable objects, and the subjective qualities of experience (for example the matter versus mind problem) by showing that life creates itself primarily in relational processes. Gare contends that the development of process philosophy requires positing categorical schemes as fundamental concepts for understanding the world in terms of interrelated emergent processes, while accepting that it is impossible to precisely define these concepts or their relationship to each other. These categories are: activity, order and potentiality (the categories of the Ultimate); process, structure and event (the categories of experience); cause (the categories of explanation); and spatio-temporal position (the categories of ultimate potentiality)⁵¹. The “Ultimate”, or activity, is equivalent to the concept of energy in physics, and Gare further defines this by analogy to sound: ‘the very being of sound is activity, and no unchanging substratum of activity need be supposed’⁵². Process is further defined by comparison to Aristotle’s concept of energy as ‘enacting of form’, and ‘ultimate potentiality’ refers to concepts that define ‘potential relationships between actual or potential existents’⁵³. It is according to these categorical concepts that process philosophy can develop effective challenges to the mechanistic concepts dominating science and society.

While experience itself is not posited as a category, it is a core project in process philosophy to understand the *becoming* of humans as part of nature. A process-oriented approach to questions concerning human experience of the world, including awareness, cognition and understanding, reconceives epistemology as the study of ‘the cognition and experience of *living, embodied, interacting and inter-signifying natural beings*’⁵⁴. Cognition and consciousness are made possible by more basic biological activities of sensing and responding. The senses are a necessary component/process in productivity as they develop from awareness of immediate environment, to sensing at a distance, to more complex forms of semiosis including human culture⁵⁵. Ricoeur’s idea of pre-conscious perception, involving biological signs, rules and norms as rudimentary pre-narratives, suggests that biological matter is in some way fundamentally *mindful*.

Two further important contributions to this project are the phenomenology of Merleau-Ponty and the pragmatism of Charles Peirce⁵⁶. Both argue for the primacy of lived

⁵¹ A Gare, *Nihilism Inc* p. 312. These categories and some of their related projects are detailed in Chapter 13

⁵² *Ibid* p. 313

⁵³ *Ibid* p.313

⁵⁴ According to M Dix ‘Living and knowing: how nature makes knowledge possible’ *Cosmos and History: the Journal of Natural and Social Philosophy*, 9, 1 (2013) pp.1-34; p.1 (italics original)

⁵⁵ According to the discussion of Schelling and his contribution to biology in A Gare ‘Approaches to the question: what is life? Reconciling theoretical and philosophical biology’. *Cosmos and History, The Journal of Natural and Social Philosophy*. 4, 1-2 (2008) p.69

⁵⁶ M Harney Naturalising phenomenology: a philosophical imperative. *Progress in Biophysics and Molecular Biology* 117 (2015) pp. 661-669

experience as kinds of relational processes, which make possible the qualities of sensation, perspective, and meaning. Both argue that the reality described by reductionistic “scientism” should properly be understood as merely an abstraction of lived experience. Moreover, both approaches extend the conceptions of creativity and meaning beyond cognition, and indeed beyond human lived experience and throughout nature.

Merleau-Ponty argued that our experience of ourselves in the world, including mind or consciousness, is always embodied and relational. In our experience of ourselves, there is no subject/object divide: rather, we are both perceiving subject and perceived object. Perception, as primary experience, is neither subjectively nor objectively grounded but resides in the reciprocal, or dialectical, relationship between subject and object. Perception as bodily knowledge comes before cognition, it is not mediated by mental representations yet it is meaningful. It involves a bodily orientation towards a setting (*attunement*) that is habituated from past experience of interactions with the world, and also anticipatory of potential interactions⁵⁷. Attunement in the world is only possible with our bodily knowledge of what the world allows for us, or *affords*. The ground affords walking, for birds, air affords flying. Our world exists in relation to us, it is not just a passive recipient of our actions upon it, any more than we are passive recipients of external stimuli. Even a minor reflex action expresses an orientation towards a setting, a relation that has been and continues to be created between the organism and its world. Thus meaning, or significance, is not a representation caused in any determinate fashion, but is created “within” relationships between the organism and its world.

There is a need for a “middle term” to describe this creative process⁵⁸, one that can also express the apparent stability of perception and other features of experience. Merleau-Ponty discussed the tendency for life to attain stability through *habituation*: the learning of an embodied, practical intelligence through persistent effort until the desired effect (itself a relation) is achieved or maintained. For Merleau-Ponty, a habit was conceived as a poise or readiness to ground experience, and as such it can serve as a kind of middle term that gives a stable form to a relation, without being determined in the way of a program. It is, rather, an interpretation that is primarily sensory and somatic, not cognitive or even conscious. In other words, the effects of mechanical causation notwithstanding, any relation between organism and world is primarily interpretive rather than determined.

Charles Peirce’s triadic theory of interpretation, semiosis, also embraces this interpretive relational ontology between organism and world. Peirce’s metaphysics of synechism holds that everything exists as a part of a continuous whole. No part is fully separate, determined or determinate, yet in this continuum there are infinite possibilities of determination. Thresholds are conceived according to three categories of experience; Firstness, Secondness and Thirdness⁵⁹. Firstness is immediate, spontaneous feeling or simple sense quality, such as colour, sound or pressure, a single and instant impression. Secondness is whatever is in relation (or reaction) to First, and indeed all phenomena appears as Second to an observer, as discrete perceptions and actualities. Thirdness is in relation to both First and Second: including the observer as interpreter, and any other means of relating, mediating

⁵⁷ Ibid

⁵⁸ Ibid

⁵⁹ These categories are both ontological and phenomenological, according to Peircean metaphysics. S Rosenthal ‘Categories, pragmatism, and the experimental method.’ *The Commens Encyclopaedia; The Digital Encyclopaedia of Peirce Studies* (2001).

or representing. Secondness is a dyadic relation, while Thirdness, triadic relation, includes interpretants: generalities, habits and laws. Peirce's categories are an attempt to reveal irreducible complexity in the universe, for the categories

are conceptions of complexity. That is not, however, to say that they are complex conceptions. When we think of Secondness, we naturally think of two reacting objects, a first and a second. And along with these, as subjects, there is their reaction. But these are not constituents out of which the Secondness is built up. [...] while Secondness is a fact of complexity, it is not a compound of two facts. It is a single fact about two objects. Similar remarks apply to Thirdness⁶⁰

Just as the continuity and complexity of the universe is generated by these conditions, so is the continuity and complexity of sense, perception and interpretation, including meaning, purpose and cognition. These phenomena cannot be explained by dyadic relations.

For Peirce, triadic sign relations comprise a sign object, a sign vehicle that stands for the object, and an interpretant. An interpretant can be roughly defined as an effect of perception of the sign, partly created by the organism itself. For Peirce, signs and the generation of interpretants are all pervasive in nature. Genetic coding and transmission are interpretants, and cognitive or symbolic representations are interpretants peculiar to humans. This three-way relation between object, sign vehicle and interpretant establishes meaning, from the perspective of the organism, as a cause, rather than limiting causes in the living world to the "blind" cause-effect dyadic relations of mechanical forces acting on things or entities. The boundaries between dyadic relations: force, raw sensation, perception and reaction, and triadic relations: mediated self-causing causes, are undetermined and relational⁶¹. The boundary between life and non-life does not coincide with that between Secondness and Thirdness. Living beings, in responding to Second, inhabit the semiotic world of Thirdness, even if the very apogee of Thirdness, human thought, is "regularly under the spell of secondness"⁶². On the other hand, Peirce insisted that semiosis is not limited to minds, nor even to living processes. Peirce's differentiated continuum of relations tends towards increased relational generalities, providing the grounds for his pragmatic view on cognition as a semiotic activity which could only have emerged in a universe wherein more basic forms of "quasi-semiosis" are possible⁶³.

Peirce's theory of semiosis is both telic and pragmatic. It introduces final causation into nature in the sense of the production of meaningful and indeterminate interpretants, it also conceives of this meaning in terms of the consequences that follow the interpretation, allowing for past consequences to be extended as anticipated consequences. Here, "purpose"

⁶⁰ Charles Peirce, 1.526, 1903, cited in Jaime Nuiola 'Complexity according to Peirce' *The Commens Encyclopaedia;The Digital Encyclopaedia of Peirce Studies* (2000)

⁶¹ In recent decades Peircean semiotics has inspired research in interpretive causation in biology. One continuing controversy in this field of study concerns semiotic "thresholds": including the distinction between dyadic and triadic relations, and between hierarchical levels of semiosis. How to conceive and handle such distinctions is critically important for an ecological model, and this subject is further discussed in Chapters 4, 9 and 10.

⁶² R Vila Vernis 'Peircean categories: an old name for a new way of thinking' *The Commens Encyclopaedia;The Digital Encyclopaedia of Peirce Studies* (2007)

⁶³ J L Esposito 'Synchism: The keystone of Peirce's metaphysics.' *The Commens Encyclopaedia;The Digital Encyclopaedia of Peirce Studies* (2005)

is natural, not a cognitive or necessarily even conscious purpose, nor aimed at an ideal evolutionary or spiritual end. Peirce's notion of purpose is like a propensity, disposition or habit grounded in lived experience, similar to Merleau-Ponty's poise or readiness. Peirce's pragmatism, based on lived experience, is comparable to Merleau-Ponty's embodied, habituated knowing. Harney states:

For both Peirce and Merleau-Ponty, our notions of truth and the real are tied to the process of inquiry rather than to any kind of Kantian in-itself, and this helps to explain why we can assert the hypothetical status of the real - in a universe which has an element of non-determinism what else could it be? Our judgements are always fallible and it is for this reason that we engage in practices of scientific testing and experimentation. This is a result of an ontological commitment to a mode of being which is dynamic, animate and includes possibilities and the operation final causation⁶⁴.

According to Harney, Merleau-Ponty's experientially-based dialectical relations in nature can be expressed as semiotic relations. Semiotically, an opposition, or difference, is a relation: a sign vehicle prompting an interpretant of this difference. The interpretant can set up further oppositions or differences, prompting further interpretants. Dialectics concern not just a comparison of two oppositions, or even one acting on the other, but concerns the *relation* of oppositions, a third or middle term bringing into being a synthesis. A opposition can be as simple as: *what is present* as opposed to *what is not present*, or *what is similar* to *what is different*, or *what is self* to *what is not-self*. Complexity-oriented biologists, reviewed in Chapter 4, have been strongly influenced by dialectical and semiotic theories and their capacity for understanding evolutionary, metabolic and regulatory processes, consciousness and the emergence of cognition and knowledge as created in the process of living.

Biological Information

Peirce claimed that semiosis requires an embodied mind, but is not limited to human consciousness. For Peirce, mind is synonymous with Thirdness and is as ontologically fundamental and ubiquitous in the universe as energy or matter. Nor are mind and matter to be considered as separate kinds in Peirce's synechism. Peirce's categories can be seen as a means of organising or codifying energy, from the potentiality of Firstness to the instantiation of Secondness to the establishment of regularity of Thirdness. Energy is effectively transformed or organised into mass with restrictions and regularities of behaviour, thereby constituting not meaningless matter but something formed and capable of informing by means of its own organisation and its relations to other forms: information⁶⁵. The creation of information via relational processes is universal and not limited to living beings, however living beings, unlike non-living forms of energy, have the property of sensitivity. This property is critical to the creation of information by living beings, according to enactivist accounts of consciousness, emotion and cognition.

Enactivism, based on a relational ontology, rejects mechanistic metaphysics on the grounds that this reduces information and meaning for organisms to the "processing" of abstract representations, without explaining how these representations might arise, or even how their

⁶⁴ M Harney 'Naturalising phenomenology: a philosophical imperative' p. 668

⁶⁵ The relations between energy, mass, work and information are considered from a Peircean semiotic perspective by Edwina Taborsky 'Energy transformation and semiosis' *The Commens Encyclopaedia; The Digital Encyclopaedia of Peirce Studies* 2003

importance can be “known” by the organism⁶⁶. Oppositions or differences, whether conceived as perceptions (Secondness) or relations (Thirdness) are sensed by the organism. Felt sensations are responses that reflect the meaning of these differences. These may be further elaborated into cognitive representations of these meanings. Enactivists propose that information is created by the interaction of the organism in the environment by virtue of their sensitivity to whatever might be important in the environment, or in themselves, and sensitivity enables global responses of somatic felt importance that direct “interest-driven” and “phenomenologically charged” behaviours⁶⁷, including higher-order cognitions.

Daniel Hutto, promoting a “radically enactive” account of cognition⁶⁸, contends that only an entirely content-free account of basic consciousness can adequately account for the development of intentional directedness, abstract representations, and more elaborate forms of cognitive processes, that yet retain self-created felt importance⁶⁹. Information treated this way is based on the sensitivity and responsiveness of the organism in its circumstances. Hutto contends that emotional responses understood enactively may take narrative form, including the expression of emotional or behavioural disorders as meaningful responses to life’s problems. Rather than targeting the contents of mind or body (cognitions or affect) as the cause of psychological disorder, he identifies narrative therapy as an effective means of guiding patients to enact different ways of being in the world that enable them to meet their needs⁷⁰.

Taking the position that information concerns the process of knowing, rather than the acquisition of knowledge, Dix argues that theories of self-organising processes and biosemiosis⁷¹ are required to understand experience, living and knowing from cellular to cognitive to cultural levels, and this ‘knowing fits us for life in this world’⁷². Importantly, knowing the world concerns the world of whatever is salient and important to a given organism: it is the perceived world made possible and limited by the organism’s sensory abilities and limitations. Drawing on Jacob von Uexküll’s concept of *umwelt*⁷³, Dix contends

⁶⁶ D Hutto ‘Truly enactive emotion’. *Emotion Review*, 4:1. 2012 pp. 176-181

⁶⁷ D Hutto and E Myin *Radicalizing Enactivism, Basic Minds Without Content*. (MIT Press, 2012) 2012, p-7

⁶⁸ See D Hutto and E Myin *Radicalizing Enactivism, Basic Minds Without Content*

⁶⁹ This embodied-process conception of intentionality is consistent with a consensus view of intentionality from a biosemiotic perspective identified by D Favareau and A Gare: “that intentionality is first and foremost a naturally occurring biological phenomenon rather than the product of human mental activity fundamentally” p-420; in ‘The biosemiotic glossary project: Intentionality’, *Biosemiotics*, (2017) pp. 413, 459

⁷⁰ D Hutto and S Gallagher ‘Re-authoring Narrative Therapy: Opening the way for future developments’ *Philosophy, Psychiatry and Psychology*. 24:2. (2017) pp.157-167

⁷¹ See page 79 for a more complete definition of biosemiosis

⁷² Knowing is intended to include epistemological and biological terms, including perception, memory, learning, experience and significance. In M Dix ‘Living and knowing: how nature makes knowledge possible’ p.5

⁷³ Umwelt translates as the interactive unity of an organism and its world. K Kull ‘Jakob von Uexküll: An introduction’. *Semiotica* 134 (2001) pp.1-59

that an organism's life-world comprises signs that mediate its interaction with the 'world at large'⁷⁴

Biological Time

An ontology of creative becoming rejects Newtonian time as a mathematical absolute. Time is not treated independently of being, but is experienced as a relation, a core thread running through the web of perceptions and relations making up the narrative of lived experience. This thread is decidedly non-linear: "Semiosis is not simply a ternary (triadic) interaction, but a cycle which includes it... Semiosis is the cycle of being, in a very deep sense. It includes a temporal characteristic, however, it does not include a clock. Despite this, semiosis creates time of being"⁷⁵.

In an indeterminate nature wherein lived experience is fundamentally meaningful, yet never certain, where just about anything can be a sign, where oppositions and differences are everywhere, semiosis incorporates not just inquiry and hypothesis but choice and problem-solving. Kull points out that every sign includes at least two options: to use or not use the sign⁷⁶. These decisions are not confined to cognitive representations of options, nor are they determined by learned habits, reflexes or instincts, but occur every time an organism "chooses" to act or respond⁷⁷. Indeed, semiosis can be described as a "general mechanism of choice"⁷⁸.

Choice brings the organismic "present" time as an element of lived experience into semiosis, as choices can only be made with the simultaneous presentation of options⁷⁹. Choice brings change and also brings the possibility of error. Merleau-Ponty also recognised subjective time as an important element of lived experience, observing its cyclical processes connecting history, present and future. Merleau-Ponty observed that the long-term habitual body (*corps habituel*) and the short-term body in the moment (*corps actuel*) have a reciprocal relationship that allows for an ongoing spatio-temporal "recalibration" that functions to "update" bodily orientation over time⁸⁰. The cyclical, narrative temporality of lived experience places the organismic "sense" of time as experienced in the present, in memory

⁷⁴ M Dix 'Living and knowing: how nature makes knowledge possible' p.7

⁷⁵ K Kull 'Organism as a self-reading text; anticipation and semiosis' *International Journal of Computing Anticipatory Systems* (1998) pp. 93-104.

⁷⁶ K Kull 'Semiosis stems from logical incompatibility in organic nature: why biophysics does not see meaning, while biosemiotics does'. *Progress in Biophysics and Molecular Biology* (2015) pp. 616-621

⁷⁷ D Favareau 'Creation of the relevant next: how living systems capture the power of the adjacent possible through sign use' *Progress in Biophysics and Molecular Biology* (2015) p.593

⁷⁸ K Kull 'Life is many, and sign is essentially plural' C Emmeche and K Kull (eds) *Towards a Semiotic Biology: Life is the Action of Signs* (Imperial College Press London, 2011) chapter 6, p.124

⁷⁹ K Kull 'Semiosis stems from logical incompatibility in organic nature' pp. 618-619

⁸⁰ T Carman *Merleau-Ponty (The Routledge Philosophers)* (Routledge New York, 2008) p. 220

and in anticipation, in contrast to the Newtonian concept of absolute, mathematical time independent of any observer.

Summary

Process metaphysics, in contrast to mechanistic metaphysics, describes a world of living entities that continually and creatively participate in their own becoming. It seeks to transcend distinctions between mind and matter, human consciousness and matter. Humans belong to nature, along with all other forms of life. Humanity, including culture and consciousness, can emerge from “natural” causal phenomena because these are not limited to efficient causation, but include reciprocal and dialectical dynamics which are both causal means and ends. In this way, entities, as complex systems, are defined as much by their interrelated spatio-temporal processes as they are by their material being, which itself is means of its own production. Meaning and purpose as valued, end-directed becoming is explicable, even central to a metaphysic of organism rather than machine, and creative becoming rather than matter in motion. Yet end-directedness, while being causal, need not determine or entail any final product, rather life can be an ongoing creative narrative. The metaphor of narrative allows us to conceive the non-determinate coherency of entities as they configure and refigure their meanings, purposes and boundaries. This is a natural process that occurs in the lived experience of living beings, it is not limited to but provides the grounds for cognitive representations of meaning, including language.

Gare identifies the close relationships between philosophies of process and becoming, and the budding sciences of complexity, with their shared projects of understanding activity, process and relational causes in nature. That is, a shared project to understand the processes of the self-organisation of complex systems, including organisms, rather than reducing them to another version of matter in motion. The fundamental activities and emergence of process and structures from a self-organising perspective in biological systems are explored further in the next chapter.

CHAPTER 4

Complexity-Oriented Biology

The science devoted to understanding irreducible complexity had its beginnings in the first "non-classical" science, thermodynamics. In 1865, Clausius coined the term *entropy* to refer to reduction in usable energy, and formulated the second law of thermodynamics, which states that the entropy of an isolated system increases irreversibly over time to a maximum, or thermodynamic equilibrium. This observation was the first challenge to the eternal clockwork universe of Newton, but its more compelling legacies were the questions raised about the maintenance of living systems in the face of entropy. As the physicist Ilya Prigogine (1984) observed, open systems in nature do not end in a state of maximum entropy. Instead, they can increase in order and complexity into a far from equilibrium state. Living systems escape the fate dictated by the second law of thermodynamics by virtue of their ability to import energy and/or matter from their environment, converting, storing and using this energy and/or matter, and exporting non-usable energy and/or matter (entropy) to their environment. The particular specialty of living systems is to continually refine these processes to achieve the most efficient use of energy possible, thus defeating, at least temporarily, the tendency towards entropy¹.

Prigogine observed that far from equilibrium systems, including living systems, are sensitive to small changes or perturbations, which can be amplified throughout the system into new emerging order. The emergent order then constrains the flow of usable energy. Thus can order arise from chaos, and potentially how life itself arose from non-life. Because emerging order is a form of structure that constrains energy flow in the system, it is termed by Prigogine a dissipative structure. Importantly, dissipative structures give coherence to a system, constraining it to behave as a whole. Living systems can now be seen as systems that import and order energy to defeat their own entropy, maintaining themselves in a far from equilibrium state, and functioning as dynamic wholes rather than collections of parts. While emergent order is "caused" by perturbations acting on far from equilibrium systems, the effects of these causes are not proportional to the magnitude of the input. Emergent order therefore depends on *non-linear* causation.

Emergent Order and Irreducibility

The emphasis on the ordering of energy is crucial to a non-mechanistic and non-reductionist conception of causation. The assumption of reductionism is that breaking complex systems down to the smallest parts and the linear relationships between parts is sufficient to explain their behaviour. Reductionist biology seeks to find the most basic units of systems, assuming these have ontological primacy, in a "bottom-up" causal model of the material components and movement of energy in living systems². This assumption underlies projects to determine and control biological functioning according to biochemistry and genetics. In reductionist cellular biology, energy is a mechanical concept, understood as a means by which to measure the capacity for work in joules, fuelled by the synthesis of adenosine triphosphate (ATP) by mitochondria in cells, which convert chemical potential energy into kinetic and thermal

¹ Prigogine, I & Stengers, I. *Order out of Chaos: Man's New Dialogue With Nature*. (Bantam Books, New York, 1984)

² This approach is detailed and critiqued in R Levins and R Lewontin *The Dialectical Biologist* (Cambridge, Mass. Harvard University Press 1985) especially the Introduction and Chapters 1 and 6

energy. Energy in biological systems, like that in machines, is simply force in motion, converted into one form or another³. A reductive approach assumes that there is no validity for claims of causal properties obtaining from emergent levels of order, as these can be reduced to the causal properties of what parts are made of, and how parts act on each other (material and efficient causes). In short, the whole cannot be more than the parts without violating the principle of objective causality.

In contrast, understanding self-organisation in complex systems depends on understanding not just the production of usable energy or the transformations of energy, but the always emerging processes of ordering energy and of change that produce hierarchical levels of organisation. Theories of emergent order are based on the metaphysical assumption that dynamical systems such as organisms cannot be understood according to the analysis of parts, or even part-whole relationships, as reductionist theories attempt to do. Countering the bottom-up reductionist approach are various conceptions of top-down or downward causation, considered by some to be the most important determinate of emergence in biological systems⁴. Downward causation is the view that higher-levels of order constrain the functioning of the whole system, and that this higher-level organisation constitutes the emergence of *novel* causal properties that cannot be reduced to or predicted by the analysis of parts, and indeed that sometimes the parts can only exist in the context of the whole⁵. This means that the emergence of higher-order has to be irreducible to, but still dependent on, lower order, which in turn may only exist due to the higher-order. Various conceptions, and criticisms, of emergence have addressed this challenge, and in particular the apparent violation of causal closure of the physical world that non-linear causation and emergence seems to imply⁶.

The most successful and coherent theories of downward causation are arguably those that focus on dynamical processes, rather than particles of matter, as the basic components of composite systems. This argument is supported by the revelation of quantum physics that “particles” are indeed processes, which imply by definition that organisation rather than matter is fundamental⁷. To consider living systems in terms of component parts obfuscates their nature as self-creating systems⁸. The “parts” of an organism cannot function or survive without being embedded within the whole, their structure and properties are largely derived from the dynamic organisation of the organism as a whole, and furthermore they are the

³ L Wolpert *How we live and why we die: the secret lives of cells*. (London: Faber and Faber, 2009)

⁴ See T Deacon *Incomplete Nature: How Mind Emerged from Matter*. (New York, W.W.Norton & Co, 2013) and S N Salthe What is the scope of semiotics?: Information in living systems. In M Barbieri (ed) *Introduction to Biosemiotics: The New Biological Synthesis*. (Springer Netherlands 2007) pp.133-148

⁵ M H Bickhard ‘Emergence’ In P B Anderson et al (eds) *Downward Causation*, Aarhus, University of Aarhus Press, (2000) pp.322-348

⁶ J Kim *Supervenience and Mind*. (Cambridge, Cambridge University Press 1993) and J Kim ‘Making sense of downward causation’ in In P B Anderson et al (eds) *Downward Causation* pp.305-321

⁷ See M H Bickhard ‘Emergence’ and R J Campbell and M H Bickhard ‘Physicalism, Emergence, and Downward Causation’. *Axiomathes*, 21,(2011) pp. 33-56

⁸ P Humphreys ‘How properties emerge’. *Philosophy of Science* 64 (1997) pp. 1-17

product of evolutionary processes that have constrained the development of the organism as a whole.

Further support for the emergence of causal properties at higher-levels of organisation comes from mathematical simulations showing that the random interaction of “cells” following simple iterated operations can produce regular, but not predictable, complex patterns at a global level⁹. Similarly, non-linear mathematical equations using a recursive computational logic wherein solutions out are also values in tend to produce regular but non-predictable solutions, the values of which can be mapped to show distinctly repetitive but non-identical trajectories known as “attractors”: a statistical tendency for values to converge into a similar pattern that is regular yet chaotic. The emergence of order cannot be reduced to or predicted by initial causes, nor can emergent order determine all future states or processes of a far from equilibrium system, whether in computer simulations or in natural organisms. Thus complexity theorists describe these systems as *non-linear*, and are interested in non-deterministic causes of their behaviour including boundary conditions and dynamic processes. These are termed *constraints* on energy flow and change, including emerging order and functional relations.

Theorists of self-organising complexity in biology are often concerned with how these processes constrain the origin and evolution of species (phylogeny), embryonic development (ontogeny), and the origin of life itself. A core concept concerns the understanding of living beings as active agents in their own evolution, with their own organisational principles “imposed between the genes and the environment”¹⁰. “Adaptation” involves the development of life strategies by organisms actively maintaining themselves¹¹. This conception raises the issue of the nature of purposeful behaviour in living systems.

The reductive explanation for the behaviour of living things is defined according to the inheritance of a biological program. Most mainstream biologists assume that Darwin’s theory and the discovery of genetic mechanisms in heredity has fully negated any teleological principle in nature and cemented the mechanistic-materialist view for good¹². Natural selection, not the organism, is seen as the active agent in evolution, indeed the organism is reduced to no more than the manifestation of the interplay between internal genetic forces and external environmental forces. This strictly “bottom-up” perspective means “biology has been dominated by ontological reductionism that is more committed to explaining away life as an effect of physical processes rather than grappling with the question ‘What is life?’”¹³.

In excluding the role of the organising processes of the organism, the metaphor of the biological program begs the “purpose” or final cause of such a program. The biologists Levins and Lewontin argue that mechanistic theories of change and order in evolution presuppose linear progress, such as increasing complexity, diversity, and stability or

⁹ “Kauffman models” described in S Kauffman *The Origins of Order: Self-Organisation and Selection in Evolution*. (New York, Oxford University Press, 1993)

¹⁰ B Goodwin ‘Organisms and minds as dynamic forms’. *Leonardo*, 22, (1987) pp. 27-31, p.29

¹¹ Ibid

¹² While still allowing for biologists to use telic language on an ‘as if’ principle, according to E Mayr ‘Teleological and Teleonomic: A New Analysis’. *Boston Studies in the Philosophy of Science* (1974) XIV, pp. 91-117

¹³ A Gare ‘Approaches to the question: what is life? Reconciling theoretical and philosophical Biology’. *Cosmos and History, The Journal of Natural and Social Philosophy*. 4, (2008) p.59

homeostasis, and assume a tendency in evolution towards perfection of "fit" between species or entity with environment. They suggest that these assumptions constitute a teleologic account of evolution, with superior fitness standing in for a final cause¹⁴. Deacon¹⁵ and Hoffmeyer¹⁶ also argue that mainstream biology both (covertly) relies upon and (overtly) rejects the phenomenon of end-directed behaviour in organisms.

Mayr also noted the tendency for biologists to use teleological language in explanations for the behaviour of organisms, while at the same time denying the validity of anything other than efficient causes and "bottom-up" causal pathways in biology. Mayr argues strongly against any form of deliberate goal-directed behaviour in organisms, and proposes that biologists should differentiate between *teleomatic* behaviour (determined by physical laws) and *teleonomic* behaviour, which he defines as that governed by a program that incorporates an end¹⁷. According to this conception, organisms engage blindly in end directed behaviour, without awareness or agency with regards the "program" they are following. Thus biologists avoid teleology by assuming that past consequences account for the evolution of these functions or programs by natural selection. This results in effectively passing the agency buck down the line to the genes, so that genes are now endowed with the properties of "strategies" that prevail or fail. Yet the claim that genes, as groups of molecules, can be said to possess a strategy seems inherently flawed¹⁸. How could such strategies, and genes themselves, have come about? What in nature makes this possible? In retaining a mechanistic view on organisms, biology assumes they are machines run by genetic programs. Unlike machines, organisms have somehow created and varied themselves, and their 'programs', in the process of maintaining and reproducing their forms¹⁹. In short, the problem with biology is that by "appealing to the design of regulatory devices designed to produce end-directed mechanical tendencies, we are already assuming what we need to explain"²⁰ This requires a theory of dynamic organisation based on and in organisms themselves, not just analysis of their components or forces acting on them²¹.

Complexity and evolution

Non-mechanistic theorists have highlighted the inherent difficulties in reductive, bottom-up approaches in biology and propose that organisms are far more active participants in their own creation and self-maintenance than the latter view allows. Levins and Lewontin challenge the linked assumptions of increasing complexity and fitness in evolutionary theory

¹⁴ R Levins and R Lewontin, *The Dialectical Biologist* Chapter 2

¹⁵ T Deacon *Incomplete Nature: How Mind Emerged from Matter*. New York, W.W.Norton &Co See chapter 4.

¹⁶ See J Hoffmeyer *Biology is immature semiotics'* in C Emmeche and K Kull (eds) *Towards a Semiotic Biology: Life is the Action of Signs* pp. chapter 3, p.44

¹⁷ E Mayr 'Teleological and teleonomic: A new analysis' *Boston Studies in the Philosophy of Science*. XIV, (1974) pp. 91-117, p.97

¹⁸ J Hoffmeyer 'Biology is immature semiotics' p. 45

¹⁹ The influence of the mechanistic metaphysic on Darwin's theory has obscured the importance of these questions in biology, according to T Deacon *Incomplete Nature* chapter 4

²⁰ *Ibid* p.138

²¹ B Goodwin 'Organisms and minds as dynamic forms' p.28

with the observation that complexity is found on every spatio-temporal level of ecosystems and organisms, whether ancient or contemporary. How can bacteria be measured as more or less complex than vertebrates? In the relational domain alone, both have predators, parasites, competitors and symbionts. And these "primitive" forms of organisms persist and succeed for billions of years without "needing" to "evolve". The ancient lineages of bacteria easily overwhelm the more complex mammals with their million-plus species, thriving in every environment on Earth yet encountered²². Complexity pervades every aspect of life²³ yet even when evolutionary theorists acknowledge this, they still tend towards linear assumptions regarding increasing complexity as evolutionary progress according to an overarching metaphor of fitness²⁴. Furthermore, following Darwin, the mainstream view of evolution has assumed an essentially linear process of change occurring in very small steps²⁵.

In *Life's Grandeur*, Stephen Jay Gould explains that while Darwin denied the need for any direction in evolution, referring to non-linear metaphors such as a tree of life, and to an interconnected web, these metaphors were not well developed. Models of gradual, slow change tend to invoke more linear metaphors, such as the ladder metaphor developed by Thomas Henry Huxley and Othniel Marsh depicting of the evolution of horses from ancient eohippus with its many toed feet at the bottom rung, to the allegedly more evolved penultimate species: the modern single toed horse at the top. However, as Gould points out, far from resembling a ladder, the phylogeny of the equidae resembles a many branched bush, with no discernable central trunk, and with considerable irony he notes that far from being an evolutionary success story, the equidae are today represented only by a single surviving twig, the genus equus, in comparison to the success of rodent families with their many surviving branches²⁶.

In contrast to linear metaphors are those which attempt to capture complexity and processes. Kauffman and Johnsen²⁷ accept the concept of fitness as being superior adaptation to the environment, including other organisms, and use the metaphor of a fitness landscape, with peaks and valleys to represent the relative fitness of species. However, while the metaphor of peaks suggests upwards progress towards superior fitness, they define fitness as relative and temporary, not absolute. They describe a fitness landscape in motion, wherein the fitness of all species is affected by that of all others, and like the Red Queen in *Through the Looking Glass*, everyone must keep running merely to stay in one place. The fitness landscape metaphor illustrates irreducible interrelatedness of different spatio-temporal levels of organisation (in this case, between species).

Kauffman and Johnsen were interested in exploring processes underlying the occurrence in nature of large, non-linear events, such as mass extinctions and also explosions

²² See R Levins and R Lewontin *The Dialectical Biologist* Chapter 2

²³ The theme of R Sole and B Goodwin *Signs of Life: How Complexity Pervades Biology*. (Basic Books, 2001)

²⁴ Evolution is mistakenly conceived as though it concerns increase in complexity, according to S J Gould *Life's Grandeur*. (Harmony Books, 1996)

²⁵ See R Levins and R Lewontin *The Dialectical Biologist* Chapter 2

²⁶ S J Gould, *Life's Grandeur*, (Harmony Books, 1996) chapter 5

²⁷ S Kauffman and S Johnsen 'Coevolution to the edge of chaos: coupled fitness landscapes, poised states, and coevolutionary avalanches' *Journal of Theoretical Biology* 149, 1991, pp. 467-505.

of new species, the punctuations in evolution noted by Gould, in an attempt to reconcile these phenomena with the gradual changes in phylogeny produced by mutation and selection. Drawing on their work, and using piles of sand as simple representations of non-equilibrium systems (compared with evenly distributed sand), Bak showed that these systems were susceptible to minor perturbations, such as the addition of grains of sand, which could then produce dramatic, systemic changes, such as avalanches, once a critical threshold is reached²⁸. Bak and his colleague Kim Sneppen²⁹ also used simple computer simulations in an attempt to establish whether this phenomenon of self-organised criticality was an endogenous feature of far from equilibrium systems in nature. They simulated organisms in an ecosystem by arranging random numbers representing fitness between 1 and 0 in a circle, and at each time step, the lowest number, and the numbers at its two neighbours, are each replaced by new random numbers. They found that initially, the average fitness values increased as the lowest were eliminated. Then, as all values reached a threshold of around 0.66, the next value to be selected would start an avalanche or an extinction event as its neighbours and their neighbours are reassigned values and can likewise be eliminated.

From these results, Bak concluded that far from equilibrium systems abound in the living and non-living world, that life is continually being shaped by the behaviour of far from equilibrium dynamics, and that minor perturbations such as small variations in fitness can lead to the extinction of a single species, triggering an avalanche of extinctions in the wider ecosystem. He further concluded that self-organised criticality is the general mechanism that generates self-organisation in nature, and that it is consistent with Darwinian concepts of random mutation and natural selection, providing a robust non-linear alternative to linear metaphors for evolution. According to Bak, nature experiments with mutations until it arrives at a temporarily stable complex network of interacting organisms via a process of self-organisation, however this stable state is also a critical state. Being far from equilibrium, it is susceptible to perturbations, including endogenous variations by mutation, which can trigger "avalanche" extinction events, freeing ecological space for survivors to diversify and exploit as the cycle of nature's experimentation begins again. The critical state with fluctuations and avalanches of all sizes and all levels, including catastrophic, is the most efficient in terms of retaining self-organising stability³⁰. Indeed, highly ordered states may be most vulnerable to minor perturbations triggering catastrophic events. It is the non-linear dynamics in the critical state that constrains individual organisms and whole species to influence each other, such that the fate of one species is linked to that of many others.

Bak, Kauffman, and their colleagues' work flags the need for a profound rethinking of the notion of fitness. Their simulations suggest that fitness as a superior survival value, albeit temporary, is a redundant concept. In the stable, complex network of self-organised criticality, both individuals and species are by definition equivalently "fit" relative to each other. Yet they may remain vulnerable to elimination due to their susceptibility to minor variation, rather than to inferior fitness. Indeed, as Bak and Kauffman note, those species at the peaks of the fitness landscape would have nowhere to go but down. In other words,

²⁸ Per Bak *How Nature Works: The Science of Self-organised Criticality* (New York, Copernicus Press 1996)

²⁹ P Bak and K Sneppen 'Punctuated equilibrium and criticality in a simple model of evolution' *Physical Review Letters* 24 1993

³⁰ Similar behaviours or patterns recurring in multiple spatio-temporal scales within a finite space is a definition of fractal geometry. Bak's most efficient self-organised criticality describes fractal organisation.

species that are the fittest in the sense of being most attuned to their environment, are also the most vulnerable to variation, and therefore elimination.

Thus adaptation may come at the price of adaptability, a paradox noted by the 19th century American palaeontologist Cope in his influential *Doctrine of the Unspecialised*³¹, stating that highly specialised forms descend from less specialised forms, on account of the latter being more adaptive to changing conditions, and the former being more susceptible to changing conditions. In short, there is a good argument for unspecialised, small, and relatively simple forms to have superior fitness in terms of greater adaptability and reduced sensitivity to change. This inherent contradiction in the notion of fitness does not negate the concept, rather it explicates it as a dialectic rather than a linear concept.

Dialectical biology

The dialectics of self-organising processes have been more fully explored by the evolutionary biologists Maturana and Varela, the originators of autopoietic theory, who replaced the notion of an organism adapting itself to its environment, to one where living and non-living systems are in congruence with each other and change together. Self-organisation occurs within the organism, and with the environment, and structural change and variation is a continual feature in self-organisation at every spatio-temporal scale³². They further elaborate on the inseparability of organism with environment, in that the organism's environment is its domain of existence that emerges with the realisation of the organism's way of living. These relations of reciprocal causality underpin autopoietic approaches. As Varela explains: "the organismic dialectic of self is a two-tiered affair: on the one hand the dialectics of identity of self, and on the other hand the dialectics through which an identity once established brings forth a world from an environment."³³ It is important to note that Varela does not view himself as a constructivist in the sense that organisms are constructing their worlds arbitrarily, rather his position is dialectical: that organism and world create each other.

Likewise, Varela's ontology and epistemology are two sides of a coin. He argues that an organism creates its own distinctions between what is itself and what is other, biologically and with awareness. An observer of the organism is not a discrete entity observing a discrete entity, but also makes her own distinctions about primary beings and their relations. The dialectical view of entities transforms the subject-object relation of mechanistic causation, including the multiple causation of pseudo-holistic models like the BPS model, to one in which, as Levins and Lewontin put it, "the whole...is not simply the object of interaction of the parts but is the subject of action on the parts"³⁴. According to Maturana and Varela, an entity is defined not by its constituents but by the act of it making itself. Importantly, the primary process in evolution is not selection for optimal fit, therefore there is no optimal

³¹ Cited in S J Gould *Life's Grandeur* pp. 164-166

³² See H Maturana and F Varela *Autopoiesis and Cognition: The Realisation of the Living*. (Dordrecht, Netherlands, 1980)

³³ F Varela (1992) Autopoiesis and a biology of intentionality. In B McMullin and N Murphy (eds) *Autopoiesis and Perception: A Workshop with ESPRIT BRA Addendum 3352* (Dublin University, 1992) p.14

³⁴ R Levins and R Lewontin *The Dialectical Biologist* p.273

adaptation in behaviour, structure or organ. Instead there are variations that continually occur and persist as long as they are viable. This process is termed evolution by natural drift³⁵.

Dialectical dynamics tend to constrain cyclic and hierarchical processes rather than linear or cumulative processes. Levins and Lewontin point out that historical geology describes cycles such as orogenic processes raising mountains, and erosion wearing them down again, a cycle that varies in duration over aeons of time, with continual variation of the landscape but no general direction and only the appearance of stability. At the other end of the scale, in living systems, opposing forces can work together in negative feedback relations to maintain dynamic stability at much faster rates. For example, rising blood sugar levels trigger the release of insulin, which increases utilisation of sugar in cells, then as blood sugar drops, glycogen, fat or protein can be converted to raise levels again. According to Levins and Lewontin, persistence and equilibrium are the exceptional circumstances requiring explanation³⁶, a view that stands in stark contrast to the classical mechanistic conception of homeostasis and a "state" of health, or even holistic notion of health as harmonious balance³⁷.

Dialectical processes, from regulation of blood sugar in the human body to geological transformations, can be seen as regulated by oscillations with different spatio-temporal rates. Oscillatory patterns occur in complex systems as a result of interplaying 'opposing' forces that serve to constrain the functioning of each spatio-temporal level³⁸. At the most basic conceptual level, oscillations occur between pre-existing order and chaotic variations, establishing new order which is then subject to variation, and so on. Oscillatory patterns are pervasive (perhaps ubiquitous) in biological systems and can be understood as constituting dynamical fields of activity. An example of this is the effect of gradients of chemical substances which function to orient cellular activity, such as the effect of insulin described above. Other examples of oscillatory patterns in regulatory and metabolic processes are offered by Sole and Goodwin³⁹, who also draw on mathematical modelling to contend that stability is achieved by stable oscillations rather than homeostasis⁴⁰. Sole and Goodwin cite research on E.coli bacteria⁴¹ (Ko et al, 1994) to show that even when genotype and environmental conditions are uniform, bacteria spontaneously vary in their enzyme activity rates. Moreover, an oscillation in growth rates between cells occurs. Overall, the distribution of E.coli phenotypes maintained a constant average, but cells transformed their growth rates from faster to slower and back again with a regular yet unpredictable rhythm, and many

³⁵ In H Maturana and F Varela *The Tree of Knowledge; The Biological Roots of Human Understanding* (Shambala, Boston, 1992) chapter 5, also see H Maturana and J Mpodozis 'The origin of species by means of natural drift'. *Revista Chilena de Historia Natural*. 73 (2000) pp. 261-310

³⁶ R Levins and R Lewontin *The Dialectical Biologist* p.280

³⁷ *Ibid* p.274

³⁸ Functionally, these dialectical 'oppositions' serve to complement each other, not conflict with each other.

³⁹ Including cell growth and division, the menstrual cycle, and cardiac rhythms. In R Sole and B Goodwin *Signs of Life: How Complexity Pervades Biology* Chapter 4

⁴⁰ These limit cycles keep oscillations within a range of tolerance via negative feedback processes. *Ibid* p. 98

⁴¹ E P Ko, T Yomo and I Urabe 'Dynamic clustering of bacterial population' *Physica* 75 (1994) pp.81-88, cited and discussed in R Sole and B Goodwin *Signs of Life: How Complexity Pervades Biology*. pp.62-64. Further examples of bacterial and cellular research are given in Chapter 3.

different switching sequences were involved in this variation⁴². Overall, what emerges in the studies discussed by Sole and Goodwin is a field effect.

According to a definition offered by Anton Markos⁴³ all components in a field are affected by changes in any of the constituent components. This activity is intrinsic to the field itself, not caused by external forces, although external forces can disturb the field. Considering organisms as whole self-organising systems entails the consideration of how field dynamics constrain the activity of all components of the system.

Biological field theories

Biological field theories were developed in the early 20th century, involving the work of Joseph Needham, Paul Weiss, J H Woodger, and C H Waddington among others. These theorists rejected the revival of vitalism⁴⁴ as an alternative to mechanistic theories of causation in biology, and instead investigated relationships between material substrates of organisms, and various concepts of supramolecular ordering processes. This research trajectory developed a core metaphor of *morphogenetic field*: uniting the concepts of organizing processes, and organization as structure, in order to understand the genesis of organismic forms⁴⁵. Their approach “paved the way for molecular biology, although the holistic premises from which they operated would be largely lost on later generations of molecular biologists”⁴⁶.

Waddington explored the capacity for biological systems (cells, organisms and populations) to regulate their phenotypical development to be robust to environmental and genetic variations, using the term homeorhesis⁴⁷ to describe the tendency of robust developmental trajectory in preference to homeostasis (the tendency to return to a steady state). Waddington proposed that fields comprised all components and conditions that enabled developmental pathways or “chreods” that guide cellular development towards a phenotypical endpoint. He used the metaphors of valleys and forks (chreods) within an epigenetic landscape⁴⁸, wherein pathways channel development much like marbles rolling downhill towards the endpoint, a process he termed canalization⁴⁹. The endpoint itself he

⁴² Ibid p.63

⁴³ In A Markos *Readers of the Book of Life: Contextualising Developmental Evolutionary Biology* (Oxford University Press 2002) p.94

⁴⁴ Led by Henri Bergson and Hans Driesch, who drew upon Aristotle’s concept of the immaterial life-substance “entelechy” as the generator of the structures and functions of life. In M Bischof ‘Holism and field theories’ In J Chang, J Fisch and F A Popp *Biophotons* (Springer Science, Kluwer, 1998) pp.375-394

⁴⁵ M Bischof ‘Holism and field theories’ p.377

⁴⁶ Ibid: p-379

⁴⁷ C H Waddington *The Strategy of the Genes* (George Allen and Unwin London, 1957) p. 23

⁴⁸ Ibid pp. 30-33. A similar metaphor to the fitness landscape of Kaufmann and Bak

⁴⁹ Ibid p. 19

described as an attractor. Waddington's work emphasized the regulatory effects of the field on gene expression, rather than genetic determinism, in development of the phenotype.

Waddington's concept of robustness is now acknowledged as an important concept in understanding causal processes in adaptability, evolution and development⁵⁰. Masel and Siegel argue that the degree of robustness, defined as the tendency for a system to produce invariant outcomes despite perturbations, has implications for the adaptability of organisms. The degree of robustness governs the buffering effects of genetic mutations and other perturbations. Partial robustness is thought to provide a pre-adaptive advantage by allowing the system to respond to mutations and perturbations at a rate of variance suitable for selective processes to limit potentially maladaptive effects. Greater robustness has the effect of buffering more strongly against variations, one consequence of which is to accumulate cryptic genetic mutations. If robustness is then impaired, perhaps by a major perturbation, the accumulated variations are "revealed": expressed as larger phenotypical changes that may be maladaptive or adaptive⁵¹.

In their review of genetic mechanisms affecting variance of robustness, Masel and Siegel acknowledge that there may be intrinsic properties of non-equilibrium chaotic systems⁵² that also affect robustness. An example of this is dynamic coherence: an intrinsic, self-organising quality of dynamical fields. Inspired by superconductivity in physics, theoretical physicist Herbert Frohlich introduced concepts of functional coherence based on electrical excitation states of a whole biological system. Given a minimum input of metabolic energy, the dipolar electric field of living systems produces a steady state of excitation that corresponds to the lowest frequency collective mode of electric polarisation. This single excited mode produces a highly ordered coherent electrical vibration capable of producing macroscopic regularity in the behaviour of the whole system. In other words, coherent oscillatory frequencies constrain intrinsic non-equilibrium robustness at a whole-system level. Frohlich termed this property of bio-functionality "coherent excitation"⁵³.

Noting Russian research showing that living systems are highly sensitive to extremely weak coherent electromagnetic radiation in the microwave frequency range, Frohlich argued that in the absence of any evolutionary need for this sensitivity, organisms must have this sensitivity because they employ these frequencies in the form of coherent excitation for the coordination of their biochemical reactions, of which there can occur some 100,000 or more per second per cell. Frohlich went on to show that cells can co-ordinate their behaviour with each other over large distances provided they oscillate with the same frequency⁵⁴. Sole and Goodwin also assert the importance of frequency in intercellular communication and biological regulation, stating that "the frequency coding of physiological signals is more

50 J Masel and M Siegel 'Robustness: mechanisms, and consequences' *Trends in Genetics*. 25, 9 (2009) pp.395-403

51 Ibid pp. 399-400

52 i.e. those properties that are not the direct product of natural selection, and do not require an "adaptive explanation" Ibid p. 399.

53 H Frohlich 'Long range coherence and energy storage in biological systems' *International Journal of Quantum Chemistry* (1968) pp. 641-649

54 Ibid

reliable than amplitude control”, comparing this with electronic devices wherein frequency control is a reliable means of causing resonance in an appropriately tuned receiver⁵⁵

Commenting on Frohlich’s work, G. J. Hyland states:

It should be appreciated that this new frequency-selective interaction can facilitate a whole sequence of biochemical events; for provided a minimum rate of energy supply is available to establish the cellular coherent oscillations in the first place, a force can come into play, which is dependent (through the associated electro-strictive deformation) on the state of development of the system, and which, in turn, can influence its future development.”⁵⁶

Also drawing on Frohlich’s work, Mae-Wan Ho comments that in highly coherent systems, “the tiniest possible amount of energy is subject to correlated transfer between an arbitrarily large number of space-time points in the field with minimum loss”⁵⁷. Ho adds that in the case of organisms, a high degree of coherence can be achieved when oscillatory frequencies are coupled together. Energy fed into one frequency is propagated into all coupled frequencies. Given that energy input is not great enough to be disruptive, it tends to maintain a particular pattern of order, or, as Frohlich put it: “long- range phase correlation (coherence)” providing stability to far-from-equilibrium systems⁵⁸. Like Ho, Hyland argues that Frohlich’s work shows that the electromagnetic fields of organisms, and in particular their properties of coherent oscillation, are crucial for understanding macroscopic dynamic regularities of the whole. The concept of coherent excitation offers a causal process underlying biological properties of both stability and sensitivity: frequency-dependent hypersensitivity in bio-electric fields occurs with even extremely low electromagnetic energy inputs, providing a medium for non-linear causation and communication between all elements of a field.

The importance of coherence and communication processes is highlighted when the complexity of biofields is considered:

The electromagnetic frequencies emitted from the body span across a vast range of the electromagnetic spectrum, from extremely low frequency (brain and heart waves) to infrared, visible light, ultraviolet, and gamma radiation from the potassium-40 isotope, and each of these signals would be expected to carry bio-information... There are also endogenous magnetic and electric fields of life associated with nerve activity, membrane potentials, and voltage-gated membrane channels... acoustic waves from the heart and blood flow constitute another dimension of the biofield... other types of

⁵⁵ R Sole and B Goodwin *Signs of Life* pp. 106-107

⁵⁶ G J Hyland ‘Frohlich’s coherent excitations and the cancer problem: a retrospective overview of his guiding philosophy’. *Electromagnetic Biology and Medicine* 28 (2009) pp. 316-329, p.321

⁵⁷ M W Ho *The Rainbow and the Worm* (World Scientific, London 2008) p-151

⁵⁸ H Frohlich ‘Long range coherence and energy storage in biological systems’ p-642

fields with properties distinct from conventional electromagnetic fields such as longitudinal waves and subtle energies that also comprise the biofield⁵⁹.

The co-ordination of the excitatory/inhibitory activity of neurons as they respond to sensory stimuli is described by complexity-oriented neurobiologist Walter Freeman as follows:

The visual, auditory, somatic, and olfactory cortices generate dendritic potentials that oscillate at frequencies from 1-100 Hz. These waves reveal macroscopic activity arising from synaptic interactions of millions of neurons. They share a spatially coherent oscillation as a “carrier,” by which spatial patterns of amplitude modulation (AM) are transmitted in distinctive configurations, when subjects receive sensory stimuli they have learned to discriminate.⁶⁰

Freeman considers that the properties of coherent oscillations, or more accurately oscillatory patterns, in the brain can account not only for co-ordinated responses to sensory stimuli, but also learning, memory, and even subjective meaning. With reference to the self-organised criticality of living systems described by Bak, Freeman and his colleagues have explored the implications of considering the brain as “a highly unstable organ that maintains itself in a global state of self-organised criticality”⁶¹, especially the brain’s ability to respond rapidly to input perturbations. Freeman et al propose that coupled oscillations between large numbers of excitatory and inhibitory neurons provide macroscopic regularities that can be described as spatial patterns of neuronal activity. In the absence of stimuli, these patterns comprise a high dimensional (many variable) basal chaotic attractor wherein the wave form of oscillations is similar across scales: it is fractal. Exposure to stimuli abruptly alters chaotic, basal organization towards a low dimensional attractor or “local memory basin” for the duration of the stimulus, after which the system returns to the basal pattern⁶². Experiments on the olfactory bulb of rabbits support the proposition that responses to specific sensory stimuli (in this case, odour detection and recognition) involve the creation of a stereotypical spatial pattern of the amplitude modulation of a coherent carrier wave⁶³. In this way, cell activity is co-ordinated by patterns which contain and carry stimulus-specific information.

Stereotypical patterns are learned via reinforcement or “habituation”, but can be rapidly de-habituated and replaced by new patterns when novel stimuli are reinforced, and just as rapidly re-instated again. Importantly, habituation serves to filter out irrelevant “noise”. This mitigates the sensitivity to fluctuations of the brain as chaotic system by constraining responses to perturbations on chaotic basal neural activity to those that are recognized as representing useful information. Oscillations therefore not only carry but also create “information”, by constraining the formation of spatio-temporal patterns according to

⁵⁹ B Rubik and H Jabs The human biofield: opportunities and challenges. *Cosmos and History: The Journal of Natural and Social Philosophy*. 14, 1, (2018) pp. 153-162, p.158

⁶⁰ W J Freeman and J M Barrie ‘Chaotic oscillations and the genesis of meaning in the cerebral cortex’ In *Temporal Coding in the Brain* (Berlin Springer Verlag 1994) p.13 pp. 13-37

⁶¹ W J Freeman, M D Holmes, B C Burke and S Vanhatalo ‘Spatial spectra of scalp EEG from awake humans’ *Clinical Neurophysiology* 114 (2003) pp. 1053-1068

⁶² R Kozma and W J Freeman ‘Chaotic resonance: Methods and applications for robust classification for noisy and variable patterns’ *International Journal of Bifurcation and Chaos* (2000) 11, 6 pp. 1607-1629, p. 1614

⁶³ W J Freeman and B Baird ‘Relation of olfactory EEG and EMG to behaviour: Spatial analysis’ *Behavioural Neuroscience* (1987) pp. 393-408, p.407

the amplitude modulation of a chaotic but coherent carrier wave. This means that the organization of neurological spatial patterns are robust to corruption by background noise⁶⁴.

Freeman compared conventional network and holistic approaches to measuring cortical activity, and argued that rather than the former method of measuring linear basis functions giving amplitude and phase relations at specific frequencies, EEG sampling of holistic neuronal activity should be spaced to capture coherent, fractal wave forms. As regards EEG array recordings produced in animal experiments, he observed that: “The information that served for spatial pattern classification with respect to behaviour was nonlocal, having the appearance of interference patterns”⁶⁵. From these biofield theories, organismic form can be understood as robust but dynamic patterns of oscillatory waves, and that these patterns are sensitive to specific energy perturbations.

Sankaran and Hankey assert that there is now no doubt self-organised criticality (SOC) is “a central strategy of organism regulation”⁶⁶. They emphasise that “points of criticality”, conceived as loci of regulatory control, maximise the efficiency of regulatory processes and produce fractal patterns⁶⁷. Discussing SOC dynamics in self-awareness, the directing of attention and movement, and creative cognition, they contend that mind is embodied in a locus of criticality in the brain⁶⁸.

Chladni patterns: an acoustic analogy for semiotic biofields

Theories concerning biofields emphasise the perturbation of a great many components by a constant energy source, the coupling of oscillatory activity amongst these components, and the emergence of global, coherent dynamical spatial patterns. These patterns then co-ordinate and constrain the behaviour of the whole in at least three interrelated ways: by enabling sensitivity to select perturbations (and dampening others), and by virtue of selective sensitivity, allowing spatial transitions between higher and lower dimensionality in response to select perturbations, and temporal transitions: learning, creating, sustaining, forgetting, and remembering spatial patterns. Thus perturbations create spatio-temporal forms, which then constrain sensitivity to perturbations: a recursive relation with an overall tendency towards maintaining form in a range of coherent variations.

Mathematical models of spatio-temporal variations in a finite space have contributed the notions of attractors and fractal geometry in living systems, providing useful metaphors for grasping how the interplay of chaos and order might organise living systems. However, these models lack the property of selective sensitivity, a key aspect of life fields.

Inspired by the process philosophy of Whitehead and Gare, McLaren argues that acoustic metaphors are most appropriate for understanding nature as fundamentally

⁶⁴unlike inanimate chaotic systems which tend to amplify divergences between components over time. In R Kozma and W J Freeman ‘Chaotic resonance: Methods and applications for robust classification for noisy and variable patterns’ p-1607

⁶⁵ W J Freeman, M D Holmes, B C Burke and S Vanhatalo ‘Spatial spectra of scalp EEG from awake humans’ p.1054

⁶⁶ K Sankaran and A Hankey ‘Experience information as the basis of mind: Evidence from human decision making’ *Progress in Biophysics and Molecular Biology* 131, (2017) p.370

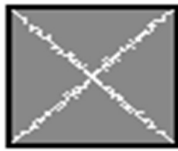
⁶⁷ Ibid p.373-374

⁶⁸ Ibid .373

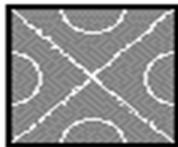
vibrational⁶⁹, as these capture spatio-temporal processes such as frequency and amplitude, and allow for dynamical organisation according to relations of regular rhythm and creative melody, including the self-stabilising variability of living systems⁷⁰.

Alongside Freeman’s observation that spatial patterns produced by neuronal oscillations have the appearance of interference patterns, and Sankaran and Hankey’s conception of loci of SOC in regulation, suggest that comparison with frequency-sensitive and acoustically generated Chladni⁷¹ patterns is useful to develop biofield metaphors further.

All inanimate objects have frequencies at which they vibrate when disturbed by an energy source. These frequencies are determined by the properties of the object, from the chemical bonds of its molecules, to its density, size, temperature and so on. The frequencies at which an object vibrates are associated with standing wave patterns, known as a Faraday wave. When an object or medium vibrates at one of its harmonic frequencies, the incident waves from the source interfere with the reflected waves from the boundaries, resulting in an interference pattern of stable nodes and vibrating antinodes. These standing wave patterns represent the lowest energy vibrational modes of the object: those that result in the highest amplitude vibrations with the least input of energy. The higher the frequency, the more complex the patterns are. The diagrams show (A) first and (B) second harmonic standing wave patterns. At any frequency other than a harmonic frequency, the interference of reflected and incident waves results in a disturbance of the medium that is irregular and non-repeating.



Pattern A



Pattern B

These standing wave patterns can be demonstrated using a metal plate, a violin bow and sand, which is sprinkled evenly on the plate. The plate is strummed, producing a tone, and begins vibrating. A standing wave pattern is produced in the medium, and the sand settles on the stable nodes of the interference pattern. This forms a pattern on the plate known as a

⁶⁹ McLaren asserts that in a vibrational ontology, making conceptual distinctions between vibration, oscillation and wave is not necessary or helpful: G McLaren ‘Climate change and some other implications of vibratory existence’ *Cosmos and History: The Journal of Natural and Social Philosophy* 5, 2 (2009) pp.134-160

⁷⁰ McLaren adds that an acoustic metaphor does not fit all of sensory experience, however I believe this could be further developed into a vibrational theory of sensation (see my discussion chapter 10). In G McLaren ‘Climate change and some other implications of vibratory existence’ p.141

⁷¹ Named for Ernst Chladni (1756 -1827) a German physicist and musician known as the “father of acoustics”, who experimented with the patterns created in sand scattered on a metal plate when the edge of the plate was bowed with a violin bow.

Chladni pattern. In the third figure, the white lines represent the sand locations (nodal positions).



Every particle of sand knows its place in relation to every other particle because all belong to a field of organized energy. Changing the tone or the dimensions of the plate alters the pattern. If a second tone is added, the interference pattern pulsates.

Frolich observed that in organisms, states of coherent excitation depend on material properties such as size, density and shape of the system, including the material property of elastic deformability of cells that function to stabilise electric vibration⁷², and the density of cells within an organ that can strengthen or weaken global coherent vibrations⁷³. A living organism is comprised of various kinds of fields and substances that act as excitable oscillatory media (standing in for the metal plate in the above demonstration of Chladni patterns). The properties of the “medium” constituting a living field comprise boundary conditions that constrain pattern formation, just as the dimensions of the plate constrain Chladni patterns.

Demonstrations of Chladni patterns require high amplitude frequencies to perturb the dense metal plate into standing wave patterns. Organisms have greatly enhanced their selective sensitivity and responsiveness to exogenous and endogenous vibrations, meaning that energy patterns can be formed in response to even very weak signals. Organisms can sense and feel, they seek out the properties that act together in relationship to preserve themselves: they seek and avoid particular perturbations, and they can change their shapes and densities.

The oscillatory patterns of organisms, being reinforced, buffered and sustained, may be considered fields nested within a hierarchy of fields of energetic processes. Oscillations and interference of multiple waves propagated in multiple fields form nodal patterns across the whole. When these nodes are at criticality, they support overall coherence. Such complex, varying and self-forming fields are best described mathematically by allowing infinite variation within a finite area: meaning these patterns are fractal.

Coherence in this multi-dimensional field is supported by endogenous self-similar harmonics in fractal, chaotic patterns at each scale, at least as regards normal functioning. This is consistent with Mae-Wan Ho’s description of coupled energetic cycles being multiscale and fractal: an organization that enables large amounts of energy to be made

⁷² G J Hyland ‘Frolich’s coherent excitations and the cancer problem: a retrospective overview of his guiding philosophy’. (2009) p. 320

⁷³ Ibid p.323

available for use and rapidly transformed in response to even very weak signals⁷⁴, given that “the system is ‘in tune’” with the signal⁷⁵.

This is not to suggest that coherence entails that all components of a living field must be equally sensitive and responsive to a signal. Indeed, Mae-Wan Ho proposes that fractal coherence enables global cohesion and “local freedom”: while a living system as a whole remains far from equilibrium, it can be organized into multiple near-equilibrium, highly coherent and semi-autonomous components⁷⁶. In contrast to two-dimensional simple tone Chladni patterns, for organisms:

... coherence does not mean uniformity: where everybody must be doing the same thing all the time. An intuitive way to think about it is in terms of a symphony orchestra or a grand ballet, or better yet, a jazz band where every individual is doing his or her own thing, but is yet in tune or in step with the whole. This is precisely the biochemical picture we now have of the living system: micro compartments and microdomains, right down to molecular machines, all functioning autonomously, doing very different things at different rates, coupled together, in step with one another and hence, with the whole organism."⁷⁷

Waddington proposed a similar musical analogy to describe the developmental differentiation of organism components:

We could not have a 'neural plate substance, a fore-limb substance, a hind-limb substance' etc. but neural plate, fore-limb or hind-limb oscillatory patterns, which could be regarded as analogous to musical themes or chord sequences. The later phases of differentiation into the various cartilages, bones, muscles, etc., must certainly involve the 'activation' of different structural genes controlling the proteins in these different sorts of cells; but we could interpret these changes as similar to the development of the initial themes according to the conventions of some school of classical music composition⁷⁸

A nuanced understanding of the spatio-temporal structure of coherence reveals a continuous dialectical relation between stability and variation: meaning the one enables the other. Variation constrained by self-similar coherence means that stability is maintained but organisms do not become locked into resonant patterns. Fractal form means that even if perturbed, components can quickly recover their place in the whole by reference to the self-similar coherence pattern.

Purpose: maintaining edge-of-chaos dynamics

While life-field theories indicate that bio-functionality depends on the excitation states that the system itself can amplify and maintain, what this conception lacks, according to Hyland,

⁷⁴ M W Ho *The Rainbow and the Worm* p.54

⁷⁵ Ibid p.92 Ho also uses the metaphor of radio to describe the selective sensitivity of organisms to signals: p.180

⁷⁶ Ibid p.47

⁷⁷ Ibid: p-151

⁷⁸ C H Waddington *Sketching Theoretical Biology* p. 180

is a clear understanding of the biological “purpose” of these states of coherent excitations. In this context, Hyland states:

it should be stressed that a coherent excitation is not necessarily a permanent feature of a living system, but may be “switched-on” only if and when required in connection with the execution of some vital function⁷⁹.

On the other hand, McLaren emphasises creativity itself as a vital function of a living system in a vibrational Universe:

not only do musical patterns merely affect each other (as waves interact) but an essentially non-linear musical semiotic emerges. Unlike non-living processes, life transforms the music of the Universe into novel arrangements in order to regulate its own existence⁸⁰.

What properties of biological systems might be responsible for switching on these processes? If purpose, as one such property, is not genetically or environmentally determined, but somehow created, how can it be understood?

In *Signs of Life*, Sole and Goodwin emphasise what they call “one of the continuing enigmas” in biology: the nature of the contribution of genes to the development of a “coherent, functional organism of specific type”⁸¹. They argue that genetic activity can only operate within the context of the living cell, and these operations are highly sensitive to that context. In turn, cells are highly sensitive to the context of the organism, and the organism to environmental perturbations in the environment. The degree of robustness and variance is determined by interrelations.

Sole and Goodwin argue that unpacking the enigma requires understanding how the extreme complexity of gene-cell-environment interactions are guided by principles of dynamic organization that allow robust coherence to emerge. They describe the behaviour of living systems as being typical of complex systems maintaining themselves on the edge of chaos, wherein order, including behaviour, is constantly emerging, rather than existing in a steady homeostasis⁸². Influenced by Kauffman's simulated models depicting random dynamic networks displaying emergent order, Goodwin also uses the terminology of system attractors to describe enduring patterns of behaviours in complex systems, and proposes the normal attractor for a healthy living system is on the edge of chaos and order⁸³. The normal attractor of health features similar but non-identical behaviours and characteristics over different spatial scales in living systems which act as a subtle coherence in that system. Giving the example of cardiac rhythms, Goodwin observes that reduced variation in biological oscillatory systems is associated with pathology, something that scale invariant self-similarity seems able to prevent. The self-similar correlations of the dynamics of healthy hearts prevent the dominance of one heartbeat frequency⁸⁴. Goodwin's observation seems to support the idea that equilibrium or stasis is a period of reduced adaptability that may indicate ill-health.

⁷⁹ G J Hyland ‘Frohlich’s coherent excitations and the cancer problem: a retrospective overview of his guiding philosophy’. p.322

⁸⁰ G McLaren ‘Climate change and some other implications of vibratory existence’ p.146

⁸¹ R Sole and B Goodwin *Signs of Life* p.61

⁸² Ibid chapter 4

⁸³ Ibid p.116

⁸⁴ Ibid pp.108-117

However, dialectical relations involve tendencies which are antithetical to each other, so dichotomising state of equilibrium versus dynamic non-equilibrium as a means of qualifying ill-health versus health would be oversimplifying the issue. Instead, Goodwin's argument is that health is an emergent property from the interaction of tendencies for stasis and dynamical change.

The understanding of living systems functioning as wholes, wherein each component, genetic, environmental, and dynamic, affects every other as described in biological field theories, means that the causes of coherent behaviour cannot be reduced to any part or force. Coherence, or the organization that maintains the specific functioning and identity of a living system, is an emergent property of the whole dynamic field, whether the field is described in electromagnetic, biochemical, or thermodynamic terms. The normal attractor proposed by Goodwin is an emergent property of a field maintaining itself on the edge of chaos, a self-causing cause which functions to continue itself on the edge of chaos. For Goodwin, this conception acknowledges the agency of the organism in the middle of genetic and environmental forces.

One biological purpose, then, of formal field dynamics is the general maintenance of normal edge-of-chaos stability-through-variation in far-from-equilibrium living systems. However, this conception does not seem to fully address the purpose of another characteristic of organisms raised by researchers: their sensitivity and responsiveness, and more especially their *selective* sensitivity. Given that sensitivity and salient stimuli vary, as the needs of an organism varies, there must be processes that switch or select specific sensitivities on and off, and this has implications for dynamic form. The next chapter considers how sensitivity and responses may vary according to more specific telic or purposeful constraints.

Telic causes: responding to meaningful differences

For complexity-oriented biologists, understanding the organizing properties in living systems does not exclude consideration of self-creative and even purposeful causal processes, and may even depend upon them. Yet these causal properties cannot be understood without considering the context of the organism. To what extent does an organism create the environmental conditions for the regularities and convergences of its behaviour? How can the self-creation of the conditions and constraints of the organism in its world be described without invoking a pre-determined end?

According to Varela, a living system must maintain its identity as a unity of organisation, whilst at the same time maintaining its coupling with its environment. The onus must be on the organism, not the environment, as the active participant in creating its own identity. From the perspective of the observer, the identity of an organism and its relationship with the environment, or the nature and meaning of organism/environment boundaries and interactions, depends on the distinctions made by the observer. But to maintain its own identity, the organism must be creating and maintaining its own distinctions between self and not self in its relationship with the environment.

Every encounter, every event, and every perturbation entails some significance for the organism in its world, a source of information for it to act to maintain its identity through its interactions with its environment. Varela emphasises that information for the organism is not something given: it is not an external object causing action, nor is it an operation of an inherited program. Information is something added by the organism that includes "its *imaginary* dimension, that is, the surplus of significance a physical interaction acquires due to

the perspective provided by the global action of the organism”⁸⁵. For a bacterium, the lack of available food in its immediate environment is interpreted as an action to move towards a higher energy gradient. Thus, information plays a critical role in self-creative processes.

In *The Embodied Mind*, Varela, Thompson and Rosch propose an enactive theory of mind that treats consciousness and cognition as emergent phenomena brought forth by the autopoietic activities of organisms in their embodied environmental interactions over time⁸⁶. Drawing on life-field theories, Thompson suggests that the dynamical forms generated by organisms are equivalent to their creation of meaning of experience, and describes the causal process in emotional responses as follows:

sensory stimuli ... induce the construction by nonlinear dynamics of an activity pattern in the form of large-scale spatial pattern of coherent oscillatory activity. This pattern is not a representation of the stimulus but an endogenously generated response triggered by the sensory perturbation, a response that creates and carries the meaning of the stimulus for the animal. This meaning reflects the individual organism’s history, state of expectancy, and environmental context⁸⁷.

Similarly, complexity-oriented psychologist Daniel Hutto argues that an enactive philosophy of life entails that “cognitive” information should be understood as created by organisms. Arguing against information-processing models of cognition and emotion, Hutto observes that while these models depend on assuming the meaning or importance of information to the organism, they cannot adequately account for these properties. Instead, information is treated as though it is a “thing”, being the contents of cognition, to be manipulated, stored, computed or otherwise processed. While these models are widely accepted, attempts to explain how things acquire their inherent meaning have not succeeded: Hutto proposes the acronym UAO (Unexplained Abstract Object) to highlight this problem⁸⁸. If meaning and purpose are treated as UAO’s, their information value is both assumed and unexplained. This is the same metaphysical inconsistency noted earlier, wherein biologists assume yet deny purposeful behaviour in organisms, being unable to account for purpose with a mechanistic explanation. A further problem with a UAO-processing view of purpose is that it cannot account for the felt importance of purpose. Emotions are “disembodied”: treated as dependent on cognitive states, or their contents, making their veracity and somatic experience merely an epiphenomenon of information-processing⁸⁹.

For Hutto, accounting for the somatic and intentional properties of emotion means placing the sensitivity and responsiveness of organisms interacting with their environment at the centre of self-creation. Developing a naturalistic, content-free account of cognition he terms ‘radical enactivism’, Hutto proposes that organisms are basically information-sensitive,

⁸⁵ F Varela ‘Autopoiesis and a Biology of Intentionality’ p-8

⁸⁶ F Varela, E Thomson and E Rosch *The Embodied Mind: Cognitive Science and Human Experience*. (MIT Press, 1991)

⁸⁷ E Thompson *Mind in life: Biology, phenomenology, and the sciences of mind*. (Cambridge, Mass Harvard University Press, 2007) p.368

⁸⁸ D Hutto, E Myin, A Peeters and F Zahoun, F ‘The Cognitive Basis of Computation: Putting Computation In Its Place.’ In M Colombo and M Sprevak (eds) *The Routledge Handbook of The Computational Mind* (London: Routledge 2018) p. 7

⁸⁹Hutto shows how this basic assumption underlies the treatment of emotional disorders by correcting faulty cognitions in D Hutto ‘Truly Enactive Emotion’. *Emotion Review*, 4:1. (2012) pp. 176-181

rather than information processing⁹⁰. Following this, basic cognition and emotion are interpretive responses that depend on both the presence of natural signs and the sensitive state of the organism. These responses are both phenomenal, being felt, and intentional: being *about* something that the organism construes as significant. Hutto accepts Prinz's functional definition of needs, and adds the emphases:

Each emotion is *both* [emphasis added] an internal body monitor *and* [emphasis added] a detector of dangers, threats, losses, or other matters of concern. Emotions are gut reactions; they use our bodies to tell us how we are faring in the world⁹¹

Emotional responses, simply put, equate to how “creatures are disposed to respond to a range of worldly offerings⁹²”. Hutto emphasises the role of emotion in directing behaviour purposefully toward an end of satisfying needs:

It is by having intentional directedness that aims at environmental situations of special importance to the organism that emotions can play their distinctive roles in guiding our activity⁹³

Moreover, in agreement with enactivists, Hutto points out that intentional directedness is created, felt and enacted by the whole organism, not by any part or subsystem. Indeed, the success of goal-directed behaviour largely depends on the organism's response as a whole⁹⁴.

An enactivist view is consistent with the concept of purpose as an emergent, global property of a sensitive living field. Sensation, including felt emotion akin to a sense of important information, directs responses including intentional directedness. Being neither pre-given nor pre-determined, purpose is an endogenously generated causal power made possible by life-field dynamics. Explicable as a dynamical formal cause that maintains self-causation, purpose also refers to what an organism senses its needs to be, and what the organism strives to bring about. This means that organisms must also be sensitive to, and create information and purpose from, what is important to them yet *not* present.

The dynamics of information: Teleodynamics

In *Incomplete Nature: How Mind Emerged From Matter*⁹⁵ Deacon attempts to explicate the causal dynamics of meaning and purpose in living systems, and how these *teleodynamic* factors with felt importance to the organism might arise from the more basic energetic dynamics of non-living systems. Deacon argues that the dominant mechanistic metaphysic resulted in causal concepts like energy, work and information being treated as pseudo

⁹⁰ This argument is detailed in D Hutto and E Myin *Radicalizing Enactivism, Basic Minds Without Content*. (MIT Press, 2012)

⁹¹ From J Prinz *Gut reactions: A perceptual theory of emotion*. Oxford, UK: Oxford University Press 2004) p.69 in D Hutto 'Truly Enactive Emotion' p.179

⁹² *Ibid* p.181

⁹³ *Ibid*, p-179

⁹⁴ D Hutto 'Philosophy of Mind's New Lease on Life: Autopoietic enactivism meets teleosemiotics' *Journal of Consciousness Studies*, 18:5-6. (2011) p. 61

⁹⁵ T Deacon *Incomplete Nature: How Mind Emerged from Matter*. (New York, W.W.Norton & Co, 2013)

substances: quantifiable things that can be stored, transported, added and depleted, or qualities that are intrinsic to things. He proposes that when starting from the perspective that matter is organised with respect to dynamic processes, the interrelated concepts of energy, work and information are better understood according to constraints that alter the dynamics of multi-componential systems (or fields).

Deacon proposes that the most basic definition of a constraint is that it is a feature that reduces the degrees of freedom in a multi-componential system. Constraints include externally imposed conditions that perturb the internal dynamics of the system by introducing a difference across a gradient. For example, exposing a cool fluid to a heat source causes the distribution of molecules in the fluid to shift away from equilibrium, the state of maximum degrees of freedom, towards a critical threshold that will result in the emergence of a new dynamic organisation of the molecules in the form of Benard convection cells. The external heat source comprises a difference across the energy gradient with respect to the fluid, with the result that the fluid molecules are constrained away from equilibrium and become organised according to the emergent, intrinsic constraint of the Benard cells. The difference in the energy gradient allows the work of heating the fluid to be done. The new level of intrinsic organisation will persist as long as the external heat source remains steady.

The term energy relates to the capacity to do work, a capacity that depends on an energy gradient across which there is a tendency to even out and dissipate. “Energy is a relationship of difference or asymmetry, embodied in some substrate, and which is spontaneously unstable and self-eliminating- a tendency described by the second law” (of thermodynamics)⁹⁶. The concept of energy is inextricably entwined with those of both work and entropy. Energy transformations have to do with changes from useable or ordered energy with global distributional properties (dissipative structures) to disordered energy such as the loss of velocity of moving object through friction and the production of heat. Disordered energy is analogous to inertia and can be described as an unforced tendency of change or an *orthograde* process (going with the gradient towards thermodynamic equilibrium or stasis) in distinction to the *conragrade* processes (going against the gradient) of ordered energy. Conragrade processes are therefore “doing work”.

Bearing in mind the definition of energy as a relationship of difference, Deacon offers the insight that conragrade processes derive from external forces that result from the juxtaposition of contrasting orthograde processes. For example, bringing together two masses of unequal temperature will result in the perturbation of the cooler mass (a conragrade change). Even the juxtaposition of individual molecules with differing velocities and trajectories within a composite system constitute contrasting orthograde processes which produce conragrade changes which in turn produce orthograde changes at the macroscopic level. Thus change is described in complementary and hierarchical terms, whereby two or more orthograde processes constrain (undo) each other conragradually to produce an overall orthograde change, and lower order conragrade processes support higher-order orthograde processes. Orthograde and conragrade processes alternate at adjacent levels of hierarchical order. Any constraint on an orthograde process, whether extrinsically imposed or derived internally from conragrade processes, limits the spontaneous tendency towards equilibrium and thus preserves ordered energy, and this preservation of ordered energy is what enables work to be done. The presence of constraints as a condition for ordered energy, and the potential for energy differences to do work prompts Deacon to suggest that entropy should be

⁹⁶ Ibid p.218

understood as a measure of constraint. A decrease in entropy is an increase in constraints which limit the degrees of freedom (orthograde change) available to a composite system.

Ultimately, all that is required to prevent the eventual complete degradation of usable energy into disorder is the constant perturbation caused by the presence of higher gradients of ordered energy, such as that which is provided to living systems in our world by the sun. The stability of this source of difference is a critical factor in the evolution of myriad hierarchical dissipative structures, including life, on our planet.

The complementary activity of contra- and orthograde processes Deacon terms *homeodynamics* (in contradistinction to homeostasis) with reference to the overall tendency to evenly distribute whatever property is being changed from moment to moment and locus to locus. The hierarchical complementarity between processes caused by the presence of a difference is a central insight into the basic dynamics that can constrain the emergence of higher-order dynamics, which in turn constrain the emergence of higher-order dynamics and so on. Under certain conditions, constantly perturbed composite systems can exhibit spontaneous regularities without these regularities being specifically imposed from an external influence. These systems have crossed a threshold from homeodynamics to *morphodynamics*: emergent intrinsic self-organising dynamics, although Deacon suggests the term *self-simplifying* may be a better descriptor in recognition of the decrease in degrees of freedom of these increasingly constrained systems. The amplification and propagation of intrinsic constraints give the system a tendency to converge to regularity, with repeating *self-similar attributes* or *redundancy*, a defining feature of self-organising systems also noted by Sole and Goodwin. As Deacon describes it: “The creation of symmetries of asymmetries – patterns of similar differences- that we recognise as... an organised process, distinct from the simple symmetry of an equilibrium state,”⁹⁷. It is important to note that these patterns of similar differences, that is: the redundancy and regularity afforded by self-similar attributes repeating throughout the system, constrains a complex system towards an asymmetrical simplicity. The self-simplifying features of highly constrained self-organising systems are critical for the maintenance of their coherence in the face of external perturbations: the spontaneous regularities that tend to reproduce themselves.

Morphodynamic processes tend to reduce or deplete the energetic or material gradient that has perturbed the system from equilibrium and constrained their emergence, undermining themselves. They are only maintained if the system is continually perturbed. However, two or more juxtaposed morphodynamic processes can constrain each other synergistically from reaching equilibrium, each providing the supportive environment or essential boundary conditions for the other⁹⁸. Organisms depend upon basic morphodynamic processes in order to do the work of living with maximum efficiency, but they also depend upon the thermodynamic loophole of synergistic complementary morphodynamics in order to compensate for their depletion of gradients and maintain their dynamical integrity. Many have evolved to *actively avoid depleted gradients and seek out optimal gradients*, and whole ecosystems evolve to maximise the work that can be extracted from gradients.

This higher-order organisation of morphodynamics has the property of self-continuation, or the perpetuation of self-similar regularities, crossing a further threshold of self-organisation Deacon terms *teleodynamics*: “a consequence-organised dynamic that is its own consequence”⁹⁹. Teleodynamics are distinct from other law-like processes in nature

⁹⁷ Ibid p.237

⁹⁸ Ibid p.308

⁹⁹ Ibid p.275

which are merely *teleonomic*: that is, processes that are organised to converge repeatedly on an end state (an attractor), thus appearing law-like while not implying purpose. In the case of a living system, the attractor is a process, not a state: the ongoing process of maintaining itself: “Organism forms evolve in the process of accomplishing a task critical to maintaining the capacity to produce this form, so the task space and the form of the organism are essentially inseparable”¹⁰⁰. According to this view, an organism is not a genetically determined self-replicator, rather it is its own embodied and historically constituted “purpose”. Purpose here should be understood as a *formal*, not a pre-determined *final* cause: it refers to that which is being created by organising principles over time.

The task of self-maintenance is not merely a matter of mechanical or thermodynamical reaction constrained by given boundary conditions, but involves changes in internal dynamics in response to extrinsic modifications or internal deficits, which alter and generate their own boundary conditions. These constrain the dynamics involved in exploiting energy gradients to make living forms possible, and are substrative to the evolutionary processes of genetic mutation and selection. Deacon observes that natural selection relies on the pre-existence of processes of persistent non-equilibrium dynamics, self-maintenance, and even adaptation. Natural selection can improve the fit between these processes and the environment but does not generate them.

Reductive analyses of physical properties of organisms, even those which attempt to capture the whole “state” of the organism, tend to focus on proximal efficient causes as a means of coping with the staggering complexity of organisms. They miss the crucial causal role of intrinsic emergent constraints which constitute the dynamic “scaffolding” of self-organising systems. As Deacon puts it:

In complex dynamical systems, attractors may be converged on from many quite diverse initial conditions, this convergence history is an irreducible factor. While a general attractor form may itself be predictable by simulation, being at some specific locus within the phase space of that attractor dynamic is not highly informative about initial conditions, nor is its specific emergent history of particular relevance to the causal properties that result¹⁰¹.

This conception of organisms demands a process view focusing on how an organism is creating itself, and suggests that a useful and manageable comprehension of the irreducibly complex biological system may depend on grasping the nature of the system attractor: the self that is creating itself. This point is made clearer when considering the next threshold of self-organising dynamics described by Deacon: *second order teleodynamics*. Organisms must constantly maintain their self-similar regularities, otherwise they will lose their ability to self-reference with respect to conditions, they will not be able to effectively manipulate conditions to do the work to maintain themselves and they will decompose. Some organisms have evolved an internal representation of their own dynamical final causal tendencies: an ability to model themselves with respect to actual or possible conditions. This second order teleodynamic is a causal loop, a self-creating a self, continually assimilating lower order morphodynamic processes, referencing its own moment-to-moment being, distinguishing self from not –self, and projecting itself into possible contexts.

Deacon posits that self-similarity is critical in providing a robust and enduring referent to juxtapose regularities and disturbances throughout the hierarchical levels of a living system, as regards spatio-temporal rates of change. But given the almost infinite and

¹⁰⁰ Ibid p.114

¹⁰¹ Ibid p.204

constant minute fluctuations occurring at the cellular level, what kind of causal coherence can it have with that of “higher” levels with slower rates, and at the same time how can its causal influence allow for the emergence of causal phenomena at higher-levels? At the lowest level, micro fluctuations of metabolic processes occur at much faster rates than those of higher-order levels, alternating in their homeodynamic interactions too quickly for these micro perturbations to affect higher-levels of organisation. Drawing on the physicist Robert Laughlin’s conception of emergence, Deacon posits that micro perturbations are robustly constrained by attractor dynamics, with the effect of statistically smoothing out fluctuations¹⁰². Likewise, quantum field theory holds that even at the most basic level of reality, field fluctuations yield organised processes, such that these quanta of energy are constrained to appear particle-like¹⁰³. It is the organisation of processes, not material components, that have causal power at every level. As Bickhard puts it: “It is *patterns* of process, all the way down, *and* all the way up”¹⁰⁴. This is an important limitation to bottom-up causality. Higher-level organisation is not determined by the “material” substrate of lower levels: only the most generalised (redundant) properties of processes have causal influence at higher-levels, and most of the noise of interacting “particles” has effectively no causal influence.

Deacon argues that the conservation of self-similarity in processes at each level constitutes an effective locus of self at each level, from basic cellular molecular relationships, to automatic regulatory neuronal systems, to the subjective self that models the self in the world. These processes, therefore, converge dynamically to a repeating pattern of self-similarity which is a global attractor at each organisational level of the organism. Note the implications of self-similar dynamics for understanding systems as wholes rather than connected but discrete parts: “For one, a common scale-free “language” among perceptual-motor or cognitive tasks and (neuro-)physiology are not expected from classical componential models, which typically posit domain-specific control structures”¹⁰⁵ .

Deacon posits feeling and emotion as the higher-level experience (sentience) of lower level dynamics, reflecting the dynamical infrastructure throughout the hierarchy. The coherence of self is *felt*, providing the connection between mental processes and lower level dynamics. Deacon argues that conceiving sentience and consciousness as emergent higher-order forms of dynamics present in lower levels overcomes the Cartesian split between material brain and immaterial mental experience. The felt experience of being a self is not an anatomical property, but is the vegetative teleodynamic substrate of the ententional self. It is the relatively passive orthograde “holding pattern” from which more active, focused “work-doing” contragrade processes, can emerge. While Deacon views this creative process in terms

¹⁰² Ibid p.200

¹⁰³ M H Bickhard ‘Emergence’ In Anderson, P. B. et al (eds) *Downward Causation*, (Aarhus, University of Aarhus Press, 2000) pp.322-348

¹⁰⁴ Ibid p.328

¹⁰⁵ M L Wijnants ‘A review of theoretical perspectives in cognitive science on the presence of 1/f scaling in coordinated physiological and cognitive processes’. *Journal of Non-Linear Dynamics*, (2014), pp.1-17, p.3

of complementary yet opposing tendencies, his conception is similar to the dialectical dynamics underlying self-organisation proposed by others¹⁰⁶.

The term teleodynamic implies intrinsically purposive behaviour, and purpose is usually defined as that which is aimed at an end: a final cause. But according to Deacon, the basic teleodynamic of living systems is a formal self-organising self-referential cause, not a final cause. It is an attractor to which all living forms “fall towards” spontaneously. But the moment by moment business of living also involves forced change. This has usually been defined as involving an efficient extrinsic cause. Deacon reconceives causal power in organisational dynamics as arising from the juxtaposition of different material or energetic gradients, or between different organisational principles. The emergence of second order teleodynamics is a further step along a dynamical pathway scaffolded by constraints that provide a formal cause (defined by Deacon as an organising principle, not a force) of self-reflective organisational logic which defines itself through its own self-similar features¹⁰⁷. A basic example is the distinction between self and other, where the self can be defined according to the felt boundaries of reciprocal, self-referential dynamics, against what is not self/not felt. Just as the differences in energy gradients that make work possible can be generated by complementary orthograde and contragrade processes at lower levels, distinctions between self and not-self generate a gradient of difference that makes information possible. The difference between self and not self is *information* for the self *about* this difference. Like the concepts of energy and work, information is a relational property: a difference that makes a difference¹⁰⁸. It is not like an independent substance that can be stored, lost or accumulated, or processed by a computer-like brain, nor is it a force that acts on organisms.

Deacon notes that his definition of the self-creating self is analogous to C S Peirce’s notion of habit: the disposition or bias in the occurrence of particular states of a process, including the general properties by which we perceive and interpret experience. Deacon agrees with Peirce that habits beget habits, or in his terms: attractor dispositions propagate constraints¹⁰⁹. Thus attractors in living systems are more than mere convergences, they are real and critical causes in the scaffolding of self-organising dynamics.

As differences are ubiquitous in nature, there is the potential for any of these differences to make a difference to someone. As Salthe puts it: “Any energy dissipation might be the beginning of something of importance, and so Nature is as replete with potential meanings as it is with energy gradients”¹¹⁰. But the aboutness of information, or the interpretation of a difference, always and only refers to the constraints of organism dynamics, and not to just any arbitrary properties of things. In a living system, self-referential or self-other referential processes can transform the presence of a difference (or an absence) into something meaningful. This is such a fundamental property of living systems that Deacon

¹⁰⁶ See discussion earlier this chapter drawing on R Levins and R Lewontin *The Dialectical Biologist*, R Sole and B Goodwin *Signs of Life*, and H Maturana and F Varela *The Tree of Knowledge*

¹⁰⁷ Ibid p.468

¹⁰⁸ Deacon proposes that Gregory Bateson’s description of information is an apt description of work. *Incomplete Nature* p. 388

¹⁰⁹ Ibid p. 202

¹¹⁰ S N Salthe ‘What is the scope of semiotics?: Information in living systems’. In M Barbieri (Ed) *Introduction to Biosemiotics: The New Biological Synthesis* (Springer Netherlands 2007) p.128

suggests an organism can be defined as the locus of work that generates constraints capable of providing highly specific, limited and self-centered information about its world¹¹¹, a definition that agrees with von Uexkull's concept of *Umwelt* (see below). According to Deacon's conception, and in line with Varela's concept of the entanglement of organism ontology and epistemology, an organism's adaptations are embodied information about its relationships with its environment. Furthermore, and echoing Peirce, an organism can only obtain information about its environment that its internally generated dynamic processes are *sensitive to*. These are the features of its world that are salient to the task of self-maintenance.

Thus in a profound sense, the subjective experience, the felt reality, the idiosyncratic interpretations of its world, and the relations between itself and not self-created in the task of self-maintenance, as organising principles are the most valid foci of scientific analysis of the nature of an organism. Bringing together a self-creating organism and its environment through the process of its perceiving or sensing a salient difference to create information, exploit energy gradients, and do work, is the study of a three-way relation: between an organism as the interpretant, its world as the object of interpretation, and the difference that makes the difference: a sign. This three-way relation of sign interpretation in biological systems is the subject of the science of biosemiotics.

Absential phenomena: needs

Importantly, and controversially, Deacon claims that because teleodynamic causal power depends on both what is present and what is absent, what is absent also has causal influence, at least for living systems. This apparently counterintuitive argument concerns what Deacon terms *absential* phenomena¹¹², which includes all phenomena that exist with respect to something not present or complete, including a condition that has to be satisfied, an experience or apprehension of incompleteness, a function, representation, meaning, purpose: anything that is not materially or intrinsically present. The causal power of these absential features for living systems he terms *ententional* causality¹¹³: that which refers to the immediate influence of something not present, Deacon observes that any constraint on a multi-componential system, including simple constraints like size, boundaries and temperature, delineate not just the material and energetic substrates of the system but also all the possibilities and potentialities not realised due to the presence of these constraints, therefore absential features appear to be fundamental and ubiquitous.

Deacon argues that the strength of his theory of absential phenomena and its related ententional causality is that it does not simply assume the activity of subjective experience in the organisation of biological systems, as does Maturana and Varela's autopoietic theory, nor does it assume an Aristotelian type of formal or final cause that is intrinsic to the nature of things¹¹⁴. Deacon's concept acknowledges the subjective importance of what is absent, from the point of view of the organism, and this highlights a telic organizing feature of organisms: namely their perception of their *needs*. A need is, by an enactive definition, a felt sensation that signals something important, or even necessary, is lacking, and directs responses accordingly. However, by defining his absential phenomena in terms of a "something-that-is-

¹¹¹ T Deacon *Incomplete Nature* p. 410

¹¹² *Ibid* p.2

¹¹³ *Ibid* p.27

¹¹⁴ *Ibid* p.5

not-a-thing”¹¹⁵ Deacon is identifying *something* that is *present*. The “incomplete” phenomena that Deacon claims to be central to his dynamical ontology is better explicated by theories of biosemiosis (see below), which posit that the presence of a difference, including anything incomplete or contingent, should be understood as the presence of a sign which stands in for what is signified but not itself present.

Biosemiosis

The word sign derives from the ancient Greek semeion, roughly equivalent to "symptom" and used in the medical sense to denote a manifestation of an internal or overall condition, which is itself unobserved¹¹⁶. The concept of "sign" entails at least two characteristics: 1) the relation of something observable to something unobservable, expressed as a *sign vehicle* and 2) the perception of this relation, which is itself also a relation, expressed as an *interpretant*. The unobserved object itself constitutes the third aspect of triadic sign relations.

The history of semiotics, since the time of Augustine, has been characterised by debate over the ontological primacy of the relation between sign vehicle and object, independent of the interpretant, or of the perception of the sign relation by the interpretant. This debate echoes the Cartesian duality of mind and matter which has resulted in subjective experience being equated with mind, alienated from natural phenomena and eventually dismissed by positivistic science in its embrace of the study of matter as observable phenomena¹¹⁷. Biosemioticians propose to overcome this dichotomy by showing that signs are not objects, mental or material, nor are they illusory mental subjects or representations, but instead are relations. These relations embrace organisms' relations within themselves, between each other, and with the world, and underpin their organisation and existence. Mental perceptions of signs in humans, including linguistically mediated experience, rather than being the archetypal category of sign relations as they have been taken to be since medieval times, are but one subset of, and indeed are an evolutionary product of, biological sign relations¹¹⁸. As noted previously, this mistake of ontological categories can be explained by the omission of Aristotle's work in biology which otherwise would have offered the ontological context in which mental sign relations can be understood as part of the general interdependent recursivity in nature. Favareau summarises Aristotle's biological ontology thus:

1) Animal form is shaped by interaction with the world and vice versa, 2) the organisms actions upon the world (which subsequently change that world) are enabled by and constrained by the organism's systemic biological constitution (including its perceptual capacities) and 3) it follows from both 1) and 2) that there is both a "realism" to sign relations and a deep necessity for the joining together of the extra-biological relations to the external reality of the embedded biological relations within

¹¹⁵ Ibid p.2

¹¹⁶ This etymology is detailed in D Favareau 'The Evolutionary History of Biosemiotics'. In M.Barbieri (ed.), *Introduction to Biosemiotics: The New Biological Synthesis*. Berlin:Springer, 2006) pp. 1–67.

¹¹⁷ Ibid

¹¹⁸ Discussed in M Dix 'Living and knowing'

organisms such that "what occurs in the case of the perceiving (system) is conceivably analogous to what holds true in that of the things themselves"¹¹⁹.

Favareau argues that Aristotle's observations of nature, far from being limited to a static view of predetermined forms of being, give a coherent account of the evolution of the mental phenomena of sign relations from the most fundamental sign relations between living cells co-ordinating their interactions with each other and negotiating their environments to survive (e.g. the presence of x becomes the reliable indicator of the presence of y). Importantly, Aristotle did not view this focus on relations rather than things as being cumbersome complex, unlike Cooper or Paris in their critiques of attempts to establish holistic models in health. Rather, he clearly postulates this relational view as a sufficient and efficient explanation of the "double" or dialectical character of systems. For Aristotle, a human is not reducible to either a construction of cells capturing, consuming and transforming energy, or a thinking feeling agent embedded within a culture, but rather both at the same time, with an emergent quality of meaning; "that form in that material with that purpose or end"¹²⁰ (*De Anima i*). Here, purpose or end can be understood in terms of the problem of accounting for how a thing can be at the same time only itself, and also a sign for something else to someone. This problem can only be solved, according to semioticians, by examining the function of the sign in that system, that is, an examination of the history of the relations of the system and sign, and the "knowing" that emerges from these relations. This includes the honeybee knowing the ultraviolet markings on flowers mean nectar is available, the deer knowing that the scent of canine urine means a predator is near, and a child knowing that the letters CAT indicate a furry animal that purrs.

According to the sign logic developed by philosopher and scientist C S Peirce (1839-1914), these are all kinds of triadic sign relations, involving sign object (eg nectar, wolf, cat), sign vehicle (flower markings, urine, CAT), and interpretant (bee, deer, child: or more specifically the causal process or response activated by the interpreting being). These kinds of sign relations differ only in the extent to which raw sensation is being experienced by an agent, according to its biological organisation and set of prior associations, and the extent to which these perceptions are further related to each other within a web of symbolic meanings, which can be recognised as patterns or laws such as language notation. Peirce aligned himself with Aristotle and with Schelling (and in contrast to Hegel) in a dialectical evolutionary view of creative being, such that *actual* existence in relation to *potential* being provides the fundamental dialectical dynamic by which new forms of semiotic being (including cognitive development, language and culture) emerge¹²¹.

The construction of meaningful worlds by purposeful organisms was first explicated biologically by the Jakob von Uexkull, who defined the focus of biological science as the study of the purposeful abilities of organisms actively integrating into their complex environments. For Uexkull, organisms can only be understood as holistic units embracing the interactive unity of the organism and the world sensed and lived by it; this unity he termed an organism's *Umwelt*¹²². Thus, the *Umwelt* is the perceived-world of the organism, comprising

¹¹⁹ From Aristotle *De Sensu vii*, in D Favareau 'The Evolutionary History of Biosemiotics' In M. Barbieri (ed.), *Introduction to Biosemiotics: The New Biological Synthesis*. (Berlin, Springer, 2006) pp. 1–67.

¹²⁰ From Aristotle *De Anima i*, in D Favareau 'The Evolutionary History of Biosemiotics'

¹²¹ Discussed in A Gare 'Speculative naturalism: A manifesto'. *Cosmos and History: The Journal of Natural and Social Philosophy* 10, 2, (2014) pp. 300-323

¹²² K Kull 'Jakob von Uexkull: An introduction'

all that is salient and meaningful to it, given its sensory abilities and limitations, and it is the organism's activity of perceiving and interpreting phenomena of significance to it that mediates its interaction with the world¹²³. This obtains from the most basic level of biochemical sensitivity and response enabled by the specific sensitivities of a cell membrane, to the multivalent self-reflective cognitive processes of a human responding to a complex moral dilemma. In other words, for all pragmatic *intents* and *purposes*, an organism's world is defined by its interpretant processes.

Drawing on the semiotic theories of Uexkull and Peirce, Dix proposes an ontogeny of biological semiotic processes of "knowing"; of sensing, interpreting, and making signs¹²⁴. This ontogeny illustrates how semiosis pervades life from the simplest lifeforms to whole ecosystems. Dix argues that the theory of biosemiosis, the semiotic processes of living things, can explain how a sign as a very small input into a biological system, whether a few molecules, a sound, a temperature difference, even the perception of something that is absent, can cause a hugely disproportionate "output" or consequence for the living system. This is biosemiotic causation: defined by Dix as a non-linear causation of constraint of processes, affording both the entrainment of higher-order processes from subserving levels and the constraining of activity of superordinate levels of living systems¹²⁵.

Hoffmeyer similarly defines biosemiotic causation as the bringing about of effects through interpretation, based on the historically defined needs of a sensitive system¹²⁶. These effects can occur at all spatio-temporal levels, from cellular activity to reading newspapers, to all species interacting in ecosystems, and thus are hierarchical and multidimensional. They also allow for creativity and novelty, or emergent phenomena. Hoffmeyer proposes a process he calls semiotic scaffolding to describe a trend in living systems to "build up" from basic levels of semiotic relations to more sophisticated relations, increasing their semiotic freedom; that is, increasing their capacity for reading and responding to signs, in line with the needs of the organism. What is known becomes a platform for further potential knowing. This conception of the processes of knowing in biological systems means consciousness itself can be understood as an emergent phenomenon in nature¹²⁷. However, organisms are not "trapped" into their systems of knowing: rather, the functional character of biosemiotic causation entails that interpretants are continuously evaluated for their viability¹²⁸. In contrast to the blind "as if" purpose of Mayr's teleonomy, wherein biological functions are simply

¹²³ M Dix 'Living and knowing'

¹²⁴ Ibid

¹²⁵ M Dix 'Living and knowing', for further discussion of subserving, focal, and superordinate levels see S Salthe 'Evolving Hierarchical Systems: Their Structure and Representation'. (Columbia University Press. New York 1985)

¹²⁶ In J Hoffmeyer 'Origin of Species by Natural Translation'. In S Petrilli (Ed) *Translation* (New York, Rodopi, 2008) pp. 329-346

¹²⁷ Argued in M Dix Living and knowing; also J Hoffmeyer 'Semiotic scaffolding of living systems'. In In M Barbieri (Ed) *Introduction to Biosemiotics: The New Biological Synthesis* (Springer Netherlands 2007) pp. 149-166; and J Hoffmeyer 'Semiotic freedom : An emerging force'. In N H Gregeren and P Davis (Eds) *Information and the Nature of Reality* (Cambridge, University of Cambridge Press, 2010) pp. 185-204

¹²⁸ M Dix 'Living and knowing'

inherited by virtue of past success, biosemiosis can account for true learning in organisms, including remembering, forgetting, misunderstanding and inventing¹²⁹.

Semiotic freedom equates to the degrees of freedom of agency that can enable historically grounded anticipatory responses, evaluations of the viability of these responses, and the potential for novel, exploratory responses. Hoffmeyer suggests that the tendency for semiotic freedom to increase could be interpreted as a "direction" in evolution¹³⁰, however there is no determined end, and indeed semiotic scaffolding is a process by which novelty emerges¹³¹. Hoffmeyer's concept of scalar ordering increasing degrees of semiotic freedom seems to be in contrast to Deacon's view that the scaffolding of constraints, both extrinsically imposed and intrinsically generated, increases redundancy (self-similarity) which reduces the degrees of freedom in a system. Likewise, Bertalanffy describes a loss in potentiality or degrees of freedom that occurs with specialisation¹³². However, these two positions are not incommensurable; a reduction in broad potentiality can be associated with an increase in specialised potentiality, in fact the latter may depend on the former. Both Hoffmeyer and Bertalanffy suggest that hierarchical ordering is the most efficient solution for more complex organisms to organise themselves, and that the efficient use of energy or gain in negentropy is associated with a gain in higher-order functioning, or top-down processing. Freedom is both gained and lost with specialisation. To use Deacon's terminology, the scaffolding of self-similar levels of order in a system both reduces chaotic noise and perpetuates gradients of asymmetry that allow work, including creating information, to be done. To put it another way, emergent order means new degrees of freedom specific to the functional relations of organisms can be created¹³³.

Dix also argues that the peculiar causal power of knowledge that obtains from biosemiosis is ultimately a consequence of the dependence of living things on non-linear, low energy causation, rather than high energy mechanical causation employing physical pushes and pulls. Non-linear, low energy biosemiotic causation is comparatively efficient (not to be confused with efficient causation). As Dix puts it: "Given the many thousands of biological modulation and control systems involved in our highly complex bodily functioning – at the levels of organism, organs, cells, and subcellular processes – we will need much more energy-efficient modes of sampling, feedback and control than could be provided by mere infliction of pushes and pulls"¹³⁴. Moreover, the non-linearity of biosemiotic causation means that a cascade of consequences at multiple spatio-temporal levels can obtain from the interpretation of a single low energy sign. This kind of causation is ubiquitous and necessary in biological systems, and constitutes the physical/systemic signature of biosemiosis. "Where we find, in a system far-from-equilibrium, a physical stimulus prompting an initially tiny

¹²⁹ J Hoffmeyer 'Biology is immature semiotics' in C Emmeche and K Kull (eds) *Towards a Semiotic Biology: Life is the Action of Signs* (Imperial College Press, 2011) pp. 43-66, p.48

¹³⁰ Semiotic freedom allows organisms to read cues in the environment, thereby gaining a 'fitness' advantage according to J Hoffmeyer In *Semiotic freedom* esp. p.195

¹³¹ Semiotic emergence is proposed as the evolutionary mechanism of purposive behaviour. Ibid.

¹³² In L Bertalanffy *General Systems Theory* (London, Penguin Press 1971)

¹³³ In J Rosen 'Robert Rosen's Anticipatory Systems Theory: The Art and Science of Thinking Ahead'. *Proceedings of the 53 Annual Meeting of the International Society for the Systems Sciences* (Brisbane, 2009) at <http://journals.iss.org/index.php/proceedings53rd/article/view/1249>

¹³⁴ M Dix 'Live and knowing' p.17

transduction of energy that subsequently produces a non-linearly increased *hierarchical* cascade of entrained physical sub-system consequences peculiarly or typically associated with that stimulus-type, there we have biosemiosis”¹³⁵.

Biosemiotic causation is also comparatively safe. Organisms maintain a dynamic equilibrium that relies on the continual “flow” of energy into the system and perturbations that keep the system in self-criticality driving the intrinsic dynamics that enable dynamic self-maintenance. However, strong perturbations present a danger to the integrity and dynamic balance of the organism. Dix suggests at least three ways that organisms can cope with or avoid dangerous perturbations. Different temporal rates of change between scalar levels function to help insulate the system as a whole from overwhelming disturbance and dangerous shocks, the sensitivity of organisms via biosemiosis to low energy signs means that knowledge can be created and acted on without the need for potentially damaging external mechanical forces to “push” change, and finally, knowledge of salient dangers, whether large mechanical forces or small but disruptive perturbations, enables organisms to avoid them. Thus, organisms rely on low energy sign interpretation to know what is happening and what is likely to happen in their “perceived-world of significance”¹³⁶. Biosemiosis, then, invokes purpose in the sense of anticipatory behaviour in living systems.

Anticipation

An organism can only function as an interpretant of signs, or as the someone for whom a difference makes a difference, from the standpoint of its own Umwelt (lifeworld). Interpretation involves not only what a sign means to the interpretant in the present, but also what it means to the interpretant for the future. Deacon posits that second order teleodynamics constrain a self creating-a-self that projects itself into possible contexts, and the projection of an internal representation of itself into the future is argued by several theorists to be a fundamental and necessary feature of living systems. As Salthe puts it:

A system would cease to function properly if one of its functions ceased to be influenced as usual by average downstream expectations. That influence from the future can be represented using the grammatical construction, the future progressive as in: ‘I will have been doing’, derived from the past progressive, ‘I have been doing’, in turn derived from the present progressive, ‘I am doing’. Any continuing system needs to rely upon the ability of its components to be assured of the continuing validity of their future progressive expectations. These act as final causes; systematicity implies finality”¹³⁷.

This conception of final cause does not suggest either something “absent” or something predetermined, but rather the presence of representations of possible futures, or predictive models, that are intrinsic to the present functioning of a system. These models are created (encoded) by the historical functioning of the system, both in terms of the organism’s own lifetime and its inheritance of its species evolutionary pathway, and depend on the relations of organisms to causal regularities in the world. In short, it involves organisms learning “what leads to what”. These models of historically encoded information constrain an organism to sense and respond to (decode) signs that stand in for something of significance to the organism, including events that have yet to occur. All biosemiosis is anticipatory¹³⁸. Thus,

¹³⁵ Ibid p.19

¹³⁶ Ibid p.5

¹³⁷ S Salthe ‘What is the scope of semiotics?: Information in living systems’ p.134

¹³⁸ M Dix ‘Living and knowing’

these intrinsic models comprise encoded information about the world that allow the organism to make predictions about future events and to change behaviour accordingly. Living systems are anticipatory systems.

The theory of organisms as anticipatory systems was first proposed by the biologist Robert Rosen (1934-1998), who developed function-based models for biological processes showing that organism behaviour is not simply reactive according to present percepts¹³⁹. The most fundamental and distinctive biological functions, metabolism and repair, entail several interrelated characteristics, including that they are constrained (emerge from) the organisation of the organism, that they are always manifest in terms of relations with the environment, and that they always involve a systemic definition of self and the optimal conditions or health of the self¹⁴⁰ (Rosen, 2009). These functional models are not just examples of feedback systems wherein biological sensors are triggered to *react* by changes in conditions. In contrast, they are “feedforward” systems that interpret and *respond* to signs of events that have yet to occur¹⁴¹. Models are not fixed in their responses, rather the process of modelling comprises the bringing into congruence of patterns of entailment between a model and that which is modelled¹⁴². This process is self-correcting as new information arises in the process of encoding and decoding. Effectively, predictive models are guidance systems. As Judith Rosen puts it: “They consistently initiate behaviour in the present according to events which have *not yet occurred*”¹⁴³.

Rosen argues that even basic organisms have somatic predictive models. She gives the example of plants that detect signs, such as shorter day length, that winter temperatures are approaching, and respond accordingly by preparing for colder conditions before they have occurred. Somatic models are limited by a slow rate of change and by their physical structure in their ability to encode, decode and modify their predictive models. Thus tropical plants cannot adapt functionally to cope with frost and are killed. Judith Rosen argues that for humans, the emergence of intelligence means that we have:

two distinct sources of predictive models—two anticipatory systems within a single organism. What intelligence allows an organism to do is encode new models (learning) and adapt to environmental changes “on the fly”—in real time—rather than having to wait for evolutionary processes to generate those adaptations in the flesh. The somatic encodings we have are the same category of encodings that all living organisms must necessarily possess, but the human mind represents another, which can (and often does) conflict with the first. Indeed, a great deal of human pathology is likely caused by the battles for supremacy between our two evolutionary steering wheels¹⁴⁴

Rosen’s point is that somatic and conscious predictive models operate at radically different spatio-temporal scales, permitting the possibility of conflict between the changes

¹³⁹ A H Louie ‘Robert Rosen’s anticipatory systems’. *Foresight*, 12, (2010) pp.18-29

¹⁴⁰ In J Rosen ‘Robert Rosen’s Anticipatory Systems Theory: The Art and Science of Thinking Ahead’.

¹⁴¹A H Louie ‘Robert Rosen’s anticipatory systems’

¹⁴² A Gare ‘Approaches to the question: what is life? Reconciling theoretical and philosophical Biology’.

¹⁴³ J Rosen ‘Robert Rosen’s Anticipatory Systems Theory: The Art and Science of Thinking Ahead’.
p.6

¹⁴⁴ Ibid p.10

their operations entail. Higher-order models rapidly generated in the mind may override slower somatic models, at least temporarily, and under some conditions this may interfere with optimal functioning. Or slower models may exhibit resistance to change, thus impeding efforts to adapt rapidly. On the other hand, human intelligence has enhanced our ability to perceive regularities in nature, and to rapidly learn from them and to encode this information into predictive models that have enhanced our ability to manipulate and control our future conditions to the advantage of our species. So much so, in fact, that perhaps our perception of, and reliance on, regularities in nature has partly obscured the nature of inherent unpredictability in the world: those properties our predictive models cannot reliably account for.

This negligence amounts to what Louie would term an encoding error: a misrepresentation of the world that translates to the encoding of misinformation in our predictive models. Other classes of errors found in models include faulty “effectors” meaning that any of various kinds of properties that should be activated to produce change are in some way defective, and “side effects” which include all unplanned effects of operations. These unplanned effects are more or less ubiquitous, both because models are necessarily incomplete, and, importantly, that functional organisation operates simultaneously in multiple physical structures and levels of the system, as Louie puts it “structures have multiple functions and functions are carried out by multiple structures”¹⁴⁵. However, considering the inherent unpredictability of modelling, this concept of error as mistake is somewhat misleading. Modelling relations in an unpredictable world must take into account unpredictability, or they will fail. Furthermore, an accident or misapprehension, like a genetic mutation or chaotic change in behaviour, can lead to benefits for the organism. Nakajima (2015) observes that the role of uncertainty in adaptation is controversial, and that “activity to achieve a better probability distribution of events for survival and reproduction through an embodied internal model for external reality, rather than the reduction of uncertainty, is an essential biological property to characterize adaptation”¹⁴⁶.

Therefore, error is perhaps better defined as a lack of variability, or in other words an over-reliance on assumptions of regularity and control, rather than a mistaken prediction¹⁴⁷.

Rosen’s work focused on the general properties of anticipatory systems and their modelling relations with the world, and not on their construction. He did, however, show that “objective” knowledge is not counterposed to but inclusive of subjective knowledge¹⁴⁸. According to Rosen, modelling is an art, not a mechanism. Encoding and decoding are relations between what is modelled and models, they are not entailed by components of either. This applies to the modelling relations that occur in the practice of empirical science, however decoding and encoding processes are masked by the belief in objective measurement, and the resultant formal systems of this modelling are mistaken for the real

¹⁴⁵ A H Louie ‘Robert Rosen’s anticipatory systems’ p.27

¹⁴⁶ T Nakajima ‘Biologically inspired information theory: adaptation through construction of external reality models by living systems’ *Progress in Biophysics and Molecular Biology* 119 (2015) pp. 634-648, p.647

¹⁴⁷ This is discussed further in Chapter 5

¹⁴⁸ A Gare ‘Approaches to the question: what is life? Reconciling theoretical and philosophical Biology’

world¹⁴⁹. If error can be defined as an illusion of objectivity or regularity in an unpredictable world, then modelling relations in science are examples of this kind of error.

Rosen's theory of modelling gives a place to a variety of causal properties in systems, equivalent to Aristotle's four causes, and showed how these causes are interwoven. In Rosen's models, functional components are products of the system, context dependent, and their organisation cuts across physical structures¹⁵⁰. To compare the analytic/syntactic mechanical model to Rosen's synthetic relational model is to see that the former describes what the system does in terms of what the system is (made of) while the latter describes what the system is in terms of what it does (its functional and relational processes). To understand a system, it is therefore appropriate, and necessary, to ask *why* the system does what it does, to what end? At least some important ends include the processes of metabolism and repair: survival, health, optimization of conditions and avoiding threat¹⁵¹

Rosen suggested that what is encoded in our predictive models has implications for well-being and ill-being:

The study of anticipatory systems thus involves in an essential way the subjective notions of good and ill, as they manifest themselves in the models which shape our behaviour. For in a profound sense, the study of models is the study of man; and if we can agree about our models, we can agree about everything else¹⁵²

Louie notes that one of the implications of Rosen's work is that the understanding of organism behaviour depends on understanding their predictive models and how they correspond with the world¹⁵³. This calls for a focus on the relationship between model and modelled that extends beyond Robert Rosen's dualist view of congruent causal patterns between model and modelled. This can be achieved by introducing a Peircean triadic view of semiotic relations into anticipatory systems theory¹⁵⁴, which, as suggested in the first paragraph of this section, involves the mediation of signs which are significant in the particular *umwelt* of the organism in modelling relations. In other words, the ability of organisms to encode congruent models depends on their ability to sense and interpret differences that make a difference to them because they stand for something else: the modelled world or sign object. This conception of anticipatory models grounds them in the reality of the experienced world of organisms. As McLaren argues: "Rosen's models are better understood more complexly as intuitive analogies and metaphors than as

¹⁴⁹ D C Mikulecky 'Robert Rosen: the well posed question and its answer – why are organisms different from machines?' *Systems Research and Behavioural Science*. 17, 5, (2000) pp. 419-432.

¹⁵⁰ Ibid

¹⁵¹ J Rosen 'Robert Rosen's Anticipatory Systems Theory: The Art and Science of Thinking Ahead'.

¹⁵² R Rosen *Anticipatory Systems: Mathematical and Methodological Foundations* (Pergamon New York 1985) p. 404

¹⁵³ A H Louie 'Robert Rosen's anticipatory systems'

¹⁵⁴ A Gare 'Approaches to the question: what is life? Reconciling theoretical and philosophical Biology'

representations”, which as abstractions mediating experience entail a Cartesian split of mind from environment¹⁵⁵

Metaphor, Meaning and Time

Temporality and scalar hierarchy were not well-developed concepts in Rosen’s work, but are necessary to understand complex organisms, especially humans with higher-order conscious models including the subjective sense of self being an active agent in the world. This particularly obtains for the experience of consciously anticipating the future. Drawing on phenomenological theories of durational becoming to further extend Rosen’s work, Gare states:

It is necessary to appreciate that experience involves multiple levels of anticipation and retention to account for the sense of enduring self-hood temporally transcending the immediate situation. This in turn requires that there be multiple levels of durational becoming if the ontological status of this experience is to be taken seriously¹⁵⁶.

With so much to consider in grappling with the irreducible complexity of organisms, especially conscious, self-reflecting, self-positing humans, embedded in their socio-cultural self-organising systems, it may seem that any practical means of comprehending this complexity must involve reductive analysis towards basic mechanisms of some kind. But this assumption is constrained by the dominant mechanical metaphysics in science, from which derive the mechanical metaphors that attempt to reduce complexity and are so pervasive in the sciences.

In contrast, from a self-organising processes perspective, the regularities of self-organising systems can be understood as constrained by intrinsic dynamics that emerge initially as these systems are perturbed, and which can perpetuate themselves as behaviours converge within a phase-space or attractor. These processes reflect the self-simplifying tendencies of redundancy or self-similarity, allowing behaviours to be coherent and somewhat predictable, yet are also variable and creative. In living systems, biosemiosis is a process that can constrain these regular behaviours.

Our beliefs about ourselves and our worlds, and their power to create our experienced reality, are an emergent conscious level of biosemiotics: the intertwined dynamics of living and knowing, the bringing about of effects by interpretation that is ubiquitous in all organisms as semiotic systems. Organisms create their lifeworlds over time through acts of interpretation, and these acts are constrained by historical models which anticipate the future, including the unpredictability of the future. Organisms exist in the present “actual” world, but embedded in this present is the past and models for the future. To return to Gare’s observation: organisms maintain an enduring selfhood across multiple levels of durational becoming, including multiple levels of anticipation and retention. The semiotic-anticipatory perspective of organisms begs the question: how do organisms manage these multiple spatio-temporal levels coherently? Or, to borrow Rosen’s metaphors, how do organisms act as

¹⁵⁵ G McLaren develops this argument using the Radical Embodied Cognitive Science of A Chemero in ‘The obesity crisis and biosemiotic corruption: Towards a unifying semiotic understanding of obesity’. *Cosmos and History: The Journal of Natural and Social Philosophy* (2015) 11, pp. 199-200

¹⁵⁶ A Gare ‘Approaches to the question: what is life? Reconciling theoretical and philosophical Biology’ p.75

“active players in their own fate” and “weave” their experience of past, present and future into a complex, coherent whole?

Ricoeur’s narrative theory has been introduced as an alternative source of metaphors, one which is identified with a metaphysics of creative becoming. Reconciled in the light of biosemiotic theory, wherein all organisms are semiotic interpretants, Ricoeur’s rudimentary prefiguring as the perception of signs is conceptually similar to biosemiosis as it pertains to all life, while creative configuring and reflective refiguring requires the manipulation of symbols and representations possible at least in conscious minds. They are higher-level cognitions of the same meaningful relations that all organisms “live and know” in their lifeworlds. Even at the most rudimentary level, the creation of pre-narratives includes self-reference and self-regulation operations. The anthropologist Roy Rappaport argues that these operations are constrained by “general-purpose systems” geared towards survival and reproduction and common to all living systems¹⁵⁷. In this way Rappaport defines purpose functionally as the basic processes needed for survival. But we can extend the narrative metaphor further than that. Rappaport also emphasises the temporal, hierarchical structure of meaning:

...the persistence of living systems is founded upon ordered sequences of responses to perturbations. If such sequences are to remain orderly the systems in which they occur must possess certain structural characteristics. More specifically, they must be both cybernetic and hierarchical, with their hierarchical dimensions including specificity, concreteness, reversibility, arbitrariness, response time, duration, value, sanctity, and authority¹⁵⁸

He argues that values, as categories of meaning, are more specific and instrumental at lower levels compared to the more general and “vague” but hence more adaptive meanings at higher-levels:

But as (specific) information is decreased, meaningfulness is increased; for similarities, substantive or structural, between that which we seek to understand and that which we already “know,” are made explicit. Metaphors are constructed¹⁵⁹

And: “Higher-order meaning is, then, not information in the digital sense but, rather, metaphoric.”¹⁶⁰

In short, organisms can be seen as stories of themselves being written through time, ontologically and epistemologically. It is these stories of themselves that bring non-reductive coherency to complexity. Both the functional business of living, and the interpretive and anticipatory processes that identify salient variables and values, constrain behaviour purposefully and distinguish these purposes from all other potential purposes. And this brings us to the metaphysical meeting place between process philosophy and complexity science: the conception of organisms creating themselves and their lifeworlds according to how they comprehend what is meaningful. A narrative approach to understanding this process allows us to observe the interwoven and reciprocal processes of order and chaos in living organisms,

¹⁵⁷ R Rappaport *Ecology, Meaning and Religion* (North Atlantic Books, Berkeley, 1979) p.146

¹⁵⁸ Ibid p. 156

¹⁵⁹ Ibid

¹⁶⁰ Ibid

and how they constrain self-creation towards coherence and simplicity according to meaningful functions and goals.

Summary of the Complex Processes Paradigm

Living organisms have been described here as irreducibly complex yet self-simplifying systems. Drawing on the concepts of dialectical biology, biological field theories, teleodynamics, biosemiotics and anticipatory systems, we can summarise this ontology of organisms as follows: they are actively self-creating hierarchically ordered systems that embody both chaotic and ordered processes, combining these two intrinsic tendencies in a dialectical dynamic that converges towards a normal attractor: the organism as a whole at the edge of chaos. Their behaviour is regular yet unpredictable: it is not determined by fixed automatic reactions or external conditions: rather, organisms are sensitive to perturbations, the “differences that make a difference”, and can respond to environmental changes creatively, including experimenting with novel responses.

The sensitivity of organisms to perturbations is not undifferentiated. It is constrained in a gross sense by the needs of general functioning, and more specifically by anticipated needs which are in turn specific to the historically constituted interpretive processes of the organism. Organisms are both constrained by their habits of general and specific purposes, and can also respond creatively. This process of creative but constrained becoming causes higher-levels of order to emerge, perpetuating this process as the organism tells its own story against the backdrop of all potentialities.

The physical boundaries of living systems do not so much delineate where an organism begins and ends, but rather they enable necessary conditions for organisms to create themselves and their relationships with the world. The tendency for constraints to propagate effects beyond physical boundaries is a fundamental feature of their causal characteristics, meaning that the organisational boundaries of an organism extend far beyond the physical boundaries. Non-linear dynamics in self-organised criticality constrain individual organisms and whole species to influence each other, such that the fate of one species is linked to that of many others. On the other hand, the boundaries of the felt self are critical to understanding self-maintenance and other kinds of end-directed behaviour. This research proposes that a dialectical and biosemiotic view of organism and environment is helpful in understanding the non-determinate but critical role of boundaries, and indeed dialectical and biosemiotic processes operate at every level of self-organisation.

Despite points of difference, most theorists agree that “causes” of self-organisation include those phenomena that constrain non-linear dynamics and unpredictable effects, and affect systems in terms of functioning of wholes rather than parts. Furthermore, they can account for end-directed behaviour in organisms, in the sense of anticipated conditions and needs, whilst not determining those ends. In short, they are non-determinate “autopoietic” causes, those that enable organisms to cause themselves, and they extend beyond physical boundaries to cause the world of the organism. This view of living systems replaces types of efficient causation as the global set of rules for understanding biological systems with types of constraints or formal causes, including models, boundaries, habits and values.

Deacon argues that at the basic level, organisms create their own boundaries according to what is felt self and what is unfelt not-self. This awareness of self as a higher-level emergent order constrains the organism as a whole throughout different spatio-temporal levels according to the teleodynamics of self-similarity. A second source of overall order derives from the anticipatory nature of organisms. Ways of being in the world are encoded and decoded in modelling relations between the organism and its world, and this keeps

organisms “one step ahead” of events, according to anticipated needs. Biosemiotic processes are proposed to be the means by which organisms can interpret signs that trigger this meaningful, end-directed behaviour. In this sense, organisms can be said to be “purposeful”. Henceforth, the term “purpose” in this research is defined as such.

Ultimately, the purpose of organisms involves constructing a world based on salient self-centered relations that enables the self to continue being. A metaphysic of narrative becoming rather than machine has been proposed as both an ontological and epistemological solution for organisms to comprehend and create themselves, each other, and the world, as entities of creativity and habit.

The regularities of living systems discussed in this and the previous chapter, including habits, models, codes and species, are not determined by the laws of nature, but they do not contradict them. Rather, the laws of nature provide the conditions of existence for the tremendous variety of these regularities¹⁶¹ as living systems proceed in their “ongoing action-based investigation constrained by reality”¹⁶². The non-determinate regularities of living systems have implications for understanding health (or illhealth) as an interpretive process constrained but not determined by laws, causes or conditions, including needs. This also provides a new perspective for viewing medical and therapeutic interventions. These implications are the subject of the remainder of this thesis.

¹⁶¹ K Kull ‘Life is many, and sign is essentially plural’ p.121

¹⁶² D Favareau ‘Creation of the relevant next: how living systems capture the power of the adjacent possible through sign use’ *Progress in Biophysics and Molecular Biology* (2015) p.598

SECTION TWO: THE ECOLOGICAL MODEL

CHAPTER 5

Adaptive Sequences: Normal Functioning and Need States

According to the mechanistic perspective in biomedicine, disease and dysfunction are known by the presence of symptoms caused by external forces: trauma and microbial invasion, and internal causes: including congenital disease and genetic errors or mutations. These causes act on the organism, overwhelming homeostasis. Regardless of cause, symptoms are treated as “pathogens”, in the sense that they cause suffering and are therefore targets for intervention. The aim of intervention is to effect functional and structural changes by acting on the diseased part in a “forceful” manner. The metaphorical language employed in medicine reflects these causal assumptions: “fighting” infection, the “battle” against cancer, pain “killers”, “powerful” medicines that “act fast”. Even bio-psycho-social approaches in medicine view the relation of body, brain and environment in terms of interacting forces acting on the patient. The more inclusive these models, the more inefficient and incoherent they become.

Process philosophy and complexity-oriented biology suggest a different approach to healthcare models, based on the patient at the centre of pathogenesis and healing. This chapter develops the concepts presented in the previous two chapters toward an ecological model for illness and healing.

Homeostasis and allostasis

A mechanistic perspective offers only a very limited view of health as the absence of symptoms/suffering, and is virtually blind concerning the adaptive or transformative processes of healing. These processes are conceived as merely pre-programmed operations that serve to maintain homeostasis.

Often compared to the operation of a thermostat to control the internal temperature of a house, homeostasis involves negative feedback mechanisms by which an organism maintains an optimal range of physiological functioning according to given parameters or set points. When a perturbation or pathogen causes deviation from the set point, effectors belonging to the regulatory system are activated to return the system to the set point. The failure of these systems results in pathology.

In the last few decades, researchers have challenged these assumptions. A 1978 experiment showed that the spinal cord and hypothalamus could be stimulated to produce opposing responses to different temperatures, challenging the notion that a central regulator is necessary for controlling effectors and proposing a hierarchical organisation of regulatory responses¹. A 1961 experiment found that when armadillos were exposed to incremental drops in temperature, they responded by increasing both core temperature and oxygen consumption above the normal range observed prior to the experimental condition. These overcompensating responses were described as drastic and prolonged². Since the 1990's and 2000's, research on regulatory responses to opiates in both addicts and in pain relief patients

¹ E Satinoff 'Neural organisation and evolution of thermal evolution in mammals'. *Science* 201, 4350, (1978) pp.16-21

² K Johansen 'Temperature regulation in the nine-banded armadillo' *Physiological and Biochemical Zoology*, 34, 2 (1961) pp. 126-144

have found paradoxical activation of effectors involved in reward/aversion responses. Reviewing nine studies of the phenomena, Ramsay and Woods conclude:

Chronically tolerant individuals can in fact exhibit persistent sign reversals (inversions) of the regulated variable in the *opposite* direction to the initial drug effect despite the presence of maximal drug concentrations, indicating that these reversals are not rebound effects or instances of drug-withdrawal. Similar sign-reversal phenomena also occur with non-drug disturbances. Along with persistent activation of effectors and concurrent activation of opposing effectors, such phenomena challenge many of the assumptions underlying homeostatic regulation and have important implications for understanding allostasis³

Similarly, Kirmayer notes the complexity of responses to psychoactive medication, and cites several studies showing:

there is evidence that blocking of dopamine D2 receptors, which is part of the mechanism of action of most antipsychotic medications, may lead to an increase in sensitivity of related pathways, which can cause a rebound “supersensitivity” psychosis if the medication is stopped. The same process may account for the symptoms of tardive dyskinesia, a movement disorder caused by long-term use of these medications. A similar process of habituation may occur with the use of antidepressant medication, resulting in loss of its effectiveness, relapse, and treatment-resistant depression⁴.

These observations have resulted in the recognition by some researchers that regulatory processes are far more integrated, unpredictable, and self-varying than homeostatic models allow, and have resulted in the development of an alternate model of transformative regulation: allostasis: “the process whereby in order to be adaptive, organisms must be able to change the defended levels of one or more regulated parameters as needed to adjust to new or changing environments”⁵. Novelty, unpredictability and uncertainty, combined with a “sense of threat” is the definition of stress offered by Peters et al, whose neurobiological model of allostasis suggests that the reduction of uncertainty and/or “habituation” to changed conditions reduce the toxic effects of stress⁶. This reduction of stress concerns endogenous responses, such as updating one’s expectations or internal model of the world to bring this

³ D S Ramsay and S C Woods ‘Clarifying the roles of homeostasis and allostasis in physiological regulation’ *Psychological Review*, 121 (2) (2014) p.240

⁴ L J Kirmayer ‘Revisioning psychiatry: toward an ecology of mind in health and illness’ In L J Kirmayer, R Lemelson and C Cummings(eds) *Re-visioning Psychiatry: Cultural Phenomenology, Critical Neuroscience, and Global Mental Health*, (Cambridge University Press, 2015) p. 633

⁵ D S Ramsay and S C Woods ‘Clarifying the roles of homeostasis and allostasis in physiological regulation’ *Psychological Review*, 121 (2) (2014) p.229

⁶ A Peters, B S McEwen and K Friston. ‘Uncertainty and stress: how it causes diseases and how it is mastered by the brain’ *Progress in Neurobiology*, 156, (2017), according to whom the toxic effects of stress include “a vicious cycle of altered brain architecture and systemic pathophysiology” p. 169. The definition of stress and coping is discussed further below in the section **Stress: an interpretation**

into line with changed external conditions. Others have emphasised that psychosocial factors concerning how stressors are perceived and responded to mediates the effects of stress⁷.

Allostatic models attempt to explain how ideal set points can vary, and how the activity of multiple interacting effectors can “balance” each other to achieve a resting point of optimal efficiency rather than be controlled by a central regulator. These “balance points” must co-ordinate antagonistic effectors that can be activated simultaneously, and effectors belonging to multiple regulatory systems. As such, Ramsay and Woods contend that allostatic models can account for the complexity of interrelated regulatory processes across biological, psychological and even social domains. In their review of allostasis research, Ramsay and Woods also acknowledge that regulatory systems can function more efficiently by learning and anticipating perturbations rather than relying on direct perturbations and linear proportionality, and cite some half dozen prior studies in which they and their colleagues have described associative and conditioned learning processes that could be implicated in pre-emptive regulatory responses.⁸

Ramsay and Woods suggest three main categories of dysregulation involved in pathogenesis that they believe can be explained by allostatic processes⁹. The first and main category is allostatic load: the energy expenditure and wear-and-tear occasioned by adjusting the range of functioning according to changed needs. Allostatic load is compared to the load placed on a home heating system by setting the thermostat at a high constant level to compensate for poor insulation and is offered as an explanation for the pathogenic effects of chronic stress, including that imposed by poor social and environmental conditions.

The second category of dysregulation includes the poorly understood phenomena of antagonistic effectors, which can greatly amplify allostatic load. This is represented in the thermostat analogy by simultaneously running an air conditioner with the heating system, causing overload and eventual system failure. Drug addiction research suggests that drug taking activates both reward and anti-reward effectors, and that the former can become over-activated, creating a chronic deviation of the reward set point. This is described as a positive feedback cycle whereby reduced reward activation triggers behavioural effectors (drug taking) which perpetuates anti-reward compensatory effectors, and so on.

The third category suggested by Ramsay and Woods concerns anticipatory error. They speculate that because regulation should involve anticipatory activity, it is possible to anticipate incorrectly, resulting in inefficient energy use and increased allostatic load for no adaptive gain. They include in this category the possibility of failure to anticipate change, and suggest that the more highly adapted an organism is, the more vulnerable to unanticipated change¹⁰.

Ramsay and Woods observe that homeostatic models continue to dominate in biomedical and biological education, even while research increasingly highlights the inadequacies of these models. They also acknowledge that models of allostasis, while more accurately describing some of the complexity of regulation, have raised more questions than

⁷ M Seligman *Learned Optimism: How to Change Your Mind and Your Life*. (New York, Knopf, 1991)

⁸ Ibid

⁹ Ibid pp. 237-240

¹⁰ D S Ramsay and S C Woods ‘Clarifying the roles of homeostasis and allostasis in physiological regulation’ p.239

offered explanations. In the absence of central controllers, how is regulation co-ordinated? How are balance points to be conceived, and by what means do they vary themselves? By what means do organisms anticipate perturbations, and how should the effects of uncertainty and anticipatory “error” be conceived given that organisms have evolved in an unpredictable world?

Allostasis theory often emphasizes dysfunction associated with multiple bio-psycho-social stressors. However, shifts in regulatory parameters cannot be considered pathological or adaptive without considering the needs of the organism, for instance the development of polycythemia in people living in high altitudes, or even hyperinsulinemia in obese subjects¹¹. Far from being anomalous examples, this applies to far more ubiquitous processes like inflammation and pain, which can be conceived as basic physiological responses to many disturbances, analogous to anxiety as the basic psychological response to trauma or threat¹².

These questions concern the self-organizational and interpretive processes of organisms, and highlight the problems of the co-ordination of multiple processes that bio-psycho-social and allostatic models have failed to grasp.

The need for an autopoietic model

This chapter will show that autopoietic (self-organising) processes that govern pathology can only be understood according to the regulatory processes of the whole, as organisms actively and creatively respond to perturbations. Regulatory processes are reconceived according to the continual creation of organisms in an everchanging lifeworld, wherein there is no necessary distinction between external perturbation and internal regulatory processes. Rather, organisms maintain themselves as part of their relations between internal and external environments. As Judith Rosen puts it:

The material ingredients of any system are certainly part of its organization, but those ingredients and the material structure of the intact system are only a small part of what the term “organization” means. The way a system is organized subsumes material structure. Structure, then, has the capacity to act as a distinct component, within the overall organization, in its own right. Organization must also necessarily include, as ingredients or components of the system, all the relations between material parts, all interactions (specified according to those relations), all effects of those interactions within the system, relations between the effects, interactions between the effects (as specified according to those additional relations), etc... and all non-material ingredients, like time.¹³

And in the words of physician Thure von Uexkull:

Medicine must replace its mechanical model for the body with a model of the living system. Living systems do not react in a mechanical way to mechanical inputs; rather, they transform inputs of the environment on their receptors into signs which inform the systems about the meaning of the environment for its needs. These signs enable

¹¹ P Bellavite and A Signorini *Homeopathy: A Frontier in Medical Science*. (North Atlantic Books, Berkley 1995) p.90

¹² Ibid p.88. These responses are discussed further in Chapter 6.

¹³ J Rosen ‘Robert Rosen’s anticipatory systems: the art and science of thinking ahead’ p.4

the system to recognize and to assimilate the resources of the environment in order to maintain their autopoiesis as basis for their health.¹⁴.

The ontological status of matter itself has been profoundly questioned and reconceived by process philosophers and complexity theorists. These theorists argue that process, not matter, is fundamental, and that the “material” nature of things is a product of self-organising, self-reflexive, self-creative processes. The historically constituted, enduring and coherent nature of these processes, which constrain their material appearance and regular function, can be understood as energy efficient solutions evolved towards the ends of self-preservation and reproduction. These are conceived in terms of habits, boundaries and hierarchies of processes rather than fixed structures. From a more epistemological standpoint, theoretical biologists and biosemioticians argue that interpretive processes are causal constraints on self-creation via structural processes such as semiotic scaffolding and modelling relations. Drawing on theorists of culture, including Ricoeur and Gare, and the phenomenology of Merleau-Ponty, this thesis proposes that, at least in the realms of human culture and consciousness, systemic interpretive habits such as values, metaphors and narratives function to shape and guide our experience of reality. Each viewpoint converges on conceptions of constraints on causal processes, including boundaries, patterns and sensitivities.

This end-directed (telic) formal causation is creative and unpredictable, not pre-determined or context dependent. Speaking of the telos of biosemiosis, Fernandez states “When we talk about purposes we consider actions directed to an anticipated end. The term “directed” exploits an analogy to a path or trajectory in space that traces the direction of a motion. This analogy is very apt because the action of the signals is precisely that of providing directionality”¹⁵.

The previous chapter identified the causal constraints operating in the creative becoming of whole living systems at each spatio-temporal level. These can be described according to two broad and interrelated ontological categories: dialectical processes, which include the dynamics of chaos and order, state and change, self and other, and historical and projected being; and biosemiosis, which constrains the creation of the lifeworld by interpretation and anticipatory modelling. Biosemiosis provides boundary constraints by forming second order interpretants, defining the objects, choices and problems of significance in the organism’s lifeworld according to the ends of survival and reproduction.

Autopoietic causes and consequences are inherently reciprocal, and tend to be organised in recurring patterns of behaviour or habits. These can be described as providing their own constraints, or their own causal closure, as: “second-order constraints emerge from the component’s endogenous dynamics and these second-order constraints then loop back down to influence the lower level dynamics and particle production from which the higher-level dynamics emerged in the first place”¹⁶. Thus between levels, part-to-whole, and both upward and downward causation creates its own forms for reference and self-reference,

¹⁴ T von Uexküll ‘Varieties of semiosis’. In T A Sebeok and J Umiker-Sebeok (eds.), *Biosemiotics: The Semiotic Web* Berlin: Mouton de Gruyter, 1991) p.455; cited in K Kull and J Hoffmeyer ‘Thure von Uexküll 1908-2004’ *Sign Systems Studies* 33.2, (2005) p.491

¹⁵ E Fernandez ‘Signs, dispositions and semiotic scaffolding’ *Progress in Biophysics and Molecular Biology* 119 (2015) p.605

¹⁶ A Juarerro ‘What does the closure of context-sensitive constraints mean for determination and autonomy, self-determination and agency?’ *Progress in Biophysics and Molecular Biology* (2015) pp.510-521; p.514

without intervention from efficient causation. Rather, it operates as its own formal and telic cause.

Sensation and even human consciousness can be understood as higher-level emergent phenomena constrained by dialectical processes and biosemiosis, and which in turn “downwardly” constrain the whole. Consider the sense of self and the “sense” of purpose. An organism senses or reflects on itself, it’s “state” in the moment, and can posit itself in terms of a difference in the future. Salient potential future trajectories, or purposes, are constrained by the sensations and cognitions of the organism in the now. Hunger will guide behaviour towards nourishment, fear towards safety.

To simplify the understanding of a complex organism without losing the defining characteristics described above is to ask the question: *why* is it doing what it is doing? Who is it and what is it trying to achieve at this time? From the point of view of the organism, the questions are reframed as who am I, and what do I need at this time? Understanding of a purposeful and self-creative organism is crucial in understanding health and disease processes.

Prior research

In *Nihilism Inc*, Gare explores the implications of the complex processes paradigm in the broad domain of the health of communities and ecosystems¹⁷. He argues that metaphysics is a critical level for inquiry to reveal the metaphors that constrain the emergence of cultural practices. According to Gare, our beliefs about ourselves and the world are powerful causal constraints in the creation of our lifeworlds. The creation and operation of metaphors and narratives, as habits of consciousness, are a solution evolved by humans that makes sense of our enormously expanded semiosphere, in terms of how we perceive ourselves, each other, and our world. They are a means of organizing complex information.

Gare focuses on how the mechanistic paradigm, perpetuated by mechanical metaphors, alienates people from nature, and constrains humans to be treated as consumers driven by appetites and aversions, and nature to be treated as a storehouse of products to be consumed. This results in the degradation and destruction of the critical dissipative structures in communities and in nature upon which we all depend. Gare argues that a process-oriented “Grand Narrative” to replace mechanistic materialism is required, one which supports people to “orient themselves, practically and theoretically, to nature, to each other, to their society and to outsiders: to recognise and appreciate nature’s, their own and each others’ significance and potentialities, and to realise these potentialities”¹⁸.

McLaren likewise argues for the pervasive causal power of metaphor in culture. He examines the implications of self-organising processes for health at the more specific level of physical well-being, arguing that the failure of current health models to address the epidemic of obesity can be traced to the inadequacy of the mechanistic paradigm on which they are based¹⁹. According to McLaren, this dominant metaphysic underlies the capitalist/consumerist society that creates and perpetuates the conditions for its own illhealth, through industries that treat (and promote) health and fitness as commodities to be consumed,

¹⁷ Esp. chapters 16 and 17

¹⁸ A Gare, *Nihilism Inc*, p.420

¹⁹ G McLaren ‘The obesity crisis and biosemiotic corruption: Towards a unifying semiotic understanding of obesity’ *Cosmos and History: The Journal of Natural and Social Philosophy* 11, (2015) pp.181-220

just like any other product including junk food. In agreement with Gare's argument that in order to challenge the negative impact of the mechanistic paradigm, people need to be empowered to organise themselves, McLaren argues that radical change in society is required so that healthcare can be decommodified and deinstitutionalised and based instead on communities that can take responsibility to create healthy ways of living at multiple and reciprocal levels.

According to Mitleton-Kelly, director of the Complexity Research Program at the London School of Economics, and author/co-author of over 20 studies of applied complexity techniques in organisational settings, effectively addressing the problems of complex systems requires rejecting linear and reductive approaches, including the notion of establishing 'best practice' standards, because they fail to take into account that the processes of change in these systems are both emergent and context dependent²⁰.

Mitleton-Kelly's work has focused on creating "multidimensional enabling environments", capable of encompassing all inter-related dimensions of a complex self-organising system simultaneously. This entails "a methodology which first identifies the multi-dimensional problem-space and then helps the problem owners to co-create an enabling environment to address the challenge"²¹. This methodology should include the core concepts in complexity approaches, such as the capacity of complex systems not only to adapt but to evolve and create new order, the primacy of interdependent relationships, the importance of both bottom-up and top-down processes in self-organisation, and the embrace of multiple causes and possible solutions in the problem-space. These concepts can be considered generic applications of a complexity approach in research. Importantly, she observes that successful organisations engage in continual processes of creative transformation. While Mitleton-Kelly employs a predominantly qualitative approach in her work (eg qualitative analysis of material from interviews and follow-up "reflect-back" meetings) supported with quantitative data when applicable, she posits that any techniques that take into account the "logic of complexity" can be used effectively within this framework²². As Goodwin argues, the logic of complexity makes it necessary to rethink processes as meaningful according to the "complementary" relations between event and context²³.

In *Re-Visioning Psychiatry*, complexity-oriented psychiatrist Kirmayer proposes an ecological theory of mind, which posits socio-cultural constraints supervening those generated by individuals. For Kirmayer, individual purpose or need is acknowledged as a top-down constraint comprised of "particular cognitive schemas, templates, goals, or plans that we strive to adhere to"²⁴ while socio-cultural values and norms are higher-levels of organisation supervening individual selves in what he terms the "ecosocial" mind. Kirmayer

²⁰ E Mitleton-Kelly 'Identifying the multi-dimensional problem-space and co-creating an enabling environment'. In *Moving Forward With Complexity: Proceedings of the First International Workshop on Complex Systems Thinking and Real World Applications*. In A Tait & K A Richardson (eds) Emergent Publications (2011) pp. 36-37

²¹ Ibid p. 23

²² Ibid p. 24

²³ B Goodwin 'Organisms and minds as dynamic forms' p.30

²⁴ L J Kirmayer 'Revisioning psychiatry: toward an ecology of mind in health and illness' p-647

contends that a dynamical systems view of life implies that humans can create adaptive responses and also can create pathology, at least at the socio-cultural level:

This approach would be ecological in that it understands humans as deeply embedded in and interdependent with their environment, occupying specific niches in local worlds. The approach is social in that the local world is both constructed by and constituted of other human beings and cooperative institutions. On analogy to the study of ecosystems, this social context has its own dynamics, which can be self-sustaining and adapt to perturbations, but can also develop its own pathologies.²⁵

From the perspective of research in general practice and family medicine, health psychology, and nursing, most authors argue that the practical application in medicine of the insights from dynamical systems theory is limited to non-physiological interventions. These include the recognition of influences of doctor-patient relationships, the organisational dynamics of health care systems, and the wider socio-cultural context of patients on diagnosis, treatment and patient response. The review of 25 years of bio-psycho-social models in general practice by Borrell-Carrio and colleagues²⁶ is typical. It concludes that linear models of causation remain necessary for integrated treatment approaches, and that:

The biopsychosocial model was not so much a paradigm shift—in the sense of a crisis of the scientific method in medicine or the elaboration of new scientific laws—as it was an expanded (but nonetheless parsimonious) application of existing knowledge to the needs of each patient²⁷

Attempts by healthcare researchers to expand their thinking beyond the kind of extreme physiological reductionism exemplified by RCT research methods and genetic determinism, and embrace the unpredictability and complexity of living systems, have led to a recognition that:

... in open systems, it is often impossible to know all of the contributors to and influences on particular health outcomes. By describing the ways in which systems tend to self-organize, (complexity theory) provides guideposts to inform the clinician's actions. It also buffers the tendency to impose unrealistic expectations that one can know and control all of these contributors and influences²⁸

Egnew, taking a patient-centered perspective, argues that a creative and purposeful view of human life implies that healing is more than the absence of symptoms. Egnew accords purpose a causal power in the transcendence of suffering. Beyond adapting to limitations, this crucially involves a patient's journey of creating new meanings: "By reconstructing identity,

²⁵ Ibid

²⁶ F Borrell-Carrio, A L Suchman and R M Epstein 'The biopsychosocial model 25 years later: principles, practice and scientific inquiry' *Annals of Family Practice* 2, 11, (2004) pp. 576-582

²⁷ Ibid p. 581

²⁸ Ibid

reforming purpose, and revising their life narratives to accept or find meaning and transcend suffering, patients experience healing”²⁹.

However, Egnew largely confined his conception of healing to the “subjective experience” of illness, amounting to an emotional, psychological and even spiritual transformation of patients, fostered by the supportive and compassionate care of the physician. While he suggests that the transcendence of suffering may influence the outcome of biomedical treatment of physical illness, he did not attempt to apply his model of intrinsic healing processes of patients to physical disease. The implication is that the causal laws governing disease and healing of the physical body are distinct from those affecting the mind.

The ontological duality of mind and body remains a pervasive, indeed virtually unchallenged assumption in medical science and allied healthcare, despite regular references to their “interaction” or “connection”. A complex-processes view, in contrast, assumes that mind and body emerge from the same self-organising processes. Distinctions between different processes reflect differences in spatio-temporal scales, yet these can only exist by virtue of participating in the functioning of the whole.

Applying a complex processes view to individual organisms.

This research aims to focus the insights obtained from the complex processes paradigm at the level of salutogenic and pathogenic processes within organisms, as complex systems themselves. Applying the “logic of complexity” to this level of analysis concerns explaining health as an emergent phenomenon of the same dynamical processes responsible for the organisation of living systems generally. Adaptation, the development of strategies for living, occurs at the scale of evolution of species, and at the scale of individual organisms throughout their life cycle³⁰. Autopoietic and biosemiotic processes underlie adaptation and transformation of organism/environment relations. As such, they are healing processes. These are summarized here as a set of propositions:

1) organisms function as dynamic, hierarchically organised totalities, not collections of parts or symptoms. Their dynamical processes of self-organisation apply to both body and mind

2) the basic functioning of organisms is organized around or *directed at* viable use of energy and other responses needed for self-maintenance and reproduction: this is the basic or normal attractor of life

3)The normal attractor is comprised of dialectical processes that constrain stability through variation. This organization enables the organism to create itself embedded in a continually varying landscape of relationships with the world in which no “optimal” efficiency or adaptation can ever be attained

4) biosemiotic causation: “bringing about effects through a process of interpretation”³¹ is the defining feature of the sensitive, energy-efficient processes of

²⁹ T R Egnew ‘The meaning of healing: transcending suffering’ *Annals of Family Practice* 3,3 (2005) p.259

³⁰ Discussed in B Goodwin ‘Organisms and minds as dynamic forms’

³¹ J Hoffmeyer ‘Semiotic freedom : An emerging force’ p. 195

organisms as they respond to perturbations and co-create their life-worlds. These responses include “symptoms”.

5) the variety of potentially meaningful responses is highly constrained (and simplified) by the locus of self-organisation of the organism in its life-world. This locus can be defined in terms of a problem space. Symptoms, then, should be understood as responses to a problem, or more specifically, to needs defined by a problem.

The explanation of pathogenesis is identified as a particular problem for autopoietic theory, as pathogenesis must now be reconceived as an emergent phenomenon of self-causing processes. In other words, when organisms encounter disturbances and forces their responses include “symptoms”. These, while sometimes painful or inconvenient, cannot in themselves be termed pathological if they are part of a healing response. How then should we understand pathology?

Despite the recognition that balance points for optimal functioning must be constantly adapting, allostasis theory lacks an explanation for the processes involved as organisms strive to maintain efficient (or viable) functioning across the lifespan, or indeed how stressors themselves should be understood. These and other questions raised by allostasis researchers, such as paradoxical effects in regulatory responses and the role of anticipation in regulation, require a more dynamical and relational theory of regulation than allostasis.

Both illness and healing, then, are broadly defined here as **dynamical and meaningful responses to perturbation**. This definition guides more specific questions about how to conceive illness and healing. These are now addressed in detail and summarized as a set of further propositions specific to dysfunctional processes.

Stress: an interpretation

Since the work of Hans Selye³², stress is recognised in medical and psychological literature to be far from a simple objective concept. Selye argued that stress is a non-specific response involving general sensations of being unwell, and its non-specificity has meant that its significance was long overlooked in medicine. What the sensations of stress signify is the response of the whole organism to a perceived threat: the stressor. For Selye, distinctions between the internal stress response, or “general adaptation syndrome”, and the external stressor, obfuscate the fundamentally relational nature of adaptation: “Let us remember that it is not the microbe, the poison or the allergen, but our reactions to these agents that we experience as disease”³³. He noted that even if the “causative” agent is removed, the patient does not necessarily recover from the effects of the response to the agent, meaning that disease is partly explained as an endogenous dysregulation associated or inadequate adaptation. As such, he proposed that the general processes involved in adaptation should be studied, and supportive therapies developed, as an important adjunct to pathology-specific therapies.

The mediating effect of subjective appraisal on stress is not a new or controversial argument in medicine or psychology. Viktor Frankl published his first work on the importance of finding personal meaning in life to overcome adversity in 1946: his personal account of surviving Auschwitz. Factors that mediate the effects of stress on health have been widely researched. A review of research on the nature and effects of stress on health found consistent and strong support for the argument that appraisal of events mediates both the

³² Director, Institute of Experimental Medicine, University of Montreal (1950-58)

³³ H Selye ‘Stress and disease’. *Science*, 122 (1955) p. 625

perception of and the effects of stress³⁴. “Positive thinking” and “optimism” are identified in the review as general psychological coping strategies for challenges, including illhealth, that reduce physiological and psychological symptoms of stress, improve recovery rates, and are associated with greater subjective well-being.

Acknowledging the mediator role of the responsive organism appears to support the position that interpretation of events, rather than just the events themselves, is a causal factor of interest in pathogenesis and healing. However, since Selye’s time, a more reductive view that optimism is a universally adaptive coping strategy has been embraced. The limitations of this view in stress-response research are illustrated in Naseem and Khalid’s conclusions: that even people suffering deprivation or living in dangerous war zones would benefit from an optimistic perspective towards their challenges, making them “more healthy and productive citizens”³⁵. But would an optimistic appraisal of conditions in these situations be adaptive, or could it make people underestimate danger and place themselves at greater risk? Even worse, could “adapting” to adversity even stop people from striving to improve their conditions? This raises the question of the fit of appraisal to event: what makes a “positive interpretation” adaptive?

Peters et al ³⁶argue that three key neurological processes concerned with altering models of the world are involved in mediating the effects of stress. First, attention: hypervigilant arousal selectively enhancing the procurement of relevant sensory information. This information then functions to “test” current expectations or beliefs against new information, detecting divergences as errors and correcting accordingly, thus reducing uncertainty. This phase of change is identified as learning. Finally, habituation: which concerns not simply repetition-induced attenuation of the effects of uncertainty, but more likely involving updating one’s “predictive coding”, including expected goal states. In sum, uncertainty itself is pathogenic, and successful coping with stress depends on resolving uncertainty by updating one’s beliefs. This view on coping implies the adaptive relation of organism to the world is based on successfully modifying oneself to changes in the sense of adjustment.

This thesis argues that the understanding of adaptiveness, and therefore healing, must consider the ‘middle term’: the *interpretive cause* of the particular organism in its lifeworld and its aims or needs, rather than the reductive view than mediating factors themselves, such as optimism or adjustment, cause better coping. But even for specific organisms, how can the appropriateness or otherwise of interpretation of perturbations be evaluated?

Dysfunction as error in interpretation

Like Selye, Rappaport speculates that errors in regulatory processes result in dysfunction:

Maladaptations may be conceived as anomalies in the hierarchical and self-regulatory features we have taken to be characteristic of orderly adaptive structure. That is, relations along the several dimensions of adaptive order-- response time, duration,

³⁴ Z Naseem and R Khalid ‘Positive thinking in coping with stress and health outcomes: Literature review’ *Journal of Research and Reflections in Education*, 4, (2010) pp. 41-62

³⁵ Ibid p.54

³⁶ A Peters, B S McEwen and K Friston. ‘Uncertainty and stress: how it causes diseases and how it is mastered by the brain’

reversibility, specificity, sanctity, meaning, value- can become disordered, producing interlevel contradictions or conflicts³⁷

Louie notes various categories of errors causing dysfunction in anticipatory systems, arguing that aside from faulty effectors and unavoidable side effects, the main cause of dysfunction involves encoding error. This position suggests that dysfunction may arise from modelling errors in overestimating or underestimating causal regularities, failure to perceive causal processes, or misjudging our ability to respond as we intend. Kirmayer makes a similar case in describing psychopathology as the distress caused a result of the failure of the brain's function as a "prediction machine"³⁸. For Kirmayer, organisms may respond to this distress by ignoring aspects of life that do not fit preconceptions, leading to various kinds of cognitive, affective and behavioural responses comprising the symptomatology of anxiety, mood and psychotic disorders³⁹.

Judith Rosen suggests that organisms may be unable to keep up with changes in their familiar lifeworld, and adds that this dysfunction may be reinforced by encoded behaviours that act to conserve a familiar lifeworld:

Because our bodies have multiple aspects of our evolutionary environments encoded into them, we now must maintain certain aspects of those prior environmental conditions or else we run into dysfunction. Why dysfunction? Because the models don't stop interpreting current behaviour of environment according to encoded information. If the behaviour set of our actual environment changes too far beyond what our somatic models were encoded *from*, the interpretations of current behaviors of environment are bound to be erroneous and the predictions will be, also. Yet, they can still trigger changes in our physiology!⁴⁰

According to these views, change and uncertainty are problems for anticipatory organisms. But does this mean that our less than perfect ability to interpret, predict and control our world, or ourselves, is the cause of dysfunction? This seems problematic, given that most theorists from the complex processes paradigm assume we have evolved as sensitive beings of "stability through variation" in relation to an inherently unpredictable world.

A creative view of adaptability must reconsider the role of unpredictability, including unfamiliar perturbations or signs in an organism's lifeworld. An organism may not be able to interpret unfamiliar signs or anticipate their causal relations, but it may interpret their very unfamiliarity as a potential threat, and it can certainly be affected by their gross mechanical pushes. Responses could either lead to the organism's death, or could constrain a (curious but cautious) process of trial and error responses that will eventually lead to the encoding of the new sign (and associated causal relations) into its lifeworld. It might be assumed that any processes that support the latter option would convey an evolutionary advantage and be selected for. But unpredictability also applies to the familiar, as even familiar events and causal relations can vary unexpectedly. The following sections outline the argument that the

³⁷ R Rappaport *Ecology, Meaning and Religion* p. 161

³⁸ L J Kirmayer 'Revisioning psychiatry: toward an ecology of mind in health and illness' p. 635

³⁹ *Ibid.*

⁴⁰ J Rosen 'Robert Rosen's Anticipatory Systems Theory: The Art and Science of Thinking Ahead' p.10

biosemiotic processes of anticipating, apprehending, responding to, and evaluating both change and regularity can be strongly implicated in health and illness.

Adaptive dynamics

Adaptive processes have been argued to be fundamental to the becoming of a living system, comprising as Varela has suggested: the identity of the organism in its coupled relationship with its world, and entailing the evaluation of the world from the perspective of this identity. An organism can be understood as the history of its own adaptive processes as it creates and defines itself in its world. Rappaport likewise defines a living system in terms of a unity of responses to perturbations:

I include with the class "living systems" both organisms and associations of organisms. The latter may include such social groups as families, clans, tribes, States, and even societies and ecosystems-- any association that can be shown to have inhering in it as a unit distinct processes initiated in response to and as response to perturbation⁴¹.

These processes include self-regulatory processes which maintain self-organising processes within the range of variables necessary for its viability, including the organism's "systemic flexibility"⁴²: the ability to keep responding to unpredictable perturbations of varying magnitude and duration. Organisms never attain a fixed, perfected adaptation or efficiency, but are constantly responsive to an ever-changing world that continually presents both opportunities to defeat entropy and threats to these opportunities. Recall Goodwin's conception of the normal attractor on the edge of chaos as a definition of health: one which allows an organism to maintain historical system integrity yet prevents the domination of any one frequency or behaviour. Goodwin argues that organisms must embrace and embody unpredictability and can only be adaptive on the edge of chaos and order.

Likewise, Schwartz and Wiggins argue that the ceaseless activity of living things is a function of the constant interplay of what they call "vital polarities" which situate organisms as "suspended between opposite poles of reality"⁴³. These polarities are present at every level of organization in living things, from single cells to the organization of identity of the whole organism, and include those between self and not-self, and stability and change. As has been argued previously, the key issue here is not the nature of parts but their interplay or relations. These may be variable or fixed, and may include opposition, compensation, and mutual constraint. Polarities are defined in relation to each other, and the qualities of these relations have causal implications for autopoiesis. Of particular interest to a complexity-oriented view of adaptation are those relational dynamics that constrain variation and change.

In sum, adaption is a process, not a state, and adaptive processes are fundamental to understanding both what organisms *are*, and the processes creating their health or illhealth. Dialectical adaptive processes offer the necessary dynamics to achieve both energy conserving stability and energy intensive responsiveness. This applies to every level of hierarchical organization.

This leads us to the first proposition for understanding the health status of an organism: **that dialectical dynamics constrain adaptability**. These include dialectics

⁴¹ R Rappaport *Ecology, Meaning and Religion* p.150

⁴² *Ibid* p. 151

⁴³ M A Schwartz and O P Wiggins Psychosomatic medicine and the philosophy of life *Philosophy, Ethics and Humanities in Medicine* 5, 2 (2010) p.2

between order and chaos, orthograde processes and contragrade processes, stability and flexibility, self and other, and present and possible circumstances. In this way, organisms can both ground themselves in their present and historical being in the world and anticipate both causal regularities and unpredictability in the world. Most importantly, they can transform their relations. Health concerns these adaptive processes.

Adaptive sequences

The above proposition for understanding health as a dynamic process suggests that disease processes must tend towards maladaptive states of relatively fixed behaviours and responses: a departure from the “normal” attractor combining both order and chaos. In other words, an organism in a state of dysfunction resembles (at least superficially) a mechanical entity, one for whom ordered processes tend to dominate, as described by Goodwin in his example of the increasingly ordered heartbeat observed in heart disease. Determining the cause of pathology is a matter of asking how, and why, a self-creating organism can create itself into a fixed state with apparently negative implications for its adaptive viability.

Given the ontology of organisms as complex adaptive systems, it seems a reasonable proposition that the adoption of a fixed state may be part of an adaptive response. Recall Rappaport’s observation, presented in the previous chapter, that the self-regulatory processes of organisms entail both “general-purpose systems” of self-organisation geared broadly towards survival and reproduction, and also more specific purposes geared towards specific perturbations. Furthermore, adaptive responses are not isolated, but occur in organised sequences. Rappaport notes that responses to acute stresses are more specific and energy intensive than general-purpose functions, and are often characterised by “gross behavioural and physiological *state changes*”⁴⁴. In other words, organisms may respond to acute perturbations by adopting a relatively fixed pattern of behaviour entailed by the specific needs of surviving that perturbation. These specific needs will override the general-purpose systems of the organism. An antelope will interrupt its feeding to evade a predator, and its evasive behaviour will continue until either it fails in its specific purpose (the antelope is caught) or until it notices the threat has passed and the specific response is no longer needed. The sequence of adaptive responses continues toward general-purpose functioning: resting, eating and watching for predators. These acute, high energy responses to special needs can be highly transient: the organism can quickly move on from them.

Rappaport notes that when perturbations are more chronic, the conservation of energy efficiency entails the development of structural changes which are more difficult, or impossible, to move on from, leading to transformations in function and form⁴⁵. Over time, the antelope population may respond to the presence of particular predators by inhabiting a different habitat, a forest for example, with consequences for the selection of animals with smaller size, darker coat markings, and the ability to digest forest plant species. By transforming behavioural and biological setpoints, the antelope reduces the need to actively evade predators, increasing energy efficiency. Flexibility and energy efficiency may alternate as priorities in acute and chronic adaptive responses respectively, but nevertheless, they remain in a dialectical and interdependent relationship with each other in transformative self-regulatory processes.

The increased energy expenditure of fixed “special” states, when that state is congruent with acute needs of the organism for viability, could not be deemed maladaptive. However, if our antelope keeps on running even after the predator has given up, the energy

⁴⁴ R Rappaport *Ecology, Meaning and Religion* p.150 (my emphasis)

⁴⁵ Ibid

expended would have negative survival value. The special purpose-entrained fixed state is no longer congruent with the needs of the animal.

This conception of adaptive sequences offers the second proposition: **dysfunction is defined as the maintenance of a state that is not congruent with present needs to maintain long term viability/adaptability**. This perspective argues that dysfunction should be understood in terms of phases of adaptive sequences, and begs the question: how do errors occur in adaptive sequences, such that responses can be incongruent with the needs of the organism?

The regulation of adaptive sequences

Rappaport begins to address the question of dysfunction with an overview of the complexity of the adaptive processes of living systems:

First, however, we must consider the structure of adaptive systems, to consider, that is, how systems must be constructed if they are to maintain continuing homeostasis through the mobilisation of orderly sequences of responses to perturbation. We have already noted that adaptive systems are self-regulating and that self-regulating processes have characteristic structures. The causal structure of the cybernetic mode, probably the most important, takes the form of a closed circuit. Adaptive processes are not only cybernetic, sequential and graduated, however. The adaptive structure of any living system is not merely a collection of more or less distinct feedback loops. Particular or specific adaptations must be related to each other in structured ways, and general adaptations, human or otherwise, biological and cultural, must take the form of enormously complex sets of interlocking corrective loops, roughly and generally hierarchically arranged, and including not only mechanisms regulating variables, but regulators regulating relations between regulators and so on⁴⁶

Recall the list of variables Rappaport identified as comprising possible regulators, and it becomes clear how complex the organisation of adaptive processes can be⁴⁷. It is conceivable that simple errors may occur, in a linear sense, in the process of interpretation, much like the errors that Louie discussed in the creation and operation of anticipatory models. Yet this does not satisfactorily address the nature of such errors in autopoietic systems, wherein intrinsically chaotic dynamics make distinctions between *error*, *variability* and *unpredictability* difficult, if not arbitrary. The challenge of grasping the nature of adaptive and maladaptive processes might seem to be compounded by the inherently unpredictable behaviour of complex adaptive systems, but only if variability and error is seen as epistemologically obstructive or physiologically maladaptive. If they are seen instead as fundamental, we can confront the limitations and problems of bio-psycho-social models that have struggled to cope with multiple, interacting variables and unpredictability without regressing to reductionist and dualist positions.

I propose that these limitations can be overcome with a biosemiotic and dialectical perspective on adaptive processes. To begin with, the set of causal variables and relations of functional interest is limited to those that are significant from the perspective of the organism, as the locus of its own biosemiotic processes, giving some degree of parsimony to the model. This is consistent with previous observations that the trajectory of a complex system, while unpredictable, is nevertheless characterised by regularities of behaviour within a phase-space

⁴⁶ Ibid p.153

⁴⁷ See previous chapter

or “attractor”⁴⁸. Mitleton-Kelly states that the number of key interacting causal variables in a complex system is typically low, and the identification of the key variables of a given problem-space affords a coherency to complex problems which would otherwise appear intractable⁴⁹. In other words, rather than a complicated web of linear relationships between a potentially huge number of possible causes and their effects, the problem-space or system attractor delineates the orbit and trajectory of the variables of importance and their relationships. Other variables can be ignored. This is the case not just epistemologically, for the observer, but also ontologically for organisms, as the network of their semiotic interactions “scaffold” their activities in tune with their needs, ignoring signs irrelevant to these⁵⁰.

The phase space of behaviours, and the biosemiotic scaffolding of these behaviours, reflect a fundamental feature of self-organising dynamics in biofields: the emergence of repeating patterns of behaviour that give regularity and coherence to their complexity. As Deacon put it, these intrinsically generated constraints are *self-simplifying* processes comprising *self-similar attributes* or *redundancy*, a defining feature of self-organising systems. Indeed, self-simplification/self-similarity entrained by a salient problem-space not only allows an observer of a living system to assess its variables of importance, but allows the organism to know itself and its important relations, and what is not important. This knowing is not necessarily a conscious recognition or evaluation: it is more basic or embodied. It is sensitivity *only* to differences that make a difference.

Self-simplification is what makes possible all qualities of purpose and meaning, from basic general-purpose functioning, to anticipation and cognitive-level interpretation of needs. Therefore, an holistic model need not take into account all possible variables, but should instead identify the salient problem-space. This problem space is known by the organism, and can be observed by the observer, as the set of differences that make a difference.

Secondly, the transformational nature of dialectical biosemiosis reconceives phases of adaptive sequences, congruent or not, as the creation of various interpretants: in other words, as variations in relations between the variables of interest in the process of emergent ordering. Biosemiotic processes prompt transformations, functional and dysfunctional, as they constrain anticipatory responses according to what is meaningful to the organism.

The most basic relation between variables in anticipatory responses is that between continuity and change: what is occurring now, and what is expected to occur later⁵¹. Temporality is a critical feature of biosemiosis, not just because expectations for future events are constrained by previously encoded models of causal relations. Organisms live in the now, moment by moment, and each moment is a potential for transformation. Prompted by a difference that makes a difference, organisms are challenged to decide between options

⁴⁸ Including those of W J Freeman and J M Barrie ‘Chaotic oscillations and the genesis of meaning in the cerebral cortex’; R Sole and B Goodwin *Signs of Life* esp. chapter 4; and T Deacon *Incomplete Nature* esp. chapter 5

⁴⁹ E Mitleton-Kelly ‘Identifying the multi-dimensional problem-space and co-creating an enabling environment’

⁵⁰ J Hoffmeyer ‘Semiotic scaffolding of living systems’ p. 156

⁵¹ *Ibid* p.166

presented simultaneously in the moment⁵², such as: “Is what is happening now similar or different to what has happened before?” and “should I continue or change my strategy?”

Previously, I have suggested that narratives can provide a means for efficiently organising information in living systems, ontologically and epistemologically. Narratives also describe the transformational processes inherent in adaptive sequences. A narrative organisation for adaptive processes can illustrate this proposition and the phenomenon of dysfunction. Drawing on Ricouer and Gare’s arguments for the centrality of narrative organization in the interpretation of lifeworlds, it is proposed that the reconfiguring of an organism’s lived narrative, moment by moment, requires a dialectical relationship between the present and the (anticipated) future. Yet the interpretation of what is currently perceived to be, and also what might instead be the case, still depends on the interpretation of present signs. Reconfiguration is not caused by events of the past or present, nor is it driven towards a pre-determined end somehow existing in the future. It is a process of emergence that explains how organisms can be both creatures of habit, and can also create novel responses according to their needs in the situation. Importantly, the creation of narrative affords a wholeness to these processes, as McLaren puts it:

Because human beings are ontologically temporal creatures, we are primarily story tellers, whether we are physicists or poets. Wholeness and therefore the conditions for health, is created through the creation of stories which produce wholes out of our always partial knowledge and understanding. The ability for living creatures to generate healthy predictive models of themselves is the ability to situate themselves within a continuity between past, present and future⁵³.

The conception of dialectical interpretation I describe is a transformational sequence. The antelope’s perception of danger is based on the interpretation of signs for a predator. The interpretation of this meaningful sign entails a change in normal “general-purpose” functioning towards a special-purpose state of evasive behaviour. A further change in this behavioural state (of evasion) requires the reappraisal of signs, a reconfiguration of what is meaningful. Is the danger still present? Are there other meaningful signs present? This reconfiguration requires the ability to engage a higher-order reflective function, a stepping out of the present state. Ricouer has suggested that this entails a cognitive awareness of reality transcending the present, via the engagement with symbolic representations (metaphors) as signs. However, there may be more basic biosemiotic processes to constrain a similar process of transformation. For example, Deacon suggests that a constant source of information constraining teleodynamics is an awareness of felt sensations. These sensations are endogenous signs. For the antelope in a state of evasion, these sensations may include exhaustion, overheating or thirst. It may be the awareness of these felt sensations that triggers a re-evaluation of the current need state, which may then override the special purpose of evasion, in the absence of any continued signs of predators, in favour of the conservation of energy and the maintenance of general purposes. In other words, a dialectical interpretation of *what is* and *what could be* is in play. Initially, *what is*, for the antelope, comprises a business-as-usual opportunity for grazing, and *what could be* is the presence of a predator. The perception of a sign of a predator transforms *what is* into a special purpose for evasion,

⁵² Discussed in K Kull ‘Semiosis stems from logical incompatibility in organic nature: why biophysics does not see meaning, while biosemiotics does’. *Progress in Biophysics and Molecular Biology* (2015) pp. 616-621

⁵³ G McLaren ‘The obesity crisis and biosemiotic corruption: Towards a unifying semiotic understanding of obesity’ *Cosmos and History: the Journal of Natural and Social Philosophy* 11,(2015) p. 212

while the category of *what could be* now includes the possibilities of escape and exhaustion. The perception of signs of exhaustion, and/or signs of a lack of danger, again transforms via interpretation *what is* to a state of exhaustion, with the special purpose of rest, and eventually, as felt sensations of exhaustion recede, to resumption of general-purpose processes. This description of adaptive sequences from the point of view of an organism responding to perturbations in its lifeworld can be summarized as a third proposition: **a sequence of adaptive responses can be seen as a narrative describing a problem space, which takes its unique meaning only from the perspective of the organism.**

This view reconceptualises error to be one possibility in a sequence of transformations of special states and general purposes, all of which involve unpredictability. Movement in grass may be the wind, or it may be a predator. “Error” in interpretation is inevitable in an autopoietic system living in an unpredictable world. The anticipation of change and uncertainty is part of the pragmatic evaluation of being in an unpredictable world, and necessary for reconfiguration. Therefore, interpretive “error” as an explanation for dysfunction is entirely insufficient. According to a narrative view of the transformational sequences of adaptation, dysfunction is more likely to be a case of failure to reconfigure the present according to signs of change and uncertainty. In other words, dysfunction entails the relative cessation or curtailing of creative becoming as a moment-by-moment process, and instead is a moment-in-time-past that is being preserved, despite outliving its usefulness or obstructing needed change. This conception of dysfunction is consistent with an enactivist view of emotional disorders: a felt sensation of fear promotes globally self-defensive behaviour, and this makes sense in the context of the patient’s narrative even if there is no present evidence of threat.

This can be summarized in a fourth proposition: **Need states become pathogenic when reconfigurative processes are obstructed.**

The hierarchy and centralisation of regulatory operations

So far, the discussion concerning general and special purposes has referred mostly to easily reversible acute behavioural processes and states focused on a single focal level of organisation. Bearing in mind our ontology of whole systems as hierarchically organised processes, it is necessary to consider transformational dynamics as they operate physiologically, and here, the concept of hierarchical organisation is crucial for unpacking biosemiotic and dialectical processes in transformational sequences.

Hierarchical organisation confers the dialectical dynamics of, on the one hand, differentiation between levels according to differing spatio-temporal rates, which constrains the dampening or insulating effects between levels, and on the other hand, the maintenance of processes that constrain the systemic coherence of the whole. Organisms depend upon their “components” yet maintain their enduring “identity” by constantly replacing and reorganizing these components⁵⁴.

This mereological dialectic is expressed in the relative functional autonomy of special purpose physiological substructures (organs) in organisms, and at the same time, the centralisation of regulatory operations, for example the central nervous system. As this description indicates, lower levels and specific substructures have special purposes to

⁵⁴ M A Schwartz and O P Wiggins Psychosomatic medicine and the philosophy of life *Philosophy, Ethics and Humanities in Medicine* 5, 2 (2010) p.3

perform, while higher-levels tend to have more generic, regulatory functions. Rappaport speculates:

In orderly adaptive systems, relations between subsystems and regulators at different levels should be hierarchical along a number of dimensions. The simplest of these, entailed by the characteristics of response sequences, to which reference has already been made, include: specificity of goals (highly specific at lowest levels to highly general at highest levels), response time (very fast and continuously operating at low levels, slower and tending toward sporadic operation at higher-levels), and reversibility (easily and quickly reversible at lowest levels to irreversible only at the highest levels).

It follows from the ordering of the simple dimensions that higher-order regulators are not so much engaged in the regulation of specific material and behavioral processes as they are in the regulation of relations among these processes. They become involved in the details of the systems subordinate to them only when lower-order regulation experiences difficulty⁵⁵.

Rappaport's description of higher-order regulators becoming involved "when lower-order regulation experiences difficulty" describes a process analogous to that given above of the semiotic prompt to transformation that occurs in behavioural states as perceived needs change. I describe this process above as a dialectical reconfiguration, from entrainment to sensing and reappraisal of signs (including needs) and the potential for new anticipatory responses. Rappaport focuses on signs (as values or variables) and interpretants (as concerns) themselves as transformational regulators, omitting the dialectical semiosis that is basic to the causality of signs, and which I argue is fundamental to understand the dynamics of adaptive sequences. Nevertheless, his description of the relations between levels is illuminating:

In contrast to regulators of low order, each of which may respond to fluctuations in a number of distinct and specific processes, higher-order regulators operate in terms of simplified and highly aggregated variables... This implies that higher-order regulators do not "know" or need to know all that is known by their subordinates; that they needn't be any more complex, and may be simpler, than those of lower order; that they may operate less continuously than those of lower order; and that they include within their repertoires programs for changing structurally, or even replacing, lower-order regulators or subsystems.

In sum, there is an ordering in adaptive hierarchies from a range of highly specific concerns at lowest levels to increasingly more aggregated and general concerns at higher-levels, and characteristic relationships of reversibility and time are associated with this order.... There is also the matter of duration. First, the concerns of lower-order systems are likely to be transitory, while those of higher-order systems are enduring. ... Low-order directives are typically commands, and as such are situation-specific and therefore ephemeral. Rules, which are more or less enduring, being category, rather than situation-specific, are typical of middle-range regulation. Principles, characteristic of yet higher-order regulators, may be taken by those accepting them to reflect enduring or even timeless aspects of morality or nature⁵⁶

From a semiotic perspective, it is unclear whether Rappaport refer to commands, rules and principles as signs or interpretants, however because an interpretant can also function as a (self-generated) sign, the distinction is not crucial. The importance of Rappaport's

⁵⁵ R Rappaport *Ecology Meaning and Religion* p. 154

⁵⁶ Ibid

speculation is the observation that lower levels are more concerned with specific purposes compared to the regulatory function of higher levels, which can be seen to include overriding emergent order processes which can “reset” the special purposes of lower levels. Rappaport argues that higher order purposes are more general and vague, and are continually reinterpreted, according to the realities of a given situation. According to Rappaport, this openness to interpretation affords them the flexibility needed to regulate the more specific, instrumental purposes of lower levels of organisation.

In general agreement with Rappaport’s notion of hierarchy of values, a dialectical view emphasises flexibility in terms of the priority of values. While survival might be given the first priority, exactly what is needed for survival must vary according to signs active in the problem-space. Survival may mean (be interpreted as) running or resting. Perhaps the only truly critical value could be said to be the meta-regulation of adaptive sequences afforded by dialectical configuring, although many other meta-operations must exist for this to be possible, such as the dynamics of perception and sensation.

However, Rappaport’s description of the specificity of lower level functional purposes requires further examination. Lower level functioning tends to be entrained around physiological processes needed for survival, consistent with the functional concept of purpose adopted by most biologists. While these physiological processes may be specific to certain tasks, they also general function processes in that they are constrained by a simple phase space of performing their function. A cell membrane performs many tasks specific to managing the transport of substances across this barrier, and at the same time, these tasks support the general survival needs of an organism who may be engaging in highly variable behaviours at a higher-level of functioning. There tends to be little room to vary the specific but basic functions of lower levels without disrupting the functioning of the system as a whole, due to their function in supporting the general survival needs of the organism.

Rappaport observes that higher-levels of organisation can also become organised around highly specific purposes, entraining the whole system. For Rappaport, this organization is dysfunctional, belonging to a different class than the flexibility of higher values according to contextual demands quoted above. Rappaport’s perspective regarding special purposes is now examined, then an alternative conception from a dialectical semiosis perspective is offered.

Dysfunction as entrained hypercoherence

According to Rappaport, the basic maladaptive anomalies of self-regulation consist of errors in the interpretation of, and the magnitude and duration of responses to, perturbations. He notes that these basic errors in regulatory processes seem to be related to maladaptive “trends” in the organisation of complex systems under the rubric of “hierarchical maldistribution of organisation”⁵⁷. Speaking of social and economic systems, Rappaport identifies the maladaptive trends of “oversegregation”, “overcentralisation” and “overspecification”⁵⁸. All these trends involve overriding the autonomy of lower order subsystems by the dominance of special purposes in higher-order centralised regulatory processes (although these special purposes may originally have derived from subsystems). These dominant special purposes are less responsive to the needs of subsystems, and tend to

⁵⁷ Ibid p.162

⁵⁸ Ibid

muster resources towards their own needs, perpetuating themselves in positive feedback loops.

The organisation of a system dominated by special interests is described by Rappaport⁵⁹ as *hypercoherent*⁶⁰. In a hypercoherent state, the centralised regulators dominating the system are sensitive to a set of simplified values relevant to the special purpose, and the diversity of regulatory processes characteristic of subsystems in a dynamic hierarchical organisation is decreased. This results in a decreased ability across the system to respond adaptively to perturbations. Instead, responses are constrained according to the values of the special purpose, which become “blind” to the needs and values of subsystems. Rappaport presents his argument in the light of errors of value judgements or problems of organisational scale, resulting in various types of maladaptive organisation that share the quality of hypercoherence. However, these errors are entailed by a decreased repertoire of possible interpretants and therefore potentially adaptive responses. They are not simply errors of prediction. This position is consistent with the argument that adaptive behaviour is better characterised by a “better probability distribution of events for survival and reproduction... rather than the reduction of uncertainty”⁶¹.

Contrast this view with that of Peters et al, who effectively equate uncertainty with stress, and the adaptive task of the brain to reduce uncertainty via three key processes of hypervigilant attention, correcting for error, and habituation. Hypervigilant attention is argued to be the process by which error might be detected. Like Peters et al, Rappaport contends that a system in a state of hypercoherence is selectively sensitive. For Rappaport, this sensitivity concerns fluctuations in the greatly reduced set of variables or values pertinent to its special needs, compared to the set of needs constrained by general-purpose functioning. The hypercoherent system has put all its eggs into one basket, decreasing adaptive potential. Finally, for Rappaport, the notion of a hierarchy of values, from higher and more general, to lower and more specific, is central to maintaining diversity/adaptability, and preventing hypercoherent maladaptation.

However, I argue for an alternative conception of the nature and function of special purposes: they are a part of adaptive sequences, and are not in themselves healthy or unhealthy. Their functionality depends on their congruence with the needs of the system, and congruence depends on the ability to reflectively reconfigure, moment by moment, the interpretation of one’s lifeworld, including *inherent uncertainty* as a ubiquitous phenomenon.

This is consistent with the enactivist view of disease proposed by Ongaro and Ward, who contend that health should be understood as the congruence of behaviour with adaptive relations with the world, while disease concerns a preoccupation with internal states:

A natural conception of health for the enactivist, then, is in terms of the dynamics characteristic of an optimal relationship to the environment for an organism; a natural

⁵⁹ Ibid

⁶⁰ To clearly contrast the concepts of hypercoherence with dynamic coherence as described by Frolich and Hyland (see chapter 4): the former can be considered as a highly ordered global oscillation, strongly resistant to variations and typified by positive (self-reinforcing) feedback cycles, while the latter is robust but typified by edge-of-chaos oscillations, and responsive to negative feedback cycles

⁶¹ T Nakajima ‘Biologically inspired information theory: Adaptation through construction of external reality models by living systems’ *Progress in Biophysics and Molecular Biology*, 119, (2015) p. 647

conception of illness is in terms of disruption of those dynamics, such that an organism's activity becomes directed toward its own bodily states or processes, rather than the distal properties to which those states and processes usually attune it.⁶²

The organism's need states, while originally prompted by 'distal properties', are out of tune with its world. Yet attunement is not merely adjustment to external reality, nor entrainment to general purpose values. Transformational interpretation is a form of downward causation constrained by a more fundamental system regulatory process than the value hierarchy described by Rappaport: dialectical biosemiosis.

Special purposes and biosemiotic causation

In the example of the antelope given above, the regulatory function of the higher-level central nervous system can reset the special purposes of lower levels to maximise resources available to evasive strategies. The well-known "fight or flight" response musters resources throughout the hierarchical levels and subsystems of the organism to the end of self-preservation. The entire organism is organised according to a special purpose. Blood is redirected from organs to skeletal muscles. Respiration and heart rate increases. Senses become acutely sensitive to signs of danger, and insensitive to other signs. This is a state of hypercoherence, with peculiar sensitivity to a greatly reduced set of variables, yet it is congruent with the needs of the organism, and thus cannot be described as maladaptive. The smallest indication of a predator, whether sensed visually, aurally, olfactorily, or tactilely, is immediately interpreted in a systemic response: to flee. This is an instance wherein hierarchical insulation between levels, which would otherwise dampen fluctuations, is overridden by the need to detect and respond to any sign meaningful to the special purpose of the state of arousal.

I propose that this state of special sensitivity, entrained throughout the organism by the special purpose regulated by a higher-order interpretant, explains how the unusual butterfly effect occurs. If this is correct, then while a butterfly effect, as an extreme example of non-linear causation, occurs in a far from equilibrium system, it is more likely to occur in a living system in a state of unusually uniform coherence dynamics. The notion of system attractor is useful here: the normal attractor at the edge of chaos, which preserves a dynamical balance of chaos and order, and maintains coherence via plastic self-similarity, is replaced by a more ordered attractor typified by a higher degree of self-similarity throughout the system: hypercoherence. This phenomenon suggests that any state entrained by a special purpose entails greatly enhanced sensitivity to signs meaningful to that state.

With this observation in hand, it is now worth revisiting the concept of biosemiotic causation. As Dix argued: the special sensitivity of organisms to ultra-low energy fluctuations is a necessary and defining feature not only of biosemiosis but of life itself. This sensitivity "radically enhances their viability by producing a non-linear hierarchically ordered cascade of adaptive activity peculiarly associated with the signal type"⁶³. At the same time, biosemiotic sensitivity reduces the wear and tear that would result if organisms relied on the far more massive forces involved in the push and pull of mechanical causes. The antelope doesn't have to wait for the lioness to jump on its neck to be pushed into evasive action. A few molecules of scent carried on the breeze will suffice. Indeed, the less energy required to comprise a sign, the better. As Dix explains: "it is important that non-essential causal aspects of the sign-vehicle not physically overwhelm or destabilize the interpreting system or its sub-

⁶² G Ongaro and D Ward 'An enactive account of placebo effects' *Biology and Philosophy* (2017) p.15

⁶³ M Dix 'Living and knowing' p. 1

systems (preventing or impeding interpretive-responsive activity)”⁶⁴. It is easy to see the desirability within the body of far more efficient and gentle biosemiotic causation compared to mechanical forces.

Dix describes the multidirectionality of biosemiotic causation in hierarchical organisation according to Salthe’s conception of triadic structure: a focal level for biosemiotic constraint, a subserving level below providing initial conditions/potential meanings, and a level above which constrains the boundary conditions of lower levels. This model is consistent with Rappaport’s description of infrequent higher-order regulation of lower levels, but does not entail that higher-level regulation must comprise general values or variables, even while it does tend to have a general systemic effect on lower levels. Recall Deacon’s account of the hierarchical organisation of self-ordering dynamics up to the level of second order teleodynamics, which is no more or less than a highly refined function of self-other reflexive dynamics emergent from less refined but similar lower level dynamics. This perspective reveals higher-level regulation to be a “natural” function of the dynamics of emergent hierarchical organisation, which does not require further causal explanation.

Dix also describes the need for organisms to be constantly sampling, assessing, and responding to signs in their lifeworld to “modulate their trajectories”⁶⁵ and maintain their viability in the face of constant disturbances. The ability to respond to signs means that organisms act pre-emptively in the sense of anticipating what follows from a sign, rather than being limited to a trial and error model of response, or, even more inefficiently, waiting for a mechanical push. For humans, at least, anticipatory models can operate on a purely conceptual level.

According to Dix, one class of disturbances that organisms can anticipate is biosemiotic causation itself. He argues that they can act to avoid or mitigate the potentially disruptive effects of non-linear causation entrained by sign interpretation. In other words, they can avoid unwanted butterfly effects. The avoidance of unwanted non-linear causation has previously been described as constrained by the insular effects of hierarchical organisation which occurs when general-purpose, business-as-usual, normal “edge-of-chaos” organisation prevails. Dix’s point is that organisms may anticipate and act to pre-empt disturbances to business-as-usual functioning, whether these disturbances be mechanical pushes or biosemiotic prompts. However, I argue that it is equally likely that organisms also modify their trajectories to maximise their sensitivity to signs with particular importance in their lifeworlds, according to needs. This modification occurs “naturally” as signs are detected by subserving levels, constrain focal levels, and trigger higher-level interpretation by regulatory levels. This is a process comprised of the continual modification of transient, relatively ordered states. To reprise the description given by Deacon in the previous chapter:

Organism forms evolve in the process of accomplishing a task critical to maintaining the capacity to produce this form, so the task space and the form of the organism are essentially inseparable⁶⁶.

Deacon is discussing evolutionary processes of species. My conception of adaptive sequences relates these evolutionary processes writ large to the day to day, even moment by moment scale of an individual organism. Replace Deacon’s words “a task” with “tasks” and we have a description of adaptive sequences. In other words, organisms entrain their organisation as part of an interpretive response to a specific need, disturbance or threat. The antelope, prompted

⁶⁴ Ibid p.17

⁶⁵ Ibid p.20

⁶⁶ T Deacon *Incomplete Nature* p. 114

by the scent of the lioness, entrains its organisation to be as sensitive as possible to any further sign of threat. The lioness entrains herself to be sensitive to any sign of antelope, and more specifically, to any sign of weakness or incaution in the antelope. Indeed, it may be accurate to state that sensitivity to any sign depends on an organisation that is entrained towards sensitivity to it, at least in the broad sense that an organism only responds to signs that are meaningful in its lifeworld. This, then, leads to the fifth proposition: **that a hypercoherent state, whether functional or dysfunctional, entails enhanced sensitivity to signs related to the special purpose of that state.** Salient signs have a valency in relation to the special purpose (see Chapter 7 for further discussion). This characteristic semiotic and anticipatory sensitivity found in a hypercoherent state is henceforth referred to as *hypersemiosis*.

Hypercoherence and self-similar coherence

The maintenance of an incongruent state may be explained by hypersemiotic processes. The organism is entrained towards special signs, and may misinterpret or exaggerate signs according to entrained anticipation. This error of interpretation is not due to failure to correctly interpret signs, but when signs are interpreted in highly repetitive, predictable ways, and change is not anticipated or perceived. Behaviour becomes repetitive and less responsive to changing context.

Entrained semiosis comprises a positive feedback loop, in which misperceptions support further misperceptions and the maintenance of the hypercoherent state. A vicious cycle is created.

A similar conception is proposed by Kirmayer, who describes strongly coupled psychophysiological processes as a form of self-reinforcing causation in psychopathology:

Recognizing these loops means that theoretical efforts to define distal and proximal (or primary and secondary) causes break down, since the outcomes of one process become inputs to the next in cycles of symptom amplification, maintenance, and social reification⁶⁷.

Compare self-reinforcing semiotic processes in hypercoherence with the self-similar coherence described by Deacon. Self-similarity is based on a felt experience of the self, in Deacon's terms it is the vegetative (orthograde) substrate of the ententional self, the holding pattern from which work-doing (conragrade) processes can emerge. Deacon argues that attractor dispositions propagate constraints that perpetuate those same dispositions, according to a self-reflective organisational logic which defines itself through its own self-similar features. These features have the quality of simplifying complex processes according to regular patterns, but they are not the highly predictable, entrained patterns of hypercoherency.

Self-similar dynamics in living systems combine both ordered and chaotic behaviour, giving the system both flexible coherence and maximizing adaptability. Self-similarity expressed as fractal dynamics are now a well-established feature of the oscillatory frequencies of living systems at every scale. Fractal organisation produced by loci of self-organised criticality in biological systems maximises the efficiency of their regulatory processes, and as such is now accepted as 'a central strategy of organismic regulation'⁶⁸. A review of research indicates fractal oscillatory frequencies are associated with healthy

⁶⁷ L J Kirmayer 'Revisioning psychiatry: toward an ecology of mind in health and illness' p.640

⁶⁸ K Sankaran and A Hankey 'Experience information as the basis of mind: Evidence from human decision making' *Progress in Biophysics and Molecular Biology* 131, (2017) p.370

functioning from the vibrations of red blood cell membranes, to breathing rhythms, blood pressure and gross motor co-ordination⁶⁹. Deviation from a 1/f fractal organisation in the brain and central nervous system is associated with pathogenic and dysfunctional processes including mental illness and organic brain disease⁷⁰. Self-similar dynamics in heart beat frequencies are associated with cardiac health, and chronic heart disease is characterized by a loss of chaotic variability⁷¹.

Efficiency of regulation here does not imply maintenance of homeostasis, but rather stability through constraints on variation. Optimal regulation tends to maximise “information diversity” and the sensitivity of responses, supporting the creation of information from the organism’s experience⁷². Information about the world is created by making distinctions between self and not-self, and this gradient of difference enables work, including adaptation, to be done. What are the implications of a lack of reference to (signs of) the not-self? A positive feedback loop of self-referential logic would amplify the felt experience of the self and reduce attention to the not-self. Dispositions would become organized around holding patterns of vegetative self-similarity, and the organism would become vulnerable to drifting further from congruency with unfolding events in its world. Without the complementary tendency of contragrade dynamics, habits of being would become increasingly ordered and predictable, the reduction in difference gradients tends to reduce ability to do work, increasing homeostasis and eventually death. In short, without the necessary dialectical dynamics, healthy dynamic self-similar processes degrade to the self-sameness of equilibrium, ignorance and alienation from the unfolding events of the world.

Needs and problems: a disambiguation

I am not conceiving needs as something given, although some needs, especially those at basic levels of metabolic and regulatory levels of organization, are highly predictable and repetitive, with highly constrained responses. Even at these levels, specific needs change, as specific functions are switched on and off, while the ultimate endpoint of need organization remains self-maintenance of the whole. Needs encompass what is felt, what is important to someone somewhere, what is remembered or anticipated, a problem entailing a choice, and what makes sense according to a series of meaningful but uncertain relations between organism and world. This means that the dynamic processes by which organisms create themselves, including their organizational patterns and sensitivities, cannot be understood without also considering qualities of sensation, awareness and significance from the point of view of the organism.

Organisms produce the particular responses that we term symptoms when their present way of living is challenged, and these responses might include pain, fear, inflammation etc. To repeat Selye’s definition: “Let us remember that it is not the microbe, the poison or the allergen, but our reactions to these agents that we experience as disease”⁷³.

⁶⁹ M L Wijnants ‘A review of theoretical perspectives in cognitive science on the presence of 1/f scaling in coordinated physiological and cognitive processes’ *Journal of Non-Linear Dynamics*, (2014) pp.1-17

⁷⁰ Ibid p.4

⁷¹ Ibid, also see R Sole and B Goodwin *Signs of Life*

⁷² A criticality theory of ‘Experience Information’ is discussed in K Sankaran and A Hankey ‘Experience information as the basis of mind: Evidence from human decision making’, while the characteristics of optimal regulation according to this view are summarised on p.373

⁷³ H Selye ‘Stress and disease’ p. 625

Symptoms are produced in response to perturbations or disturbances, including pathogens. These events or agents are interpreted by the organism in terms of what the organism needs to do to maintain itself or possibly transform itself, give the meaning of the disturbance to the organism in its present context. In contrast to Selye, I contend that the production of symptoms is not sufficient to define disease. Rather, these responses are very typical of life, and inextricable from processes of living and evolving. Symptoms and their resolution comprise the pathway termed an adaptive sequence.

Primary responses to needs or problems, such as inflammation or shock, tend to be automatic and highly entrained. They tend to contain and minimize the damaging effects of the perturbation, and can be considered defensive responses, organized around the need to defend. An adaptive sequence can stall when organisms are unable to meet a need: this unmet need has now become a problem. If the organism is unable to overcome this limitation to their normal functioning, the focal level, or affected component, can develop a fragmented relationship within the field. Because the normal functioning of the component is compromised, this matters to proximal components, who are themselves semiotic agents. Their interpretants, the secondary responses of proximal components, need to accommodate and compensate for this compromise, which prompts tertiary responses and so on.

Compensations are control strategies, and might include avoidance of pain, fear, and uncertainty. These needs comprise a self-perpetuating complex that may come to dominate the entire organization of the organism. Because organisms are selectively sensitive to perturbations relevant to a need state, and because energy can be rapidly and non-locally mobilized in response, these response patterns can become entrained by endogenous compensatory self-sustaining responses. From the point of view of the organism, every perturbation comes to be interpreted according to the defensive/avoidant need complex, perpetuating this organization to the neglect of other needs, including blocking awareness of other needs and perturbations. Entrainment at any or all levels propagates repetitive behaviour. Whether observed in cardiac rhythms or panic attacks, repetitive behaviour is a basic feature, perhaps the defining feature, of what we recognize as symptoms in disease syndromes. We can term this entrained pattern of self-sustaining defensive/avoidant need complex comprised of control strategies: “pathology”.

Summary: Adaptive sequences: Normal functioning and the development of need states

To recap the propositions of the ecological model thus far:

1) organisms function as dynamic totalities, not collections of parts. Their dynamical, hierarchical processes of self-organisation apply to both body and mind, constraining the emergence of both

Causal assumptions based on material components and their actions on each other (material and efficient causes) are insufficient to understand causation in living systems. Organisms cause themselves, prompted by perturbations that they sense and respond to. Evolution can be understood as the history of this process, which constrains the emergence of hierarchical levels of “purpose” from highly constrained basic yet specific functions, including Rosen’s M-R functions, to highly variable conscious symbolic interpretation and anticipation of causal regularities in the organism’s lifeworld. Hierarchical organisation may include many

levels or dimensions of functional relations, depending on the distinctions created and maintained by living systems.

2) the basic functioning of organisms is organized around efficient use of energy for the organism's general purpose needs: this is the normal edge-of-chaos attractor of life

Needs refer to whatever conditions the organism perceives is important for its continuance, and anticipates its absence or insufficiency. Efficiency does not entail an optimal state of functioning or adaptation. Rather:

3) the normal attractor is comprised of dialectical processes, constraining habitual yet variable and novel behaviours at the edge of chaos

In an unpredictable world, wherein each individual organism, every species, and all other environmental events and conditions are continually relating to each other, efficiency must be understood according to a dancing landscape of changing threats, opportunities and needs, all of which can be interpreted and anticipated but not controlled

4) biosemiotic causation is the defining feature of the energy-efficient processes of organisms as they respond to perturbations and co-create their lifeworlds.

Organisms, unlike inanimate objects or machines, do not need to wait for a mechanical force to push them into reaction. Nor do their internal processes rely on mechanical forces. Differences that make a difference can be no more than a few molecules of scent or a change in sound waves. It is the meaningfulness or salience that counts, from the response of cell membranes to extracellular electrolyte imbalance, to the vibration of a mobile phone to an anxious job applicant.

5) the variety of potentially meaningful perturbations and responses (including symptoms) is highly constrained (and simplified) by the locus of self-organisation by the organism in its life-world. This locus is the problem space.

At every level of organization, salience and responses are made possible by second-order constraints, which, being anticipatory interpretants emergent from the living system, can be termed autonomous, meaningful and future-oriented. Teleodynamically, they refer to the sensed and anticipated needs of the organism. Both felt and anticipated needs form the boundaries of the problem space, limiting the salient range of potentials and actuals. The formal and telic qualities of these causal constraints can be termed "purposeful", and give guidance in choices rather than determination or control.

General and special purposes differ in terms of highly constrained functions at the lower levels to highly variable in focus, inclusiveness, valency and temporality at higher-levels. However, the whole is constrained by self-simplifying self-similarity. At the broadest

level, what is self and what is not self is experienced at every spatio-temporal scale. Further propositions for understanding disease as a process that makes sense according to this model:

- 6) a hypercoherent state, whether functional or dysfunctional, entails enhanced sensitivity to signs related to the special purpose (needs) of that state.**
- 7) dysfunction is defined as the maintenance of a state that is not congruent with present needs to maintain long term adaptability. Dysfunctional incongruency occurs when dialectical reconfigurative processes fail.**

A response (or symptom) that may have originally been congruent with needs (or anticipated needs) is maintained past its usefulness. It becomes an automatic reaction rather than a reflective response. This entails a much more “self-organised” view of pathogenesis than that of the mere presence of suffering, or of pathogen acting on patient, or even the wear and tear of allostatic load (or combinations of all of these). Rather, automatic or habituated reactions can perpetuate themselves, creating a positive feedback loop of dysfunction.

Disease is reconceived as a self-organised state created by perceived needs and continued beyond congruence with present needs by the organism’s inattention to change, or otherwise inability to transform itself. Inattention may be passive, in the case of functional deficit such as loss of sensation, or it may be active. Active inattention may be constrained by values for control, avoidance of uncertainty, fear of change, or rejection of aversive sensations or signs (e.g. non-acceptance of pain or loss). These comprise second order endogenous responses that emerge as acute hypercoherent states develop into chronic and multi-morbid disorders.

CHAPTER 6

Pathogenesis and Complex Pathology

The mechanistic approach in health and illness views some forces or events (e.g. stressors, microbes, error and trauma) acting on organisms to cause pathology, while medicine is viewed as those forces and events acting on organisms to correct pathology. Chapter 3 details the problems of the bio-psycho-social approach in handling the complexity of living systems. One of the main problems is that a mechanical approach to multiple interrelated causes results in a highly complicated model, which, as all possible causes are analysed further, can only get more complicated. A further problem is that disease and health are not clearly defined beyond the presence or absence of suffering.

Chapter 4 argues that this problem can only be overcome by adopting an holistic, complex-processes view of living systems, where-in organisms are seen to regulate, change, and “cause” themselves according to their sensed/perceived needs in their lifeworlds. This is argued to be an inherently interpretive and meaningful process. Chapter 5 applies this autopoietic approach to understanding disease. This reframes pathogenesis and salutogenesis in terms of the production of responses (including symptoms, decisions, and changes) according to the needs of an organism in its problem space. Symptoms of “pathology” can be understood as responses produced to try to solve a problem. The processes involved in producing, trialling and reconfiguring responses has been termed the “adaptive sequence”. It has been argued that problems and adaptive sequences must be understood as meaningful from the point of view of the organism, and that problem resolution likewise is meaningful. Healing is briefly discussed as a transformative process more akin to adapting and learning than to correction of error, or absence or transcendence of suffering.

The set of propositions developed from this perspective includes that the production of symptoms is constrained, and dysfunction is “simplified”, according to the locus of the problem space. This has been illustrated with the example of responses to simple acute trauma in the previous chapter. A state of hypercoherence, while involving the whole organism, is produced around a simple, acute need, such as survival, and can be resolved via the production of changed responses when signs indicate safety to the organism (who must also be capable of sensing/perceiving these indications). It is argued that from this conception of pathology, complex processes can be grasped in a simple, yet non-reductive model based on the adaptive sequence/problem space of the organism.

The next task is to demonstrate the applicability of this idea to the multiple and apparently disconnected symptoms typical of multi-morbid illness.

This chapter examines the underlying dynamics of the development of complex pathology in chronic disease and shows that symptoms of apparently unrelated or disconnected dysfunctions or diseases may be understood as compensatory or reactive to an unresolved need state. The following chapter examines the processes involving healing more fully.

The allostatic model

The biomedical approach relies on a conception of homeostasis as a model for self-regulation. The inadequacy of these simple “setpoint” models for understanding even simple regulatory changes, let alone pathology, has been discussed. The development of allostatic models for disease and healing are an attempt to recognise the roles of adaptation and variation over time. In recognising the ubiquity and importance of variation in self-regulatory processes, researchers have paid closer attention to change over time, including identifying

several possible trajectories for pathogenesis. These are outlined at the beginning of Chapter 5, and include allostatic load (“wear and tear”, and the expenditure of energy for adjusting and regulating set-points over time), the compensatory behaviour of antagonistic effectors (including the non-linear amplification of some processes via positive feedback cycles), and anticipatory error, which refers to a failure to account for change over time. While Ramsay and Woods contend that allostatic theory can account for the development of non-linear and paradoxical effects in pathology, they acknowledge that the theory lacks a sufficient conceptual basis for understanding how the multiple balance-points for regulation are co-ordinated, how they vary themselves, and how, in an unpredictable world, some such variations are pathogenic while others might be adaptive. A more adequate conceptual basis for understanding these issues requires a science of who, when and why: the unfolding of meaningful and purposive behaviour as an organism responds to salient perturbations in time.

Signs of disease

Biomedicine considers both disease and health in terms of states of being: the presence or absence of symptoms, whether deriving from “external” or “internal” causes acting on the organism. The previous chapter argues that disease may originate with a relatively fixed state of entrained responses, ‘hypercoherence’, emerging in response to felt needs in a sequence of adaptive processes. Symptoms are thereby reconceived as interpretants of salient perturbations and are not in themselves sufficient to assess pathogenesis or healing. Rather they must be understood in the context of an adaptive sequence in the context of a problem space, which involves identifying emergent special purposes (needs) according to the narrative being created by the organism. Thus, symptoms reflect special purposes which entrain behaviour away from the normal attractor of self-organised criticality.

Goodwin also makes a distinction between symptoms and disease, arguing that health and disease are self-organising processes of which symptoms are merely signs, not the disease itself. For Goodwin, the overall dynamics of order and chaos are the more fundamental processes in diagnosing disease, and are reflected in the behaviour of the whole organism:

The characteristic dynamics of health are a result of nonlinear influences that describe the dynamic coherence of the whole organism as a single unified system, an emergent entity with subtle dynamic order. By examining the dynamics of a part of the organism... one can draw inferences about pathologies of the whole. This provides a potentially powerful diagnostic tool for identifying dynamic imbalances of physiological function¹.

Goodwin states that any “good health practitioner” regardless of training or background, will examine various parts and processes and make part-whole inferences in diagnosis, and he suggests that different forms of medicine might converge in their understanding of health as an emergent dynamic property of the whole system². These comments speak to the task of assessing the presence of disease as a general shift away from the normal attractor combining chaos and order, the normal attractor being dialectical disequilibrium rather than homeostasis, which enables organisms to continually adapt to changing conditions whilst maintaining their integrity. Hankey discusses a similar dynamical model for health, describing edge of chaos

¹ R Sole and B Goodwin *Signs of Life* p.117

² Ibid

criticality as typical of health, suggesting that shifting away from this dynamical range creates a vulnerability to disease:

... when the strain of ongoing function moves the locus of control away from (self-organised) criticality, poor regulatory response to environmental demands becomes a possibility. Failure of required system responses represents a compromise of healthy function...”³

These theories rely on an assumption of causal field dynamics in biological systems, capable of producing macroscopic regularities in the behaviour of whole systems. Frohlich’s research in biological functional coherence, discussed in Chapter 4, suggests that the electrodynamic fields of organisms, and in particular their properties of coherent oscillation (excitation states), are crucial for understanding the macroscopic regularities of the whole. Drawing on Frohlich’s work, Hyland suggests that interruptions to normal coherence can result in pathology, including cancer⁴, and that therapies could be developed to restore normal coherence, and thus health, by exposing patients to electric vibrations (microwaves) resonant with their endogenous global coherent electric vibration.⁵

These models of general dynamics and coherent field effects support the argument that organisms function as irreducible wholes: causation in biological systems, including processes involved in maintaining normal coherence and those causing deviations from normal coherent organisation, is nonlocal. This insight is of value in understanding complex pathology, wherein apparently distinct disorders can be seen as dynamically related, consistent with holistic models of functioning.

However, these models are not sufficient to produce parsimonious yet comprehensive diagnostic or treatment models. Not only are many interrelated levels of organisation involved in pathogenesis, the effects of endogenous non-linearity and emergent structures and processes may limit the predictive or explanatory power of such models. According to Kirmayer, not only is it necessary to accept “multiple levels of explanation in research and clinical practice” even these detailed models would have limited explanatory power, for:

whatever the primary or initial level of disturbance, problems will tend to propagate up and down the hierarchy to affect other levels. A corollary is that interventions applied at one level may also have effects at many other levels... However, the existence of emergent structures and processes also implies that causal influences across levels have their own dynamics... we need an adequate understanding of the dynamics at each level as well as of the processes that link the levels⁶

The conception of hypercoherence developing in response to felt needs suggests a different approach to understanding pathogenesis: that it originates with entrained hypercoherence that itself originates as a response to felt needs. Many (e.g. Deacon, Hoffmeyer, Kauffman, Mitleton-Kelly, Salthe, Varela) have discussed the convergence of self-organising processes themselves towards self-simplification (reduction in degrees of freedom compared to equilibrium). Governed by differences that make a difference, which are in turn governed by

³ A Hankey A complexity basis for phenomenology: How information states at criticality offer a new approach to understanding experience of self, being and time. *Progress in Biophysics and Molecular Biology* 119 (2015) pp.288-302, pp.291-2

⁴ G J Hyland notes that cancer appears to be typified by non-coherent excitation: in ‘Frohlich’s coherent excitations and the cancer problem: a retrospective overview of his guiding philosophy’ p.324

⁵ Ibid p.413 Microwave resonance therapy is discussed further in Chapter 7

⁶ L J Kirmayer ‘Revisioning psychiatry: toward an ecology of mind in health and illness’ p.640

felt needs, self-simplification highlights the limited set of key interactive causal variables in an organism's lifeworld. In adaptive sequences, self-simplification can progress towards hypercoherence, constrained by the limited variables of the problem-space. Likewise, an autopoietic model for health and disease can reflect the convergent processes of autopoiesis towards self-simplification. The self-organisational processes of organisms themselves provide models for coherence and parsimony in diagnosis. In other words, diagnosis can be a modelling relation between patient and therapist, wherein the therapist attempts to understand the organization of the patient according to her perceived needs.

Kirmayer acknowledges there is a causal power in self-description: "We are self-describing beings who are partly governed by our own self-descriptions expressed in images, metaphors, narratives, and scripts..."⁷. For Kirmayer, the patient's self-description is strongly representational: it is linguistically expressed and informed by participation in shared social narratives. However, self-simplification can be understood as a kind of embodied narrative organization. The functional coherence of biological systems is telic: it depends on understanding what the organism is trying to do according to its view of itself, and its needs or problems, in its lifeworld. I propose that the concept of perceived or felt needs (needs from the perspective of the organism) can capture self-simplifying convergent processes organized in the kind of embodied narrative called an adaptive sequence.

At the broadest level, organisms create a lifeworld from the history of their interactions, both as a species over millennia, and as individuals over the lifespan. The boundaries of the lifeworld are defined semiotically according to the perturbations or signs that have salience to the organism, enabling them to respond *functionally* to salient perturbations in the moment, and to anticipate causal regularities (and/or irregularities), enabling them to respond *purposefully* to maintain their continued existence into the future. Interpretations of threat to general-purpose functioning constrain adaptive sequences, effectively narrowing the salient lifeworld according to the problem space or special purposes of surviving the threat. This narrowing constrains the emergence of highly ordered, predictable behaviours, forming the attractor of the problem space. These ordered behaviours can be somewhat insulated from the general-purpose metabolism/repair functioning of the rest of the system, or, via a positive feedback loop, can entrain a hypercoherent state affecting the behaviour of the whole system.

Self-organising processes can be seen operating in a continuum of decreasing degrees of freedom (or increasing self-simplification) from broad, creative general-purpose functioning, with a small number of highly interactive variables, to extremely focused special purpose functioning. The continuum can also be seen in terms of, at one end, expansive spatio-temporal experience: a self-identity based on flexible and inclusive self-awareness, such that identity is experienced in diverse responses to a range of sensations, and refers to past, present and future self. Towards the other end, attention is entrained around a narrow focus, a specific purpose or threat, and perhaps only one key causal variable. The self in its lifeworld refers increasingly to this special purpose, and a corresponding, highly self-similar dynamic emerges as a limited set of repetitive behaviours. Thus, a diverse, flexible entity becomes a monotone entity (if this process progresses to "self-sameness" equilibrium has been reached: for a living system this means no differences can make a difference, no work can be done, and death ensues).

As complicated as chronic pathology appears, it involves behaviour that is "simplified" dynamically compared with the flexible yet regulated dynamics of normal

⁷ Ibid, p.647

attractor coherence. This simplification, manifesting as repetitive behaviour, is equivalent to the entrainment of biofield dynamics discussed in Chapter 4. In support of this conception, Pezard and colleagues have demonstrated the reduction in complex dynamics in the brains of subjects with depression compared with controls, and link this to the reduction in adaptive behaviour of depressed subjects⁸.

However, pathology is not sufficiently indicated by the presence of suffering, or even the highly ordered, repetitive behaviours known as symptoms. The interpretation of signs includes not only the nature of special purposes as meaningful interpretants, but also consideration of the history and duration of these responses and the implications of time for the functioning of the system as a whole, including paradoxical and compensatory responses. How pathology might be understood as self-organized in multi-morbid form requires a detailed consideration of how chronic disease states develop dynamically over time.

The problem space as evolving disease narrative

I suggest a narrative approach to understanding adaptive sequences should help establish the problem space (who, where, when and why) from the perspective of the patient. The narrative approach identifies the meaning of unfolding events and the patient's response to these as critical in establishing the nature of a current state in the context of the adaptive sequence. When special purposes appear to be congruent with perturbations, both in the sense of causal regularity and temporal conjunction, the problem space is more readily identified. While the patient may exhibit a hypercoherent state entrained around the special purpose, this state is not dysfunctional but a part of an ongoing adaptive process. The aim of the special purpose is to solve the problem (satisfy a need), enabling the re-establishment of general-purpose functioning. For example, a person experiencing a traumatic injury may exhibit symptoms of shock, which include lowering of blood pressure to minimize blood loss. The lowering of blood pressure is not pathological but is an adaptive strategy to "buy time" and increase chances of survival.

The definition of disease I propose concerns a breakdown in an adaptive sequence, or a failure to reconfigure the self in its lifeworld in the moment when needs change⁹. In the disease state, reconfiguration is obstructed. Special purposes are referring to past events as though they were still continuing, signs of safety or changing conditions are misinterpreted or otherwise not attended to, and general-purpose functioning is increasingly compromised over time. The traumatized patient may continue to experience symptoms of shock or arousal long after the traumatic event, as in Post-Traumatic Stress Disorder or Panic Disorder. Consider the positive feedback loop present in a "panic" episode. Initially, anxiety is triggered by the perception of a sign interpreted as a threat. This sign can be, and often is, a very small perturbation, such as a sound, however the sound may have special meaning, perhaps relating to a past experience of danger. The autonomic reaction to a perception of danger includes increased respiratory and heart rate, muscular tension, and heightened sensory awareness particularly with regards to any further signs of danger. Hyperventilation causes sensations of dizziness, muscular tension and shallow rapid breathing can cause chest pain, while the movement of circulatory blood from internal organs, including the stomach, to skeletal muscles, can cause nausea. The sensations of dizziness, chest pain and nausea are often interpreted as further signs of danger (i.e. heart attack, fainting, or simply "losing control"), increasing and perpetuating the autonomic reactions to danger, which then perpetuates the

⁸ L Pezard, J Nandrino, B Renault, F El-Massioui, J Allilaire, J Muller, F Varela and J Matinerie 'Depression as a dynamical disease' *Society of Biological Psychiatry* 39 1996 pp.991-999

⁹ A change in needs can include the need to move on from an unmet need or unsolvable problem

dizziness, chest pain and nausea. In extreme cases, such as those following trauma, “flashbacks” or intrusive memories of past trauma are re-experienced.

During the panic episode, the continuation of danger is anticipated. The hypercoherent state of panic is organized around the special purpose of escape and survival (the fight or flight response) and hypersemiotic processes perpetuate the state, effectively blinding the sufferer to signs of safety (i.e. the absence of objective threat) and entraining misinterpretation of physiological processes as further signs of danger in a self-referential positive feedback loop. From the patient’s perspective, the danger is still present.

When taking the patient’s history, it is important to recognise that past events relate to an ongoing disease state to understand the present meaning of these past events to the patient as a response to an unsolved problem. This conception of pathology is consistent with the position that symptoms are not pathological in themselves, they are (have been) attempts to adapt or problem-solve, which have lost touch with, or become blind to (notice these sensory metaphors for inattention), present needs for maintaining viability of the whole organism.

Examining this problem space from the perspective of the patient means that no a priori diagnostic categories are needed. Each disease is a syndrome that belongs to the lifeworld of the patient. All symptoms are interpretants: psychological, physiological, and behavioural: and each may add to understanding the overall narrative of the patient. Indeed, identifying the present behaviours entrained around a special purpose is probably more important than identifying the initial perturbation. To repeat Deacon’s observation:

In complex dynamical systems, attractors may be converged on from many quite diverse initial conditions... being at some specific locus within the phase space of that attractor dynamic is not highly informative about initial conditions, nor is its specific emergent history of particular relevance to the causal properties that result¹⁰.

Deacon’s concept of absential phenomena helps define needs as important causes for organisms. Needs, as special purposes, can entrain hypercoherent dynamics, which then perpetuate existing interpretive biases and obstruct change, compromising general functioning until this perpetuation is interrupted.

One implication of this perspective is that the set of behaviours known as symptoms of disease can be seen to comprise an attractor. Psychological, physiological and social behaviours share properties of the highly ordered dynamics entrained by a core special purpose: namely, repetitive interpretive processes. Symptoms are seen to be caused by self-organising processes of the hypercoherent state rather than caused by pathogens. Efficient causes may be an initial perturbation, but *the organism’s interpretation of the perturbation is the key to understanding the disease*. In particular, the repetitive, fixed quality of hypersemiosis with inattention to change indicates the living system is moving in the direction of self-sameness and equilibrium.

Semiotic error and mechanical functioning

What role does error in interpretation play in pathogenic attractors? Many (e.g. Gare, McLaren, Rappaport, Rosen, Louie) have identified interpretive error or faulty values as pathological, at least when they are not subsumed under some kind of global regulatory value. McLaren argues:

The greater complexity of humans and the highly abstract nature of many of our predictive models, lead us to greater errors and side-effects as they bifurcate away

¹⁰ T Deacon *Incomplete Nature* p.20

from our fundamental models for anticipating metabolism, repair and replication and come to constrain these fundamental conditions for generating and maintaining dynamic stability¹¹

And:

Confuse or subvert the global model and you remove these constraints opening up the possibilities for sub-systems to become parasitic on the global system. At whole system levels, predictive models will generate future healthy selves unless our ability to anticipate these are subverted leading to a loss of integrity of the whole which removes constraints on sub-systems leading to either parasitic behaviour by sub-systems or their functional failure¹²

Control values in particular are argued to be erroneous for living systems, on the grounds that they are appropriate for machines but undermine or subvert self-organising processes. A related argument is that it is never valid to propose mechanistic descriptions of organismic behaviour or organization. In their opposition to reductionism, many theorists argue that all mechanical metaphors must be rejected. Both Hirst¹³ and Gare¹⁴ quote Robert Rosen: “I hope to convince the reader, in the course of the present work, that the machine metaphor is not just a little bit wrong; it is entirely wrong and must be discarded”¹⁵.

Somewhat in contrast to these assumptions, I argue that not only can relatively mechanical states be created by organisms, they and their underlying control values are not necessarily pathological. They can be created by an anticipation of causal regularity in the world, which is then reflected in the highly predictable behaviour modelled by the organism. This should be understood in the context of adaptive sequences, which often involve fixed reactions and values for control. After all, organisms act to try to control themselves and their environments constantly, always anticipating a step ahead of present circumstances. Even if this control strategy is in error with regards the changing needs of the organism and/or the changing circumstances of its world, this need not be a problem¹⁶ as long as there is a process for recognising this error: this pragmatic trial and error process is adaptation by trialled variation.

The implication of this is that pathology should not be assessed according to the presence of an intrinsically erroneous interpretation or value, but rather as the obstruction of reconfigurative processes that occurs from inattention to change, notwithstanding that inattention may be “active” or deliberate, perhaps from fear of change, avoidance of pain, or desire for control. This obstruction constrains a subsystem or fragmentary part to behave repetitively, often according to a highly simplified value. The system has reduced sensitivity

¹¹ G McLaren ‘The obesity crisis and biosemiotic corruption: Towards a unifying semiotic understanding of obesity’ p.207

¹² Ibid p.209

¹³ In N Hirst ‘Towards a science of life as creative organisms’. *Cosmos and History: The Journal of Natural and Social Philosophy*. 4, (2008) pp.78-98

¹⁴ In A Gare Approaches to the question: what is life? Reconciling theoretical and philosophical Biology

¹⁵ R Rosen, *Life Itself: A Comprehensive Inquiry into the Nature, Origin, and Fabrication of Life*, (New York: Columbia University Press, 1991) p.113.

¹⁶ And indeed is critical for transformation and evolution

to any signs not salient to this value, and hypersensitive and automatic (non-reflective) responses to salient signs. This positive feedback loop reinforces the hypercoherent state and insensitivity to change. In this respect, the organism does in fact behave ever more mechanically. Indeed, my argument points to the identification of pathology *as the observation that a living system is behaving mechanically over time, rather than responding to changes*. Perhaps this is one reason why biomedicine assumes mechanical descriptions for disease. In a limited sense, the machine metaphor for pathological states (although NOT pathogenesis or salutogenesis) is quite apt.

Responses to acute perturbations involve the adoption of fixed but fairly easily reversed states of behaviour, while responses to chronic perturbations constrain the development of structural changes which are less easily reversed but more energy efficient. Likewise, chronic pathology is associated with structural changes. These may have begun as a stage in an adaptive response, but when they have drifted from the organism's needs in its lifeworld, they are no longer adaptive, or energy efficient. They may then give rise to new forms of pathology, some of which may appear distinctly different, even antagonistic, to the original behavioural or structural change. Indeed, one way in which pathological states seem distinctly un-machine-like concerns the presence of paradoxical and antagonistic relationships between the fragmentary parts of a hypercoherent whole. How does it happen that paradoxical or antagonistic interpretants can occur within the same case?

Chaos and fragmentation

If pathogenesis is entrained around a special purpose, how should the emergence of the paradoxical, antagonistic processes highlighted by allostasis researchers be understood? Part of the explanation may lie in changes in the dynamics of order and chaos entrained in a hypercoherent state over time, resulting in complex pathology. A high degree of order in a living system, entrained by repetitive behaviour, tends towards equilibrium. But autopoietic theory suggests that order and chaos tend to beget each other. Just as order can emerge from chaos, chaos may emerge from order when a critical value is reached, as Bak showed with the emergence of avalanche behaviour as the addition of grains of sand push sand piles beyond a critical value. In a similar way, chaotic dynamics may emerge *catastrophically* from the highly ordered hypercoherent state. Consider Goodwin's example of the ordered dynamics of heartbeat in heart pathology. Cardiac arrest itself is characterized by fibrillation: catastrophically chaotic contractions of heart muscle. McLaren compares the changes in chaotic dynamics in heart pathology to those in chronic obesity in terms of changes in the oscillatory "coupling" of order and chaos:

The conditions for health in an indeterminate universe, I argued, are those similar to the heart of having a relatively stable higher-level oscillation constraining seemingly more chaotic micro level ones which model multiple future scenarios so as to be able to anticipate uncertainty. The heart, therefore, continually creates ordered rhythm without becoming locked in to one order, allowing it to respond to sudden changes in demand for energy. The obese, I argued, were too ordered and so had diminished

potential for anticipating uncertainty. Sudden changes in conditions could quickly send them into chaos; a lurching from one extreme to another¹⁷

A change in order and chaos relations from edge-of-chaos normal attractor to hypercoherence punctuated with catastrophic chaos is the starting point for the development of multimorbidity: the fragmentation of organisation.

Multimorbid pathology: a semiotic field perspective

Multimorbid pathology, by definition, has two or more focal levels of symptoms, so understanding the relationship between these “parts” and the whole is critical for understanding the dynamics of pathology. These relationships might be observed temporally as alternating sequences, and spatially in the dynamics of a living system as a whole in terms of “fragmented” parts of a system in agonistic, antagonistic, or even inattentive relationships with each other, and with the whole.

The relationships between parts can be constrained by reinforcing, conflicting, or competing values. Kockelman discusses the concept of semiotic agency to explore the causal implications of multiple values in a semiotic spatio-temporal field. For Kockelman, semiotic causation implies:

semiotic agents that seem to lie at the center of such processes: those entities that do not just signify (by expressing signs of objects) and interpret (by expressing interpretants of signs), but also get signified and interpreted (and thus constitute an object of their own and others’ semiotic processes¹⁸.

The concept of agency represents the “purpose” of the semiotic relation: meaning the presence of the “to whom/why” that a difference makes a difference to, or what I have referred to as the special purpose: the perceived needs or problems. Breaking down the components of semiotic agency explicates the processes involved in the creation of interpretants. According to Kockelman, the key features of a semiotic agent are that it senses, instigates, and selects from its range of possible interpretants according to its evaluative standard¹⁹. Kockelman’s graphic of semiotic relations places the agent at one remove from the triadic relations of object, sign and interpretant, distinguishing the interpretant from the agent (from their own perspective) doing the interpreting²⁰. Agents become the object of sign relations for other agents, and in this way, agency is distributed in the architecture of semiotic scaffolding.

Distributed agency is not a linear process of causation, of merely passing on meaning from agent to agent. Kockelman observes that agents have a valency relative to other agents: which can be of agonistic or antagonistic kinds²¹. Like all features of dynamic wholes, these values only make sense relative to their place in the whole. Some agents have a narrow semiotic range, others more broad: the broadest agent can be considered the originary of all

¹⁷ G McLaren ‘The obesity crisis and biosemiotic corruption: Towards a unifying semiotic’ understanding of obesity’ p.214

¹⁸ P Kockelman ‘Semiotic agents’ in N J Enfield and P Kockelman (eds) *Distributed Agency* (Oxford University Press 2017) pp.25-38, p.25

¹⁹ Ibid p.28

²⁰ Ibid

²¹ Ibid p.27

agentic scenarios within the whole²². Evolutionary processes of selection are the originary agent of all the agentic processes that need to be understood in order to grasp a whole ecosystem, “notwithstanding how distributed, emergent, contingent, and confusing they might at first seem”²³. For example, the agency of predator and prey only makes sense relative to the whole ecosystem and its processes of evolution. Kockelman’s conception shows how agency is distributed across the whole. Importantly, it also explains the variability yet cohesiveness of these effects by allowing a multiplicity of agents and agentic relations operating within semiotic fields.

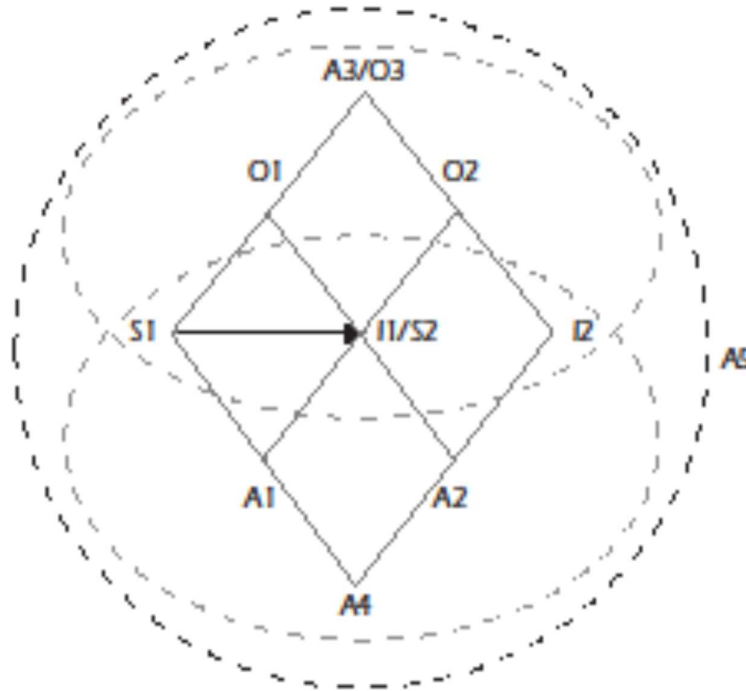


Figure 1 Kockelman’s Distributed Agency Graphic.

From the left, O1, S1 and I1 represent a triadic sign relation, with A1 representing an agent. In Kockelman’s example of two vervet monkeys responding to an eagle, I1 is the alarm call made by the agent, the first vervet monkey. A second monkey (A2) responds to the alarm call (S2) by running (I2). The object in this relation, the eagle, is an agent in its own right (A3). Its agency is partly derived by its own sensing and instigating, and partly derived by the responses of the monkeys. This distributed agency is framed by the top ellipse. A4 represents the distributed agency of the monkeys, whose sensing and instigating is partly derived by the behaviour of the eagle (bottom ellipse). Finally, A5 represents the originary agency of the whole organism-environment complex or the “envorganism”. Agency here is distributed

²² Ibid

²³ Ibid

across two agonists (A1 and A2, together comprising A4) and across these agonists and their antagonist (A3).

Who becomes ill? The self as a field

What does a multiplicity of agency imply for a concept of self: the “who” of semiosis? The causal locus of an individual organism might be considered, as Varela does, those boundaries and processes that it needs to maintain in order to distinguish itself, or as Rappaport has it, the unit of adaptive behaviour. Kockelman refers to the range of semiotic processes that an agent at any spatio-temporal scale can participate in, in line with the concepts of semiosphere and lifeworld.

Kockelman further describes spatio-temporal agentic distribution employing a force-field metaphor. An agent’s perception that one event leads to another occurs in a field of related events, embedded and enchainned (linked) within a myriad of event relations. Kockelman notes two particularly important semiotic causal processes, representing transformation and stability, that the notion of force fields explicates. An agent “setting up” a causal process between events, such that one event causes the other, transforms the field and thereby constrains the instrumental and inferential processes of other agents²⁴. This view allows for a notion of primary or originary agency consistent with the notion of an original special purpose need. At the same time, every semiotic process has, from the perspective of the agent at the centre of each process, a valency with regards the agent: to support its ends or needs, or to obstruct. This valency is constrained by the whole field of causal relations, including transformations of relations that occur as agents are prompted by indices to alter their causal linkages, prompting other agents to alter theirs.

On the other hand, viable agentic actions, defined as the selection of event relations that turn out to be accountable across time in maintaining the whole, comprise stable “innate reliable pathways”, themselves higher-level semiotic agents, within force-fields²⁵. These might include edge-of-chaos dynamics or more specific regulatory values. This would imply that pathogenesis and healing should be understood in relation to transcendent processes or values rather than those that refer to particular semiotic agents or relations.

This thesis argues that understanding pathogenesis and healing as semiotic processes requires an adequate reconciliation between “formal” and “telic” dynamics in living fields. From this perspective, the multiplicity of agents and their relations, and the multidimensionality of force-fields, are constrained ultimately by the self-simplified broad agency of the whole in maintaining itself in normal functioning, *which includes* altering its dynamical form according to felt needs (and in the process simplifying itself yet further). The organism is a multidimensional form wherein endogenous agents can take diverse relations to each other, including antagonistic relations, yet remain a unity of responses to sensations and other signs or agents according to originary felt needs and the distributed agency patterns themselves that are created in response to these needs.

In pathogenesis, agents remain entrained toward a given purpose despite changing needs, which may then become manifest in secondary responses. Pathogenesis is the

²⁴ Ibid p.34

²⁵ Ibid p.37 Kockelman’s metaphor of stable pathways within fields is comparable to Waddington’s concept of chreods and canalisation (see p.83).

obstruction or distortion of the very properties that a living field relies upon to be aware of and respond to its changing needs.

Forgetting

The normal hierarchical organization of living systems involves spatio-temporal distinctions in function and structure, such that parts emerge from the whole and can only be understood with reference to the whole. Similarly, hypercoherent and edge-of-chaos dynamics can only be understood according to the needs of the whole. Differentiation according to emerging function and structure within a whole in response to changing (or unchanging) needs is a qualitatively different process than the fragmentary processes associated with pathological entrained hypersemiosis. This has a characteristic “losing touch with” or “breaking away from” quality in mereological relations, which McLaren describes as semiotic corruption²⁶. Semiotic corruption, according to McLaren, refers to an over-simplified and often control-oriented value that constrains the function of a fragment to being fixed in time and non-responsive to changing conditions. The emergence of fragments entail compromise to interconnectedness throughout the system. Often, it entails the emergence of other fragments²⁷. Gare compares semiotic corruption to cancer cells which: “...not only *forget* their position in the whole and proliferate uncontrollably, they corrupt the semiosis within the body and through their rhetoric reorganize the body to feed the growing tumours.”²⁸ (my italics). Following Gare, McLaren argues that “...these over-simplified, isolated reductions... have *forgotten* their position in the whole, or larger contexts. They can proliferate relatively free of the constraints of larger contexts and divert other systems away from the greater whole to instead feed them”²⁹.

Gare and McLaren conceive semiotic corruption as being “the fault” of the semiotic agent losing its identity within the whole. My conception is that such fragments occur in response to the felt needs of the whole. The “losing touch with” characteristic of fragmentary organization may result from forgetting, or from multiple agents developing antagonistic or compensatory relations. My emphasis in this chapter is that in pathogenesis, there occurs a change in mereological relations which includes self-reinforcing compromises to self-awareness of the whole. As a result, the organism as a whole shifts away from self-similar organization at the edge of chaos.

The following sections further explore the implications of distributed semiotic agency in a multidimensional field context for understanding how mereological dynamics may form complex patterns of pathology over time. Few biological field theorists have explored this previously, although, as described above, several have suggested that dynamical field processes may be useful for understanding pathogenesis in individual organisms.

The remainder of this chapter is an attempt to sketch the processes involved in the development of chronic pathology drawing on semiotic theory already discussed, and on insights from research in the evolution of pathological dynamics in individual persons, in cellular inflammation and immune responses, and in social organisations. The following two

²⁶ G McLaren ‘The obesity crisis and biosemiotic corruption: Towards a unifying semiotic understanding of obesity’ pp.203-208

²⁷ *ibid* p.211

²⁸ Gare A., ‘The Semiotics of Global Warming: Combating Semiotic Corruption’, *Theory and Science*, Vol. 9, 2 (2007) at <http://theoryandscience.icaap.org/content/vol9.2/Gare.html>.

²⁹ G McLaren ‘The obesity crisis and biosemiotic corruption: Towards a unifying semiotic understanding of obesity’ p.204 (my italics)

sections discuss agentic relations involved in pathogenesis, while the third expands upon this to conceive disease as forms of pathogenic self-organising patterns in a multidimensional field.

Multimorbid disease patterns: the dynamics of maladaptive sequences

A proposed model for understanding the dynamics of health and pathology must be adequate to understand and treat chronic and multimorbid cases. This model should be adequate to capture the mereological peculiarities of multimorbid cases, yet provide a coherent framework that identifies the problem space of the patient and can ground diagnosis, intervention and assessment accordingly.

Normal functioning is characterised by self-similar oscillatory dynamics in the biofield, self-maintaining a fractal, edge of chaos attractor. I have suggested above that an initial hypercoherent state, as an acute stage in an adaptive sequence in response to a felt need, may enable the emergence of catastrophic chaotic dynamics and/or the emergence of fragmented parts. A comprehensive understanding of the dynamics of these complicated processes can be achieved by considering that despite the multi-morbid, fragmentary presentation that evolves in chronic disease, there is an underlying centre of gravity or attractor that has shifted away from edge-of-chaos. The original hypercoherent state represents an unresolved problem, to which all symptoms “down the track” and “branching out” relate as secondary (and tertiary) responses. This is consistent with a distributed agency perspective on endosemiosis, with all the potential kinds of relationships endosemiotic agents can have with each other, and the implications of these for the functioning of the whole. The concept of pathogenesis as an alteration or distortion in biofield organisation/dynamics is the topic of the remainder of this chapter.

Dynamics of the trauma response sequence

A discussion of the evolving dynamics of pathology over time in response to stress and trauma has been offered by psychologist Jon Kabat-Zinn³⁰. Kabat-Zinn believes it is impossible to fully describe even simple chronic disease without considering the functioning of the whole person. He proposes a holistic model of body and mind considering all organ systems, aspects of personality, and relationships with the social and natural world, as they are affected by acute and chronic stressors. These effects are identified and assessed according to the felt experience and behaviour of each case as a totality at any moment in time, rather than with reference to discrete “objective” diagnoses for each system separately. Drawing on Selye’s generalised stress response theory and Seligman’s stress mediation theory, Kabat-Zinn takes an interpretive and relational, rather than objective, approach to defining stress as the generalised response of the organism to a perceived threat or trauma. Like Selye, Kabat-Zinn views pathogenesis as primarily a process of inadequate or dysregulated stress response³¹, however he also discusses compensatory and antagonistic relations between symptoms or responses. I summarise his model below (with added subheadings for clarity).

Acute phase: Stress Reaction

Kabat-Zinn observes that when encountering an external stressor, such as a threat or trauma, people react with instant and strong aversion to pain and hyperarousal towards threat. The whole person is involved in this initial reaction. Physiologically, the autonomic nervous

³⁰ J Kabat-Zinn *Full Catastrophe Living* (London: Piatkus 2013) chapter 19

³¹ *Ibid* pp.289-290

system has engaged nearly every biological, cognitive and behavioural system. The purpose of survival of the whole overrides the various purposes of “parts” employed in normal functioning. Kabat-Zinn states that this acute phase can be termed a stress reaction rather than response, as it involves a very rapid perception and appraisal of threat, effectively instinctive or automatic. This generalised acute stress reaction obtains for any kind of stress, not necessarily life-threatening ones. Kabat-Zinn’s acute stress reaction describes an acute hypercoherent state, similar to the hypervigilant neurological arousal described by Peters et al.

Sub-acute phase: Stress Inhibition

The first phase is often rapidly followed by the person’s attempts to control, isolate or avoid pain and trauma: these internal responses can be considered inhibitory actions. Kabat-Zinn gives examples of people “internalizing” their socially unacceptable and painful stress reactions, ignoring their own feelings or failing to express them. Over time, the inhibition of stress reactions results in an accumulation of tension or chronic hyperarousal, including physiological tension and anxiety, an effect of sub-acute allostatic load. These effects of stress inhibition become themselves additional aversive stressors to be inhibited, resulting in a vicious cycle of pain and inhibition. Considering this as a field of semiotic relations, values (or ‘agents’) for control and avoidance emerge, in conflict with values for maintaining general-purpose functioning. The stress inhibition phase correlates to the maintenance of a hypercoherence state via an inhibition or avoidance response.

Chronic phase: Maladaptive coping habits

Over time, the strategies engaged to control or avoid suffering may become ineffective or too costly to maintain (the effect of allostatic load approaching a critical limit), requiring the substitution of new, more effective, or at least less costly strategies to maintain control, assuming substitutes are available. Usually these will be more forceful or powerful in terms of their effects on the totality, both in their intended effects (controlling suffering) and their side effects. According to Kabat-Zinn, forms of maladaptive coping include the use of medications when they are used habitually as the main means to control stress reactions, and more overtly self-destructive behaviours from psychological denial to substance dependency. In this way, maladaptive coping strategies, as tertiary responses to stress, can become disorders in their own right, and can present a greater threat to health than the initial stressors. Kabat-Zinn emphasizes the habitual nature of maladaptive coping: strategies to inhibit stress become repetitive and automatic, and by definition, they drop out of self-reflective awareness. This description of habituation and forgetting is like that of degraded or corrupted semiosis, wherein functioning is biased towards a dominant special purpose and other needs are obstructed or ignored.

Breakdown of health

For Kabat-Zinn, chronic inhibition of stress reactions fosters the development of maladaptive coping strategies, which in turn can develop into disorders in their own right. Much work must be done to maintain these control strategies, habituated though they may be. At the same time, their aversive consequences, physiological, psychological and social, add to the metabolic and regulatory burden. The result is a multi-morbid case, heading towards what Kabat-Zinn calls “breakdown” wherein the “weakest link” in the case will develop serious, perhaps life-threatening pathology. This corresponds to the concept of overwhelming allostatic load wherein there are no substitute strategies available to maintain control over the status quo, and a chaotic shift occurs. At this point, a crisis will occur resulting in death or

recovery. However, recovery is likely to be partial: a resumption of stress inhibition strategies, with eventual further degradation of health and a repeat of the cycle.

Each phase builds on the previous, both in terms of the growth of the vicious cycle of fixed behaviour that perpetuates illness, and in the consumption of resources: the time and energy needed to inhibit stress and eventually to cope with its negative sequelae as well. The processes Kabatt-Zinn identifies include overly ordered, repetitive behaviours, self – perpetuation of these behaviours, isolation of parts within the whole, and withdrawal from wider social and environmental systems. Interpretive processes, including beliefs and fears, are important causal factors in his model, and they “scaffold” the emergence of secondary and tertiary responses or strategies. The relationships between these endosemiotic responses can be conflictual, competing, and avoidant. The burden on the system as a whole can reach a critical value, triggering a sudden lurch into chaos, and eventually the emergence of a new stable order, at a reduced level of functioning (or death).

Dynamics in inflammatory/immune response sequences

Like Kabatt-Zinn, pathologist Paolo Bellavite and homeopathic physician Andrea Signorini argue that regardless of the specific external or genetic causes “every disease has a strong component related to endogenous reactivity”³² and suggest every presentation of chronic disease at least should be thought of primarily in this way³³. They add that, just as importantly, symptoms by themselves are insufficient to establish the state of disease or health: “biological systems which govern health are the same that cause most pathological phenomena, when activated inadequately, excessively or unsuitably ... to the circumstances”³⁴.

Bellavite and Signorini examine inflammation and associated immune responses, defining these as the “main reaction and repair system for damage of any kind” affecting everything in the body³⁵. Studies of cell receptors and communication systems involved in immune responses provide characteristic examples of general organisation/information processes of complex living systems, including “competitive actions, nonlinear responses, feedback loops, and spatio-temporal oscillations”³⁶. However, maintenance and repair responses can be inadequate or even excessive, notably in autoimmune diseases. In these “the inflammatory process does not succeed in fulfilling its reparatory purpose and is involved in a general organisational disorder of the body, with the result that its original aim is lost”³⁷. The authors identify healing with the fulfilment of a need, in this case the aim of repair.

Bellavite and Signorini argue we should take “the view of the inflammatory reaction as a phase in a continuous process going from damage to healing or to further damage” and

³² P Bellavite and A Signorini *Homeopathy: A Frontier in Medical Science* p.90

³³ *Ibid* p.89

³⁴ *Ibid* p.88

³⁵ *Ibid* p.106

³⁶ *Ibid* p.154

³⁷ *Ibid* p.92

that “there is a profound, consequential link between the various phases making up the disease history in a patient”³⁸.

In diseases with a predominantly inflammatory component, a chain of changes and adaptations is generated, in which one is rarely able to clearly perceive any single defect that can be defined decisive, i.e. the correction of which would allow the disease to be resolved. Most diseases, excluding single gene defects, are multifactorial and dynamic i.e. they continue to change as the disease progresses. We encounter external and endogenous factors, equilibria shifted in a positively reacted sense, unshifted equilibria, or pathological adaptations to a state of abnormality...current immunostimulatory or immunosuppressive measures are still far from coming to grips with the basic etiological level, or even the pathogenetic mechanism, going no further than barely touching the final – or almost the final – effector level³⁹.

They argue that the important task in assessing pathology is not measuring symptoms, or identifying pathogens, but rather knowing how to tell if functioning indicates healing or pathogenesis. Bellavite and Signorini propose a dynamic model to describe how the person’s inflammation/immune responses may result in complex pathogenic processes.

Initially, a perturbation prompts the activation of biological signals which prime (sensitise/activate) specific receptor systems. The biological signals involved are endowed with substantial redundancy, and can activate multiple systems in various ways, manifesting as symptoms⁴⁰. The receptor systems produce negative feedback signals, one effect of which can be to return the system to the original system values. Importantly, biological signals, and their negative or positive feedback “replies” are conceived as producing symptoms, rather than a pathogen. Hypersensitivity of receptors and amplification of symptoms is characteristic. Bellavite and Signorini term this acute phase the homeostatic cycle, or the initial or physiological phase of disease⁴¹.

If the initial perturbation continues, and/or the system continues to expend energy in the hypersensitive state producing acute symptoms, the system may reach a critical value and undergo a major change in status. Bellavite and Signorini describe this process as an in-built chaotic mechanism of generating possible new forms that are literally trialled by the body. “The body finds itself ‘undecided’ in critical phases”, oscillating between activation and deactivation, trialling the “option of attacking the disease or saving a state of tranquillity”⁴².

One option is an adjustment that decreases the energy expenditure involved in producing acute symptoms. This energy saving measure “enables the system to survive with the disease”⁴³ albeit at a reduced level of functioning. This involves the specific suppression of the initially hypersensitive receptors by means of various cellular mechanisms, which may involve “breakdown”: a passive process of receptor burn-out, or “blockade”: an active

³⁸ Ibid p.96

³⁹ Ibid p.109

⁴⁰ Ibid p.194

⁴¹ Ibid p.193

⁴² Ibid p.206

⁴³ Ibid p.195

process of switching off active receptors as their energy expenditure may in itself prompt its own negative feedback signal⁴⁴. This suppression adaptation, or desensitisation effect, tends to involve mainly agonistic receptors, while other receptors remain active⁴⁵. Variations may result in a permanent adjustment, or the process of activation, symptom production, desensitisation, and systemic changes may continue.

As the person's disease progresses, the initial aim or focal level of response may be partly or completely forgotten or desensitised in the process of re-organising around this unmet need. This compromise may result in "progressive vicariation" in the production of symptoms, and "pathological metastasis" or the spread of symptoms⁴⁶. The spread and diversification of symptoms may result from chaotic oscillations occurring "in an excessive, unpredictable and pointless manner, thus generating local disorders that may become amplified. It is as if chaos were amplified and formed nuclei of pathological interrelations between cells or systems..." which "isolate themselves from the global control system and prove self-maintaining"⁴⁷. On the other hand, too much order, manifesting in lack of variability of responses, is notable as "the onset of pathological periodicity" in cardiac pathology, epilepsy, Parkinson's disease, and bipolar affective disorders⁴⁸.

Inflammation and immune responses, both specific cellular and whole system dynamic, can be viewed in terms of how information is created and organised: "the *interpretation* of the language of inflammation (i.e. of the various messages which the systems involved exchange) is of fundamental importance for its possible control and modulation". This language includes signals, messages (inter and intracellular), priming (hyperactivation), desensitisation (hypoactivation) and memory⁴⁹. Information is "an intrinsic function of every spatiotemporal structure, capable of being transmitted to another spatiotemporal structure and thus of modifying it in a specific manner". Thus information is described as a cause and a product of organisational processes⁵⁰. Structure here refers to both the configuration of parts and their temporal arrangement, and transmission depends on not just which signal is present but also how the signal is communicated⁵¹.

Bellavite and Signorini emphasise the minimal energy content but high information content (and therefore causal power) involved in these non-linear processes. Molecules with extremely selective and specific mechanisms of action (which exploit a high information content) can act at very low concentrations, including endogenous hormones and antibodies, and exogenous toxins and allergens⁵². Many cell responses are sensitive to not just to the

⁴⁴ Ibid p.198

⁴⁵ Ibid p.196

⁴⁶ Ibid p.96

⁴⁷ Ibid p.176

⁴⁸ Ibid p.177

⁴⁹ Ibid p.94

⁵⁰ Ibid p.137

⁵¹ Ibid

⁵² Ibid p.134

amplitude of a signal, but also to frequency variations: “The receptor system of cells is often capable of distinguishing the kinetics whereby the signal is received, whether it is a sudden signal or of slow onset, whether the concentration is stable or oscillating, whether the signal is single or accompanied by concomitant or preceding signals, whether it is the first prompting or a repetition...” and so on⁵³.

As regards the ‘direct’ effects of toxins or trauma, responses depend largely on their concentration or force. At high levels, they overwhelm adaptive responses, while at lower levels, they may act as information that in-forms adaptive processes. As the authors put it: noxious agents “induce a series of characteristic biochemical modifications, at high doses damage, while at low doses these modifications have “an informative effect” enabling the system to adapt by counteracting a particular agent, using specific defence mechanisms for that agent”⁵⁴.

Bellavite and Signorini claim that many information processes in cells, including adaptation, rely on enhanced sensitivity or *priming*, and *desensitisation*. They define priming as the hyperactivation of receptors and other changes in intracellular enzyme systems in response to the exposure of cells to a specific stimulant, often in low concentrations. Priming amplifies cellular responses to specific stimulants, whether homologous (the same) or heterologous (different) to the priming stimulant. The authors suggest priming effects can explain hypersensitivity to drugs, toxins, and endogenous molecules, even when these are in low concentration⁵⁵. Desensitisation involves a number of cellular mechanisms that function to decrease responsiveness to a specific stimulant following exposure⁵⁶.

To illustrate the effects of priming and desensitisation processes, Bellavite and Signorini discuss the phenomena of paradoxical effects of drugs. They state that it is widely accepted in medicine that a pre-existing disease state causes changes in cellular receptor and transduction systems, including variations in sensitivity to drugs, and these cellular changes can be very broadly distributed⁵⁷. Imipramine (the parent molecule in tricyclic antidepressants) may lift mood in depressed subjects, but depress central nervous system functioning and induce low mood in non-depressed subjects⁵⁸. Serotonin causes vasodilation in healthy subjects, and vasoconstriction in those with hypertension, diabetes and

⁵³ Ibid p.137

⁵⁴ Ibid p.153

⁵⁵ Ibid p.149

⁵⁶ Ibid

⁵⁷ Ibid p.199

⁵⁸ Ibid p.141

arteriosclerosis. Digitalis is a cardiac depressant in healthy subjects, but a cardiac stimulant in those with heart failure⁵⁹.

In sum, Bellavite and Signorini observe that as regards endogenous responses:

- a) the same agent can induce very different effects depending on the magnitude of force of the agent
- b) Two different agents can produce the same effect on the target system
- c) The same agent can determine or induce different responses in a healthy organism compared to a sick one
- d) the same agent can prove stimulatory, inhibitory, or have no effect according to the mode of administration
- e) the effects of the same agent vary according to the conditions of the target system, which in turn are caused by previous or concomitant contact with other agents⁶⁰

Noting the practice in medical research of reducing response variability by reversion to the statistical mean, they claim that this approach is inappropriate for understanding pathogenesis, for which variability is a defining feature to be understood. For Bellavite and Signorini, attractors are a useful metaphor for understanding variability and stability, even when systems undergo profound changes in form and function.

In a network with interconnected systems (molecular, cellular, systemic) the information of the entire system passes through cycles (attractors) which have variable fluctuating spatiotemporal forms but which can always be traced back in stages of normality to a harmonic pattern where the whole is viewed in its entirety, aimed at the survival of the organism with the least possible consumption of energy⁶¹

They observe that fractal organisation means that the system has the potential to maintain a memory and an identity that remain references for the system as a whole whilst undergoing variations. It follows that fractal distribution of agency of the whole constrains continuity and communication of the whole. Pathology occurs if an “information connection” between cells or parts concerning the needs of the person as a whole is progressively severed, forgotten or distorted⁶². This may occur via a process in which at moments of choice between change: varying one’s response to needs, or conservation: reinforcing current desensitising strategies, the latter are maintained and defended.

Allostatic load pressure eventually reaches critical limits, generating chaotic transitions to another attractor state with the emergence of new symptoms and greater compromise to general functioning. These non-linear transitions may occur at any scale and “may stabilise even if the initial perturbation is small”⁶³. It is worth considering this conception of catastrophic chaotic transitions with Bak’s metaphor of critical limits, even when broached by tiny perturbations, generating avalanches of transitions at different scales of magnitude. At each transition, the effects of information distortion are compounded, as symptoms vicariate

⁵⁹ Ibid

⁶⁰ Ibid p.154

⁶¹ Ibid p.175

⁶² Ibid

⁶³ Ibid

and metastasise, resources are diverted to their production, and the original focus and aim of response is suppressed. This view of pathogenesis provides the grounds for Bellavite and Signorini's argument that chronic disease, and even specific or acute pathology, can only be understood considering the disease history of the whole person in terms of symptoms as responses, and responses to responses, and so on.

The next section elaborates on stages and transitions in pathogenesis according to a multidimensional model of 'field turbulence' constraining the organisation of agentic relations towards greater pathogenic complexity, and at the same time, reduced degrees of semiotic freedom.

Dynamics in whole causal fields: turbulence and transitions

Babüroglu's model of pathology arising from causal field dynamics is inspired by personality theorist Andras Angyal and social field theorists Emery and Trist. In their 1972 book *Towards a Social Ecology* Emery and Trist examine dynamic patterns of interdependencies in complex open systems, in their case those involving social organizations and their environments. The term "causal texture" refers to "the extent and manner in which the variables relevant to the constituent system and their interrelations are, independently of any particular system, causally related or interwoven with each other"⁶⁴. The unit of analysis, the system or organism, is organised around its own responses, yet is relational: it comprises organizations and their relevant or meaningful environments. As Emery and Trist put it: "In populations of living systems capable of active adaptation, each system is part of the environment of the others and they constitute together a social field"⁶⁵. I interpret causal texture to be equivalent to the causal force-fields of Kockelman, and constituent system to be equivalent to Rappaport's definition of a living system in terms of a unity of responses to perturbations. Indeed, Emery and Trist's model of the evolution of maladaptive social processes can be seen as a continuation of Rappaport's approach, while the synthesis with Angyal's personality model supports the argument that self-organising dynamics, including distributed agency, are applicable to living systems at all scales.

When the unit of analysis is a single organism, the ecology of that organism can be considered the environment (the originary agent), and all interdependencies within that ecology constitute the dynamical causal texture of distributed agency. That is, the emergent dynamics of the whole considering focal levels of pathology including physical, cognitive, and social organizations or fragments and their relationships with the whole and with each other. The development of these over time comprise a dynamic four-dimensional "field" of organising processes of regulatory functions and values.

Like Rappaport, Emery and Trist recognize that differentiation of parts or semi-autonomous organizations (fragments) is inevitable in a dynamic, living environment responding to perturbations. Like Rappaport, they observe that disintegration of the whole can be avoided by general regulatory values (or "institutional" values) that embody the organisational ideals of the whole⁶⁶. They studied the relations that emerge between semi-autonomous organisations along a cumulative continuum of environmental "turbulence". Turbulence is a field property of the whole system, not caused by external or internal forces,

⁶⁴ F E Emery and E L Trist *Towards a Social Ecology* (Plenum Press: New York. 1972) p.40

⁶⁵ Ibid p.18

⁶⁶ F E Emery and E L Trist 'The causal texture of organisational environments' *Human Relations* 18, (1965) pp.21-32

but by relations between endogenous parts including forces and responses to them. These relations range from simple competition for resources, to oppositional and even paradoxical relations and strategies between parts as they become increasingly fragmented. Parts or fragments should be understood as agents: units of response according to their own aims.

Turbulence as a global agentic property of the field constrains responses to stress in the sense that Peters et al defined stress: uncertainty with a sense of threat. In other words, turbulence emerges from and causes strategies aimed at defending against uncertainty. It is useful to further unpack this concept as regards its semiotic processes and organisational dynamics. Uncertainty is ubiquitous and may arise with any change in conditions, while a sense of threat occurs when change is interpreted to obstruct end-directed behaviour. The previous chapter identified perceived danger as a prompting cause for hypercoherence, constraining enhanced sensitivity to signs salient to the danger. This chapter is concerned with subsequent responses to threatening uncertainty as they arise in endogenous agentic relations. Turbulence is considered here as a measure of increasing uncertainty and threat throughout a biofield, amplified and enacted by endogenous agents in strategies aimed at reducing threat as regards their own ends. As fields become fragmented, awareness of the needs of the whole as a whole is diminished, agentic relations become increasingly conflictual, and field turbulence increases. The following descriptions of field configurations can be understood as forms of distributed agency in increasing phases of pathogenesis.

Emery and Trist argue that the greater the turbulence and interdependence of relations, the more critical become the adaptive strategies and regulatory values enacted by semi-autonomous parts and whole systems. They identify four stages with qualitatively different characteristics in their continuum of turbulence, corresponding to increasing interdependence and criticality (these are discussed below). This theory has been extended⁶⁷ by Babüroglu to conceive personality as a turbulent environment with semi-autonomous parts organized according to regulatory values, inspired by the psychodynamic personality theory of Andras Angyal.

For Angyal, personality is a system-environment process. He argued that while wholes always differentiate into parts, the domains of space and time constitute the continuous dimensional fields that make possible this differentiation⁶⁸. He proposed that these dimensions can be understood spatially as *transverse*: the side by side positioning of parts, and *depth*: the superficial to deep positioning of parts; and temporally as *progression*: the *means-end* relationships between parts that link them over time. Maladaptive responses to “disturbances” (perturbations) are identified with disintegration or segregation of parts, defined as the “lack of coherence and of regular communication between systems”⁶⁹ which causes discontinuities in any or each dimension. Angyal identifies these maladaptive responses broadly as dissociation, superficiality and fragmentation.

In the previous chapter, we considered the organization of dynamic coherence and rigid hypercoherence from the perspective of an acute phase in adaptive sequences.

⁶⁷In O N Babüroglu ‘The Vortical Environment: The Fifth in the Emery-Trist Levels of Organizational Environments’ *Human Relations* 41, 3 (1988) pp181-210 also F E Emery *Futures We Are In*. (Eiden: Martinus Nijhof 1977) and A D Crombie ‘Planning for turbulent social fields’. Unpublished doctoral dissertation ANU Canberra (1972)

⁶⁸ A Angyal *Foundations for a Science of Personality*. (New York: Commonwealth Fund, 1941) p.249

⁶⁹ Ibid p.321

Hypercoherent dynamics were identified as potentially disrupting the resolution of needs or problems. Babüroglu describes adaptive sequences with reference to Prigogine's theory of perturbation driving the emergence of dissipative structures in far from equilibrium systems. Babüroglu discusses the transformative nature of these processes, noting that systems can become "locked" in a transition state preventing adaptive transformations⁷⁰. For Babüroglu, perturbation provoking defensive reactions and transformational processes is the key causal process in both disease and healing. Dynamic response to perturbation is the norm of adaptation, while fixed states are indicative of maladaptive responses. Interpretation of the self in the environment is also a key causal process shaping responses and transformations.

Babüroglu's model of pathogenesis conceives this as maladaptive patterns constrained by values: these ultimately constrain relationships between differentiated parts in terms of continuity or communication between each other. Based on Babüroglu's model, the following exposition of dynamical patterns and their characteristics is necessarily detailed and complex, even when used to illustrate the pathogenesis of a 'simple' trauma case. At the end of this chapter, a return to the non-reductive logic of complexity (self-similarity, problem-space agency, narrative, and metaphor) is presented to preserve the goal of achieving parsimony in diagnostic models for multi-morbid disease.

Causal Field 1: General Functioning

The simplest type of causal texture is the "placid randomized" environment, wherein the causal relationships concern simple needs for accessing resources and avoiding noxiants⁷¹. The functional relationship between endogenous agents⁷² is simply one of general-purpose functioning. No special purpose applies, each agent functions semi-autonomously and perturbations are 'contained' and resolved at focal levels of response. According to Babüroglu, this corresponds to Angyal's transverse "side by side" dimension.

Causal Field 2: Hypercoherence

A particularly threatening or salient disturbance, such as a substantial injury, will at first will be felt as pain throughout the system. This initiates a response involving the whole system, a hypercoherent response, as detailed above. At the focal level of response, agents are in agonistic relations with each other, constituting a shared special purpose. As in Kockelman's graphic, O1, O2 and O/A3 are the same, but attention becomes entrained by

⁷⁰ O N Babüroglu 'The Vortical Environment: The Fifth in the Emery-Trist Levels of Organizational Environments' p.183

⁷¹ In F E Emery and E L Trist 'The causal texture of organisational environments'

⁷² Babüroglu seems to use the terms 'part' and 'value' for endogenous units interchangeably according to whether he emphasises spatial or temporal dimensions in his model. For the sake of conceptual and terminological consistency, Babüroglu's terms 'part' and 'value' are replaced with 'agent' in the description of each type of causal texture and its dynamics that follows.

emergent agentic relation A4 toward threat, and this compromises attention to change in O/A3.

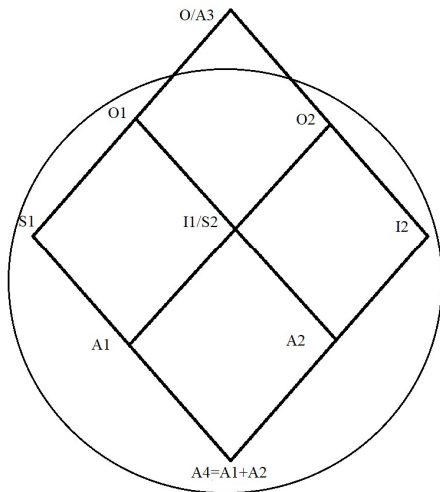


Figure 2. Causal Field 2: Hypercoherence. Endogenous agents A1 and A2 are in agonistic relation. Responses I1 and I2 are entrained toward the shared special purpose A4. A3, the exogenous perturbation, is depicted as an autonomous agent to indicate its own identity as a unit of response or source of variation. In hypercoherence, A3, O1 and O2 are the same, but A3 is depicted outside the ellipse to indicate the semiotic boundary entailed in hypercoherence, wherein variations in A3 may not be attended to.

Causal Field 3: Polarisation

Subsequent to initial disturbance of general functioning, there are two potential maladaptive secondary responses according to Babüroglu: a passive reaction of *dissociation* between parts, entailing a lack of co-ordination or mutual regulation⁷³, and a second order or active reaction of *polarization* wherein agents can be organized in opposition to each other⁷⁴. An example of dissociation between parts is illustrated by the reaction to injury. A passive response might be to ignore the pain. A polarizing response might be to attempt to numb the pain, for example holding the painful part, taking a painkiller, or distracting oneself from the

⁷³ F E Emery *Futures We Are In*.

⁷⁴ In A D Crombie 'Planning for turbulent social fields'

pain. These responses could apply for both emotional and physical pain and correspond with Kabat-Zinn’s acute and sub-acute phases of stress reaction.

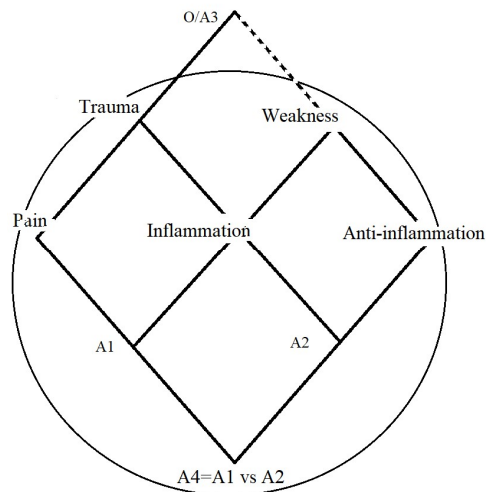


Figure 3: Causal Field 3 Polarisation. A1 and A2 are in antagonistic relation. O2 is becoming dissociated from A3 and O1, and I2 is a polarisation response to S2.

Causal Field 4: Suppression

As dissociation and polarisation become more entrained, the values and responses of some agents become strongly correlated with others, often according to a cost/benefit ratio. This is Emery and Trist’s “placid clustered” field, and the corresponding Angyal dimension is progression: the means-end organization over time⁷⁵. An example would be a localized reaction to infection, entailing an inflammatory and immune response that helps prevent the spread of infection but may compromise other aspects of general functioning, such as being able to go to work for the day. Anticipation of these entailments becomes a part of a strategy for managing them. A passive maladaptation in this case might be “segmentation”: ignoring the needs of one agent to continue to prioritise the needs of another, such as going to work anyway. (Note this conception allows agents and their relations to be defined at any spatio-temporal scale). According to Babüroglu, segmentation represents a value for escape from the demands of choice⁷⁶. An active maladaptation involves the imposition of rigid control to achieve the ends of the prioritized part, such as taking strong anti-inflammatories and stimulants. Either way, the integration of different needs or goals is compromised.

Babüroglu describes an outcome in which the system as a whole has progressed from segmentation between parts to stalemate: the needs of different agents being locked in conflict. In this case, the need to work does not eliminate the need for an immune response. Both needs are locked in conflict as both compete for resources of time and energy. “Disregard of the part-whole interdependence, as in stalemate, inevitably contributes to the means-ends discontinuity where the activity of the parts, guided by their own purposes, does not contribute toward the process of attaining some end for the whole system”⁷⁷ This stage corresponds with Kabat-Zinn’s chronic phase of maladaptive suppression of stress, including

⁷⁵ O N Babüroglu ‘The Vortical Environment: The Fifth in the Emery-Trist Levels of Organizational Environments’ p.189

⁷⁶ Ibid

⁷⁷ Ibid p.215

strategies for denial, distraction and control. Both models acknowledge the increasing use of energy and force in conflictual relations.

Causal Field 5: Depth-surface Disturbance (Dogma)

Fragmentation and stalemate may progress to the “disturbed reactive” environment, wherein there are multiple agents with similar needs, presenting similar “demands” for energy and attention in relation to the whole. Babüroglu links this to Angyal’s depth-to-surface continuum⁷⁸. Adaptive strategies to competing needs include prioritising: more superficial parts are those with less survival or general functioning value compared to more fundamental parts. An adaptive response to trauma, such as dermal inflammation, involves physiological efforts to protect more critical organs from disturbance.

Maladaptively, more critical needs might be ignored or hindered in favour of superficial needs. A passive “superficial” maladaptation to trauma might involve ignoring pain and inflammation in order to complete a non-essential task. Active maladaptation concerns fixed values, such as always completing tasks regardless of pain or inflammation, as the basis for decision-making. Control strategies, such as taking painkillers or stimulants, are reinforced by fixed values. This is identified by Babüroglu as the substitution of dogma for system values:

In dogmatism, depth is captured once and for all. It is a superficial satisfaction of the need for overriding values to guide behaviour in turbulent environments. Hence, dogma becomes the normative base for distinguishing right from wrong, good from bad, goals from noxiants. The relevant uncertainty is replaced by “crystal clear truth”, which might be called a closed system perspective to truth and reality.⁷⁹

Dogma involves choosing values, yet this is unlike reconfigurative choice that enables change. Dogma entails forgetting other choices. From the perspective of the agent there is no choice: rather there is only a “right” action according to the given dogma.

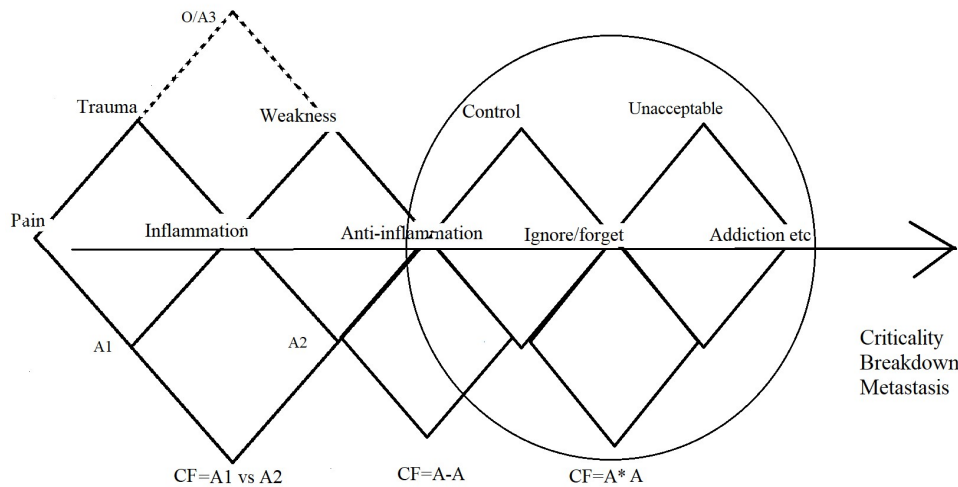


Figure 4. CF 3 suppression (A-A) and CF4 dogma (A*A). The ellipse indicates the shift in focal level of pathogenesis as more critical levels of functioning are employed in stress inhibition. Endogenous agentic relations become increasingly enmeshed and dissociated from the originating problem space. Set values (dogma) reinforce entrainment towards critical levels.

⁷⁸ Ibid p.190

⁷⁹ Ibid p.213

Causal Field 6: Critical Turbulence

In a turbulent field, parts have evolved through each stage to reach a critical level of interdependence, wherein each agent is strongly coupled with every other agent. This means that an agentic relation at any spatio-temporal scale may dominate over all other agentic relations so that “even lines of action that are strenuously pursued may find themselves attenuated by emergent field forces”⁸⁰. A chronic pain patient may know his reliance on pain medication is problematic, yet efforts to change this are overridden by fixed values for control of pain. Efforts to heal are apparently self-sabotaged as agents defend competing needs, including the threat of uncertainty. This generates multiple second order active maladaptions of polarisation, stalemate, and dogmatism⁸¹. The field transforms from a chain of interlinked semiotic processes to multiple interlinked pathogenic pathways. Yet this increasing pathogenic complexity is characterised by decreasing degrees of freedom to adapt. The semiosphere of the entire field contracts as it becomes increasingly entrained around repetitive responses to unsolved problems. The identity of the self as a creative whole is further reduced to an identity of disease state, while the needs of the whole (the originary agent, or Kockelman’s “envorganism” represented as A5 in his graphic, including the original problem) are increasingly forgotten. This phase may be visualised as the spread of entrainment patterns across different spatio-temporal scales. If these maladaptations continue, a vortical organisation dominated by multiple interrelated entrained dynamics may evolve.

Causal Field 7: Vortex

At the extreme end of Babüroglu’s continuum of turbulence are vortical fields, wherein all dynamics have become so enmeshed, polarized and stalemated, that there is a “crystallization” of the whole due to “zero degrees of freedom” in relationships between parts⁸². The metaphor of crystalline structure is apt to grasp this organisational pattern: no more than the rigid, conflictual and repetitive relations between agents, continually reinforced by the same stalemated, polarized, and/or dogmatic dynamics. A feature of vortical organization is the total preoccupation with internal conflict or stalemate⁸³ and this effectively seals off the system as a whole from external sources of energy and information⁸⁴. The system as a whole has become unable to reconfigure itself. Vortex is considered here to be the beginning of an allostatic crisis involving a sudden shift to a more deeply pathogenic state. Breakdown of vortical organisation is inevitable as control strategies fail and vulnerability to perturbations trigger chaotic transitions. Babüroglu sees crisis as a transformative phase wherein new, more adaptive dissipative structures may emerge, and similarly Bellavite describes moments of choice between conservation and change at critical limits, with the potential for adaptive variation to occur. Here I attempt to unpack

⁸⁰ F E Emery and E L Trist ‘The causal texture of organisational environments’ p.27

⁸¹ Babüroglu argues that passive maladaptions, such as segmentation, superficiality and dissociation, are unlikely to emerge in turbulent environments due to the “very strong forces generated by second order maladaptions” in ‘The Vortical Environment: The Fifth in the Emery-Trist Levels of Organizational Environments’ p.202

⁸² Ibid p.218

⁸³ Ibid p.217

⁸⁴ Ibid p.220

transformative phases further: breakdown indicates a global shift into a deeper level of pathology (see below) while transformative change concerns healing processes (discussed in the next chapter).

Causal Field 8: Vicariation and Metastasis

Assuming the organism survives, an overall lower level of functioning emerges after the allostatic crisis of breakdown. “Lower level” can be defined as a qualitative reduction in global degrees of freedom, which may have its focal centre of gravity at any spatio-temporal scale. Kabat-Zinn contends that the focal level that emerges following breakdown will be the “weakest link” in health. It seems reasonable to assume that often the weakest link will be determined by the stalemated or suppressed system that has borne the brunt of stress inhibition. Pain may lead to fear, which may lead to control of pain and fear, such control may lead to excessive alcohol consumption, which may lead to cirrhosis. Pathogenesis continues in a cycle of stabilisation, critical limits, and crisis leading to downwards, inwards or vicarious shifts in functioning, often progressing to multiple foci of pathology.

Yet multi-morbidity, while complex, involves self-reducing degrees of semiotic freedom as described above. Pathogenic states have predictable, mechanical features, both symptomatically and dynamically, and remain entrained around the small set of variables particularly salient in the person’s problem space. Over time this reduced set of self-organising rules is further reinforced by desensitisation and forgetting of both the original problems and prior (more wholesome) responses.

Drawing on Emery and Trist, Babüroglu summarises the core dynamics of maladaptive sequences thus:

with regard to the three maladaptive responses... (1) They are mutually facilitating defences (against turbulence), not mutually exclusive, (2) they all tend to fragment the spatial and temporal connectedness of the larger fields and focus further adaptive efforts on the localized here and now, and (3) they all tend to sap energies that are available to and can be mobilized by the larger systems and otherwise reduce their adaptiveness.⁸⁵

The dynamical changes discussed at each stage do not progress from one to the next but incorporate each other, changing the whole as they do so. With each shift, the person enters into qualitatively different ‘states’ of functioning, each state notable for its pattern of repetitive responses (symptoms) indicating the reduction of semiotic freedom typical of degraded semiosis in closed systems. This offers a coherent but non-reductive perspective on general tendencies in pathogenesis according to processes of the whole. The central role of interpretive relations in the model suggests a new approach to organizing diagnostic information around the concepts of endosemiotic agents with complementary, competing or conflictual relations, rather than disease entities or diagnostic categories.

Pathogenesis is reinforced by resistance to uncertainty. Change may be interpreted as threatening or impossible. Yet resolution of conflict will likely involve a reconsideration of values and their priorities. This resolution could only be achieved by a shift in attention from preoccupation with stalemate, polarized values or dogma, permitting a moment of reflective choice. This may involve the reinstatement of existing (but previously ignored) systemic regulatory values, or the emergence of new regulatory values through a reconfiguration process. The critical factor is that regulatory processes and values of the whole supersede

⁸⁵ Ibid p.210

special purposes of parts. Thus, the complicated dynamics of a multimorbid hypercoherence can be reorganized so that the whole once again becomes more than the sum of its parts.

The sufferer of chronic pain may have to “come to terms” with changes in her lifestyle, substitute less demanding physical activities for past ones and grieve this loss, and learn to attend to, accept and tolerate pain rather than depend on costly and damaging painkillers to constantly control it. This reconfiguration of herself in her world could be prompted by bringing her attention to deeper, less conflicted and less dogmatic values, such as those for being able to live as a whole person, with freedom to act according to her changing needs as a whole person, rather than organising her life around avoiding pain and managing the secondary conflicts that avoidance perpetuates. She may also need to attend to values for gaining the strength or taking the risk to tolerate pain and grieve loss. In this process, the original pain itself becomes less painful, and the effects of trauma may become more profoundly transformed in reinterpretation⁸⁶.

The coherence of multi-morbid cases: The unsolved Problem

Regulatory values have been proposed by many as important variables in the functioning of living systems. These values give coherence to the functioning of whole systems and can be thought of as attractors. For Angyal, the integrity, openness and wholeness of relations between personality systems in time and space constitutes system coherence. Dynamic integrity is the normal system attractor. Like Rappaport, Emery argues that regulatory values provide systemic coherence in relationships between organizations in turbulent social fields.

I emphasise two processes common to theories of adaptive sequences. The first is the tendency for some perturbations to constrain a change in dynamics from coherent, self-similar differentiation in part-whole relations (the normal dialectical attractor of general-purpose functioning) to a hypercoherent, highly ordered state as an acute defensive reaction to threat. Babüroglu compares this transitional process to the formation of dissipative structures when a force (disturbance) acts on an open system. However, I emphasise the role of *meaning*: for a living system, the salience of perturbations and the unfolding of interpretive, anticipatory responses is critical for understanding organizational changes such as hypercoherence and fragmentation, as regulatory values, and even special purposes, are overtaken by secondary responses which cohere around stress inhibition and threat reduction or control strategies. This may interfere with or block the attentional and transformational processes that allow reconfiguration.

The second process is the tendency of hypercoherence towards fragmentation. A hypercoherent state is critically unstable and tends to constrain spatial fragmentation over time (including chaotic lurches and breakdowns), with part-whole relations characterized by increasingly mechanical, highly repetitive processes of interpretation, reaction and counter-reaction including dissociation, polarisation, stalemate and self-destruction. In short, unresolved hypercoherence constrains fragmentation of the whole into parts characterized by increasingly rigid, conflictual, and self-perpetuating mechanical-like relations.

This can be seen as a failure of the system to successfully complete an adaptive transition from the original coherent general-purpose functioning to a new regime of general-purpose functioning. Instead, the biofield is increasingly organised around highly ordered but unstable loci, conceived as a set of interdependent first and second order responses that emerge following perception of a salient threat (the original perturbation). Secondary symptoms (endosemiotic responses) in multi-morbid cases are fragmented yet highly related

⁸⁶ Healing as reconfiguration is detailed in the next chapter.

to each other by the original perturbation (or perturbations) and their conflictual yet mutually reinforcing responses. Moreover they are constrained by field turbulence to defend against uncertainty. Symptoms cannot be treated in isolation from each other, but must be understood in relation to each other and from the overall perspective of the organism reacting to salient perturbations in its lifeworld.

The fragmentary, mechanical organisation of a strange attractor can be observed in the special purpose need which forms the centre of gravity of the case: the underlying, highly coherent theme of the narrative of adaptive sequence. Each fragmentary “purpose” of parts (or agents) can be traced back to relations to the original special purpose. This is not because the original special purpose determines the behaviour or final state of the whole, but because turbulence arising from the unresolved problem continues to constrain semiosis and organisation towards maladaptive defences. This conception is consistent with Goodwin’s contention that by examining the dynamics of parts, one can make inferences about the pathologies of the whole⁸⁷.

The boundaries of endosemiotic causation

From a semiotic perspective, the boundary between endogenous, self-caused pathology and that caused by exogenous agents (eagle, bacteria) or traumatic events is not straightforward. It has been argued that boundaries between organism and environment depend upon distinctions made by an observer: including the organism creating itself in its endogenous responses, and at a further step of agentic remove, a clinician making an assessment of a patient. In other words, semiotic thresholds are created by agents in their responses. Yet should this be understood as a semiotic ‘layer’ over an exogenously caused pathology, which might require a different conceptualisation and treatment? Are either kind of cause to be understood as more fundamental or powerful? Or does the power of semiotic causation also depend upon the distinctions made by a living observer? These questions can be addressed by considering the semiotic capacity of agents. This issue, critical for understanding the capacity for self-healing, is discussed in the next four chapters, especially chapters 9 and 10. Some key points are given here. It is assumed that any exogenous push or force can trigger semiotic activity. The causal effects of semiosis concern organisational stability and change, sequence and cycle. The magnitude, formal dynamics, and specific felt needs and responses involved in semiotic causation depend on the salience of forces as signs relative to the agent, rather than the magnitude of their biochemical or psychological force. Phenomenologically at least semiotic causation concerns time, sensitivity and attention, as well as agency. At the same time, the semiotic capacity of signs themselves, including forceful signs, must be considered. The next chapter argues that healing is also a semiotic process. The implications of this for therapy are that interventions need not depend on force but instead can be designed to exploit semiotic capacity: the salience of interventions as signs to an agent.

Self-causing pathology also concerns relatively passive semiotic processes, including the inattention, forgetting, or desensitisation of some general needs, including M-R functions. This may account for increasing vulnerability to further unresolved needs and general degradation over time, including aging. Semiotic capacity itself may degrade over time. Aging can be conceived as a slow cycle of breakdown attended by small shifts in functioning toward decreased degrees of freedom and reduced capacity to vary responses. Aging as a

⁸⁷ See quote beginning of this chapter: R Sole and B Goodwin *Signs of Life* p.117

limit on endogenous causation in healing is acknowledged, but this limit cannot be anticipated beyond a general prediction that rates of change will slow and continue to decline.

Summary

In sum, from an autopoietic, biosemiotic perspective, the key to comprehending the self-causing nature of an adaptive/maladaptive sequence lies in discovering the salience of the original perturbation for the organism and how the interpretive/anticipatory processes entrained by it continue to constrain self-organising. This includes the acute stage of hypercoherence and the paradoxical, oppositional endogenous processes caused by secondary or reactive special purposes. This provides a focus for identifying and assessing a multi-morbid case. In other words, an ecological model can represent a hierarchical/dimensional continuum or cycle organized around a strange attractor. This can perhaps be best conceived as a problem space of fragmentary subsystems with fixed relations of dissociation, polarization and stalemate. The model can only make sense when the interpretive and anticipatory processes of the organism are considered. In this sense, purpose is a central concept in diagnosis, corresponding with its causal role in the organization of the organism itself.

To revisit the questions posed by allostasis researchers (see previous chapter): in the absence of fixed-point central controllers, how is regulation co-ordinated? How are balance points to be conceived, and by what means do they vary themselves? By what means do organisms anticipate perturbations, and how should anticipatory “error” be conceived given that organisms have evolved in an unpredictable world? For that matter, how can the unpredictability of regulatory responses themselves be understood?

These important diagnostic issues can only be fully addressed when considering the processes involved for an organism living purposefully in a meaningful lifeworld. The purposeful activity unfolding in adaptive sequences constrains the co-ordination of the multiple processes that biomedical and bio-psycho-social models have failed to grasp. These models have focused on “objective” diagnosis based on the presence of symptoms and material pathogens, while interventions are designed to control symptoms and remove pathogens or stressors. An ecological, autopoietic approach to diagnosis must explore the small set of highly interacting causal variables defining the centre of gravity of the problem space: asking: “what is the patient trying to do and why?” bearing in mind that paradoxical yet highly correlated answers to these questions are likely. Likewise, an ecological approach to understanding healing must emphasise processes related to meaning and purpose, and how they might constrain transition, adaption and reconfiguration. Traditionally, when acknowledged at all, these concepts have been largely limited to the concerns of “mind” and behavioural medicine as distinct from body and physiological medicine. The broader potential for understanding meaning and purpose as causal processes in healing is the subject of the next three chapters.

CHAPTER 7

Healing: Prompts and Processes

How we understand pathology determines how we attempt to treat it. From a bio-psycho-social (BPS) perspective, “pathology” may concern anything that causes suffering: a definition that is co-extensive with the presence of symptoms. Consider three simple categories of causes of suffering/symptoms: external agent or force (microbial invasion, trauma), internal response to an external agent or force (inflammation, fear), and breakdown or insufficiency of a regulatory function (immune response, help-seeking behaviour). But the external/internal distinction is ambiguous, as suffering always involves an internal response to an external agent or perturbation. For biomedical and BPS models of care, this ambiguity is not really a problem. Regardless of the cause, treatment involves external interventions that forcefully “take over” control from our apparently inadequate or otherwise erroneous immune, repair, regulation or metabolic processes, or remove morbidic agents.

This thesis presents a radically different conception of pathology which entails a radically different approach to understanding healing and appropriate interventions. The starting point for this conception is that organisms are autopoietic and biosemiotic systems that constantly sense and respond to salient perturbations in their lifeworlds as they adapt, create, maintain and repair themselves.

Alongside the argument presented in this thesis that self-organisation is strongly self-simplified by felt needs and responses to these, constituting the problem-space of the organism, is the perspective that organisms are irreducible wholes, best understood as dynamic fields of hierarchically organised energy processes. These perspectives lead to the proposition that the organism’s life-field is precisely the size, shape and duration of its present problem-space. This conception, taken at the scale of an individual responding to perturbations in everyday life, suggests that pathogenesis and healing are similar to the evolutionary processes proposed by complexity-oriented biologists: perturbation, response, variation, and eventual transformation, degradation, or extinction, at the scale of species and ecosystem evolution.

Symptoms, from this perspective, are adaptive responses, or at least attempts at adaptive responses. This conception asks us to consider what the organism is attempting to do and why, with the view that the ultimate general-purpose is to maintain its viability in its lifeworld. When behaviour, including “symptoms”, appears to depart from normal functioning, halting creative adaptation and undermining viability, it could be assumed that either a pathogenic agent has simply overwhelmed the organism’s “defences” or adaptive capability, or that there is an error in its response. However, the notion of “error” is questionable, given that in an unpredictable world wherein outcomes of strategies are uncertain, variation in responses and behaviours is adaptive. Variation is offered as a basic adaptive feature for organisms attempting to solve everyday problems. Highly ordered states are a variation in functioning, but should be understood as part of adaptive sequences, organised around needs. Variations may occur at any or all scales of magnitude and duration, and may succeed or fail in promoting long term viability, but variation itself cannot be considered erroneous. From this perspective, healthy functioning is never “homeostatically” fixed, but always creative and variable. It can be broadly conceived as the normal attractor combining order and chaos, constrained by global system values that effectively harness

chaos and order to constrain each other dialectically, preventing the dominance of one or the other.

In highly ordered states, organisms can be observed to behave in highly repetitive ways. The previous chapters have laid the ground for conceiving dysfunction, whether mental, emotional or physical, in terms of fixed behaviours that do not vary or adapt even when the organism's needs are changing. There is an overly ordered state that has originated in an adaptive sequence as an attempt to solve a problem, or meet a need, but the organism has failed to resolve this problem, satisfy the need, and/or notice that needs have changed. The high degree of order in this hypercoherent state may reach a critical value, and may result in an avalanche of chaotic behaviour, and perhaps the emergence of a new fixed state with even greater compromise to viable functioning. In the absence of problem resolution, compensatory or conflicting purposes or needs also develop over time, producing a fragmentary organisation of components in fixed relations to each other.

The development of an ecological model is intended to present a non-reductive framework for assessing dysfunction as problems of adapting, and guiding interventions to restore adaptive functioning. According to this approach, healing is not defined by the removal of a stressor, the imposition of a global value, the correction of an error, the avoidance of an aversive sensation, or the transcendence of a limitation. Healing is fundamentally about re-establishing configurative processes that enable the organism to self-correct a non-viable state, to resume an adaptive sequence, and ultimately to transform itself toward normal dynamics.

From an autopoietic organismic (holistic) perspective, there are no different laws for body and mind. Learning and transformative processes are "embodied" and should operate physiologically and psychologically in similar ways. Fundamentally, this involves a process for enabling patients to vary interpretive and predictive models until more viable behaviours can form a new co-operative global organisation that meets needs for continuing viability. In other words, re-establishing the normal attractor of health.

"Natural" healing

Selye, in his influential article published in *Science* in 1955 presenting his theory of "general adaptation syndrome, wrote:

Whenever the available procedures of specific therapy are imperfect, the physician is forced to say he has done all he could and "nature will do the rest." The fact is that nature very often does do the rest, but unfortunately not always. Indeed we may say that the leitmotif of our work on stress was the question how does nature do the rest and when nature fails in this, could we not help if we learned more about natural methods?¹

From a complex processes ontology, living things co-create themselves as participants in larger systems, formally and meaningfully. The core argument of this thesis is that pathogenesis and healing should be understood as a sequence of events beginning with the perception of a need from the point of view of the organism, and the formal responses to that need: the special purpose organization. Hypercoherent form constrains the dynamics of the continuing problem focus. This may lead to compensatory responses and the formation of

¹ H Selye 'Stress and disease'. *Science*, 122 (1955) p. 625

complex pathology, or an eventual transformation of the organism's dynamic, relational and physical organization, making it possible to trial ways to overcome the problem.

This view can address a paradox for the autopoietic/biosemiotic paradigm: how (or why) a self-organising, biosemiotic living system that creates itself can also create pathology. I have emphasised that changes from self-similar dynamics to fixed states produce symptoms but are not necessarily pathological. Rather, they should be understood in the context of special purpose needs and adaptive sequences. These may be global or focal, temporary or permanent, single or multiple, behavioural or physiological, depending on how the organism interprets the problem and anticipates the solution.

Living systems are not automatic producers of symptoms. Discussed in the previous chapter, Kockelman's concern with semiotic agency is to highlight the contextual sensitivity of interpretant-sign relations, and the way that semiosis contributes to transformations of agents over time. These transformations include the ways that indices (signs) can change an agent's ontological assumptions about the world, and therefore the lifeworld of the agent. Transformations include expanding its semiotic range (semiosphere), enabling the perception that assumptions are "in error" and changing them (adapting)².

Assumptions, like other behaviours, can only be known to be erroneous or helpful by trialling them as possibilities rather than adopting them as fact. The ability to transform seems to require stepping out, at one degree of remove, of one's present semiotic ontology, such that indices that challenge this ontology can be perceived and form novel interpretants. This involves a transcendence of the narrow problem focus so that the organism can "remember" its functioning as a whole. The whole is an adaptive hierarchy that includes higher-order regulatory values, and these, as Rappaport argued, enable transformation given "they include within their repertoires programs for changing structurally, or even replacing, lower-order regulators or subsystems". The general or broad concerns of higher-order regulators include identifying failed or redundant strategies, and conceiving and trialling alternate strategies, including novel strategies, according to general-purpose needs for normal functioning.

Healing as creative transformation of a problem space

In her analysis of the successful functioning of complex systems, Mitleton-Kelly notes that it is not enough for a dysfunctional system to merely adapt to changes, nor is it sufficient to adopt a coping strategy imported from another context³. Likewise, "optimism" as a general coping strategy, or a belief that a medicine (active or placebo) will work, is not sufficient to ensure that a problem will be solved. Indeed, no prescription, behavioural or biochemical, based on an abstract notion of the "problem" or the "solution" is adequate. Mitleton-Kelly argues that in order to address a multidimensional problem-space, it is necessary to explore the space of possibilities and identify emergent patterns according to the context or "problem-space" of that system⁴. Solutions involve identification of needs and values from the point of view of the living system, and often involve trialled variations in strategies and overall creative transformations of the problem space. Hypercoherence, entrained by hypersemiosis, shuts down exploratory processes and trialled variation in preference to a narrow focus on a

² Discussed in P Kockelman 'Semiotic agents' esp. pp.30-33

³ E Mitleton-Kelly 'Identifying the multi-dimensional problem-space and co-creating an enabling environment' pp.36-37

⁴ Ibid p.34

special purpose. Healing, therefore, depends initially on enhanced awareness of the problem-space as a necessary precursor to the re-establishment of processes that can conceive, choose and create change.

If a model of healing purports to embrace an ontology of living, it should have “embodiment” at its core: lived experience grounded in the lifeworld of the organism. To move beyond abstract models that are grounded in a reductionist, mechanical paradigm and targeted towards control, means to embrace precisely those features of lived experience that such models cannot grasp: sensation, meaning, unique perception, self-creation. These features are critical in understanding and intervening in the problems of living systems: the perception and resolution of needs. In this chapter I emphasise the role of a property fundamental to all these non-reducible features of life, a property that is virtually always included in models, explicitly or implicitly implied, from the point of view of the observer or interventionist, but rarely explicitly acknowledged from the point of view of the experiencing subject. This property is the *awareness* of the living system.

Awareness

Previous researchers have suggested that the ultimate or “apex” field in the hierarchy of energetic fields of living organisms is “consciousness”. Hankey, commenting on Tegmark’s term “perceptronium” for the special state of matter that is consciousness, agrees that consciousness is the superordinate “state of criticality at the apex of biological regulatory systems, controlling the entire organism” and adds the proviso:

a state of system instability, with excitations only loosely coupled to the underlying material, does not really qualify as a ‘state of matter’; more appropriate would be to call it a ‘state of mind’.⁵

Further developing these concepts, Sankaran and Hankey propose that mind is coupled to physiology at points of self-organised criticality, and these dynamics regulate attention and self-awareness: “the kind of information occurring at instabilities supports subjective experience with its internal sense of self”⁶.

Gare discusses coherent electromagnetic fields at the apex of, and co-ordinating, hierarchies of fields at multiple scales, emphasizing that these “include, maintain, develop and create” new possibilities of interpretation and action that might be actualized according to circumstances. The sensitivity and responsiveness of quantum coherent life-fields can explain the possibility of consciousness. His discussion further emphasizes the exploratory and creative properties of consciousness, such as imagination, that enhance and extend new possibilities⁷.

Consciousness is not defined here as a cognitive property or function, but more broadly as a focused or directed aspect of basic awareness (sensitivity and responsiveness)

⁵ A Hankey A complexity basis for phenomenology: How information states at criticality offer a new approach to understanding experience of self, being and time p.300; citing M Tegmark ‘Consciousness as a state of matter’ arXiv, 1405.0493v1 [physics.pop-ph]. (2014)

⁶ K Sankaran and A Hankey ‘Experience information as the basis of mind: Evidence from human decision making’ *Progress in Biophysics and Molecular Biology* 131, (2017) p.370

⁷ A Gare ‘Chreods, homeorhesis and biofields: finding the right path for science through Daoism’ *Progress in Biophysics and Molecular Biology* 131 (2017) pp.61-91, p.86

that makes cognition, self-reflection and imagination possible. Deacon contends that fundamental self-differentiation occurs moment to moment with “each new focus of attention and intention”, and while “the least differentiated level of self changes little from moment to moment” the self “in its most differentiated form can include itself as recursively represented and projected into a simulated virtual world”⁸

A supervening field of consciousness permeating the entire organism, not limited to cognition, nor even to humans, is consistent with an enactivist account of basic cognition as information-sensing⁹. Thompson’s definition of enactive cognition is radically inclusive, and emphasizes the sensing property of consciousness:

Cognitive interactions are those in which sensory responses guide action and actions have consequences for subsequent sensory stimulation, subject to the constraint that the system maintain its viability. ‘Sensory response’ and ‘action’ are taken broadly to include, for example, a bacterium’s ability to sense the concentration of sucrose in its immediate environment and to move itself accordingly.¹⁰

Such sensitivity can be global and can direct the behaviour of the whole organism. This conception is also consistent with Deacon’s discussion of felt sensation co-ordinating and informing the behaviour of the whole organism. At base, by awareness I mean the capacity for organisms to notice and feel perturbations that matter, and notice and feel their own responses to these. Responses include the potential to form specific cognitions such as appraisals, beliefs, choices, goals and so on. These responses constrain and direct global behaviour.

What we are aware of, and not aware of, is strongly dependent on felt needs and is a critical constraint on biosemiosis, and therefore potential for transformation. In this sense, awareness supervenes and co-ordinates (or fails to) hierarchies of life-fields at different scales, from basic sensory awareness to the most abstract cognitions of post-modern philosophers. This “apex” or mind has a plasticity that enables awareness of the whole, including temporal orientation, focus on what is important in the present, and anticipating or imagining what is possible in the future. The plasticity of awareness is best captured by considering attentional processes (and inattention). The following sections explore the role of attention as a higher-order regulator in biosemiotic and transformational processes.

Conventional employment of attention: Cognitive-Behavioural Therapy

It is possible to counteract the hypersemiosis in panic disorder via a process of reconfiguring the sufferer’s interpretations. During an acute panic episode, interventions are designed to shift attention away from physiological signs of anxiety, and towards non-threatening signs in the environment. Relaxation and cognitive restructuring are taught in the clinic. This involves explaining that physiological sensations of anxiety are not dangerous, and that past traumas or threats are no longer present, and is reinforced by the practice of behavioural exercises to relieve hyperventilation and muscle tension, and to otherwise experientially re-explore the problem space and re-assess signs of danger or safety. Note that this intervention does not merely suppress (entrain inattention to) signs and responses to danger. Rather, these felt

⁸ T Deacon *Incomplete Nature*, p.477

⁹ As described in D Hutto ‘Truly Enactive Emotion’ pp. 176-181 and D Hutto, E Myin, A Peeters and F Zahoun ‘The Cognitive Basis of Computation: Putting Computation In Its Place’

¹⁰ E Thompson *Mind in life: Biology, Phenomenology, and the Sciences of Mind* p.125

sensations of danger are acknowledged while at the same time signs of not-danger are brought to the attention of the patient.

Psychological interventions based on cognitive and behavioural change belong to the rubric of cognitive behavioural therapy (CBT), and are endorsed by the Australian and New Zealand Association of Psychiatrists as the preferred method of treating panic disorders¹¹. The mechanism of action in CBT is explained in terms of cognitive restructuring and behavioural learning, and draws theoretically from behavioural and cognitivist theories. Despite its acknowledgment that behaviour and cognition are somehow experientially if not ontologically linked, cognitivism is a reductionist perspective that cannot account for the relationship between cognitive content and experience, let alone consciousness and reconfigurative processes (see Chapter 2). Nevertheless, cognitivism assumes that properties of cognitive content cause states of mind or emotion, and therefore underlie affective and behavioural disorders. Treatment is then targeted at the problem content, to be challenged and replaced by alternative cognitive content that can induce a more comfortable affective state or more adaptive behaviour.

Consciousness of experience, or attention, is taken for granted in CBT (as it is in most therapies), except perhaps in the broad sense of “engagement” and “rapport” which are usually accepted to be crucial to the therapeutic relationship. An appropriate analogy for the role of attention in CBT would be likening attention to the lubricant for the cognitive machine. It is necessary for the smooth operation of a mechanism but not considered causally significant in itself. I contend that the dynamic and therapeutic benefit of “cognitive restructuring” can only be understood when the core attentional processes involved in reconfiguration are properly considered. These processes are not limited to cognitive behaviours. Kabat-Zinn, who combines cognitive restructuring with mindfulness meditative practices drawn from Buddhism, argues that deliberately bringing awareness to our efforts to respond to stress can help generally to “guard against dysregulation”¹². Others suggest it is a fundamental process of biosemiosis, although with differing views on the nature of attention and awareness. It is now necessary to further consider the nature of attention *as process* itself.

Attention and Time

Merleau-Ponty describes the relation between the long-term self (*corps habituel*) and the short-term self (*corps actuel*) as being one that recalibrates orientation in the world¹³. The notion of recalibration, like reconfiguration, entails the experience of multiple possibilities., including transforming a past strategy in anticipation of a changed future. The moment of choice between possible interpretants, in which multiple possibilities are presented simultaneously, occurs exclusively in the present. For living things facing the choice of continuity or change, “time stops... in the subjective present”¹⁴. These moments of interpretant conflict have profound implications for understanding lived experience, especially meaning, choice and change: “our understanding is that the formation of the

¹¹ G Andrews (Chair) Royal Australian and New Zealand College of Psychiatrists Clinical Practice Guidelines Team for Panic Disorder and Agoraphobia *Australian and New Zealand Journal of Psychiatry* 2003; 37 (2002) pp.641–656

¹² J Kabat-Zinn *Full Catastrophe Living* p.289

¹³ According to T Carman *Merleau-Ponty* p.220

¹⁴ K Kull ‘Semiosis stems from logical incompatibility in organic nature: why biophysics does not see meaning, while biosemiotics does’ p.620.

specious present at the situation of incompatibility of operations is precisely the fundamental mechanism and basis of the phenomenal world.”¹⁵

Others have observed the importance of the moment in biosemiosis. Favareaux writes:

In Kauffmanian terms, the reception of any signal that is functioning as a sign-vehicle within a system is a change that sets up a number of immediate future possibilities for system states that the system can move into next. Peirce's interpretant is precisely that moment of effective ‘measurement’ within the system that “collapses the wave function” of possibility, resulting in the actualization of just one of those possibilities ... and in so doing, providing the change in the system state that can be likewise acted upon as the sign-vehicle for the subsequent act of semiosis (setting its initial conditions and delimiting the set of possibilities that can be actualised next)¹⁶

This conception concerns the temporal context of semiotic transformation. Organisms form interpretants (including decisions and symptoms) that are scaffolded by historical decisions¹⁷. Signs have saliency by virtue of their historical and anticipatory importance in relation to the organism’s needs. Salience is a quality of attention-worthiness. Salient signs prompt increased attention, and the shift of attention into the moment enables the sensing of multiple signs, making multiple interpretants, and choices between them possible. The role of awareness in this process is implicit: being in the moment is critical for semiotic transformations.

Attention and Oscillation

Phenomenologically, attention can be “grabbed by” or “paid to” events in the moment. Rapidly, attention can shift to the future consequences of each choice, considered separately, moving out of the moment and into the temporally sequential nature of potentialities. Just as rapidly attention can be brought back into the moment as the next interpretant is formed. What seems to be the case can be re-evaluated against what might instead be the case, resulting in a reconfiguration, or bodily recalibration, of what now seems to be the case. The dynamics of attention are argued to be at self-organised criticality¹⁸. Attention appears to vary or oscillate in time and focus: from sequential to momentary, and automatic/habitual to mindfully reflective and creative.

Recent research focussing on the “wandering mind” suggests that the oscillatory nature of attention is an indicator of healthy cognitive functioning. Godwin et al found a correlation between a tendency to drift or daydream during tasks requiring focus, and

¹⁵ Ibid

¹⁶ D Favareau ‘Creation of the relevant next: how living systems capture the power of the adjacent possible through sign use’ pp.594-595

¹⁷ K Kull ‘Semiosis stems from logical incompatibility in organic nature: why biophysics does not see meaning, while biosemiotics does’ p.620

¹⁸ K Sankaran and A Hankey ‘Experience information as the basis of mind: Evidence from human decision making’ p.373

intelligence and creative thinking¹⁹. While their findings contradicted prior assumptions that cognitive efficiency means the ability to “stay focused”²⁰, they nevertheless retain a mechanistic interpretation of mind and their research results. They define intelligence as cognitive efficiency: the capacity to quickly process quantities of information, and concluded that wandering attention indicates an efficient mind capable of grasping information quickly, thus freeing up cognitive space to attend to other things, including daydreams. The causal link suggested by this interpretation is that an already intelligent mind gets the processing work done quickly, then the mind can play. Not only does their definition of intelligence as efficiency leave the role of creative play problematic, their finding of a correlation does not establish a causal pathway. An alternative interpretation consistent with the autopoietic paradigm detailed here is that wandering attention enables and enhances biosemiotic potentials and actualities. The very process of wandering attention enables “intelligence” and “efficiency”, albeit defined rather differently in a self-creating ontology, wherein such qualities are pragmatic and embodied. Indeed, bringing attention into the moment and into mindful reflectiveness may also bring mind and body into closer co-ordination.

Attention and the Body

In *The Embodied Mind*, Varela et al acknowledge the contribution of Merleau-Ponty in explicating an ontology of lived experience as a means of overcoming the subject/object divide in science, which has for so long invalidated meaning, purpose and even sensation in living systems. Like Merleau-Ponty, Varela et al propose that primary experience (perception) is neither subjectively nor objectively grounded but resides in the relations between subject and object. The circulatory nature of primary experience entails that experience as lived (with meaning, feeling and sensation), and experience as representations (of meaning, feeling and sensation), far from being separated by an ontological gulf, actually require and create each other. The axis of this reciprocity can be considered the *embodiment* of knowledge and experience²¹.

In a well-argued critique of cognitivism and information-processing, representational theories of mind, Varela et al present the results of two experiments demonstrating the embodied nature of sensory information. In the first, conducted by Held and Hein, kittens with normal vision were paired. One kitten is harnessed to a carriage containing the other kitten but is otherwise free to move about. The restrained kitten was therefore exposed to visual stimuli but prevented from acting. When unrestrained after several weeks of being carted about, these kittens “behaved as if they were blind”. This experiment shows that sensory “information” such as visual stimuli is of no use to an organism unless paired with experience of navigating the world²². Another experiment demonstrating this

¹⁹ C A Godwin, M A Hunter, M A Bezdek, G Lieberman, V L Romero, K Witkiewitz, V P Clarke and E H Schumacher ‘Functional connectivity within and between intrinsic brain networks correlates with trait mind wandering’ *Neuropsychologia* 103 (2017) pp.140-153

²⁰ See J C McVay, M J Kane and T R Kwapil ‘Tracking the train of thought from the laboratory into everyday life: An experience-sampling study of mind wandering across controlled and ecological contexts’ *Psychonomic Bulletin & Review* 16 (2009) pp.857-863 for a review. Their study concludes the mind wandering is correlated with poorer task performance, greater trait worrying, and increased negative affect, and that correlations are stronger when subjects are less aware of their mind wandering.

²¹ F Varela, E Thompson and E Rosch *The Embodied Mind: Cognitive Science and Human Experience* pp.3-4

²² *Ibid* pp.174-175; from R Held, and A. Hein ‘Adaptation of disarranged hand-eye coordination contingent upon re-afferent stimulation’. *Perceptual-Motor Skills* 8 (1958) pp.87-90

“neuroplasticity” shows that if a blind person is exposed to tactile stimuli in a way that represents the spatial dimensions and features of the world, the blind person can, with experiential practice, learn to “see” the world using these tactile stimuli²³. This fundamental relationship of pairing processes between stimuli and experience, and experience and neurological structure, means that when mediated by experience, one kind of stimuli can stand in for another.

Varela et al also critique Merleau-Ponty’s approach to understanding embodiment, claiming it remains theoretical rather than experiential. In this sense it is still mediated by a kind of knowing that relies on cognitive structures rather than experience²⁴. To further establish the case that embodied experience involves *pre-cognitive knowing*, argues Varela, requires a means of knowing without depending on reasoning or cognitive representations of the external world (including philosophical theories). In other words, Varela argues for an understanding of mind that is primarily bodily rather than cognitive, and he does this by using the example of the systematic practice of awareness of experience: mindfulness meditation.

Mindfulness can be defined as being present with one’s mind in everyday embodied experience, including observing one’s own mind, and the process of observing itself²⁵. It is fundamentally circular in this sense, fostering awareness of self as both subject and object. While one is, in a sense, always present in embodied experience, often this presence is automatic as one “goes through the motions”. For Varela, this means that mind and body are often “not closely co-ordinated”²⁶. Lack of awareness of our experience, both mental and bodily experience, means that mind is dissociated from experience. Mindfulness refers to the practice of observing oneself as one goes through the motions, introducing a circularity of reflection: being and noticing one’s being simultaneously. This is a process of bodily awareness: noticing, not cognising about, experience. This conception of pre-cognitive embodied mind is what I am referring to as attention.

The Buddhist tradition of mindfulness, upon which Varela draws, describes the wandering mind as “unmindful”. The wandering mind is “seized constantly by thoughts, feelings, inner conversations, daydreams, fantasies, opinions, sleepiness, theories, judgements, judgements about judgements...a never-ending torrent of disconnected mental events that the meditator does not even realise are occurring except at those brief instants when they remember what they are doing”²⁷. This description of the wandering mind is identical to the phenomenological account of ever-shifting attention being grabbed described above.

In addition to automatic and mindful attention, Varela et al further elaborate on varieties of noticing experience. Drawing upon Buddhist traditions they make distinctions between *mindfulness* as the focus on an object or sensation of experience, and *awareness* as a more global engagement of mind with experience that is attained after mindfulness is

²³ Ibid p.175; from P Bach y Rita *Brain Mechanisms in Sensory Substitution*. (New York: Academic Press 1962)

²⁴ Ibid p.19

²⁵ Ibid pp.22-23

²⁶ Ibid p.24

²⁷ Ibid p.25

practiced to a sufficient degree²⁸. The difference appears to refer the spatio-temporal range of attention: more sharp and brief to more broad and enduring.

It is not necessary to keep one's attention on any aspect of being to be mindful of being, as being includes wandering attention. Being, including attention, is fundamentally processual. Attention is oscillatory and does not function properly without shifting. Indeed, keeping one's attention on a single stimulus has the eventual effect of becoming desensitised to that stimulus, as can be readily observed by staring fixedly at an object for an extended period. Eventually the object will become hazy and distorted, as though obscured by a blind spot. If visual focus is shifted away then returned, the object becomes clear again. Returning one's attention to a particular object, such as breathing, is a useful device to "remember" to be aware of the processes of shifting, losing, returning and grabbing attention. It is also a useful device for learning to direct one's attention purposefully, as in "paying attention to" rather than simply allowing it to be grabbed by sensations, events or thoughts.

Perhaps the most important point to grasp concerning mindfulness is that it is not so much a skill for controlling awareness or attention, but rather an ability to let go of that which habitually grabs one's attention without one's noticing it. Indeed, mindfulness as a meditative practice brings the recognition that attention is grabbed and held repeatedly precisely because we are unaware of this process occurring, at least until such time as attention is once more brought into the moment when noticing a difference.

Attention and Regulatory Values

Shifting attention, or awareness, is a regulatory meta-process that allows the coming-to-awareness of potentialities that can be actualised. It thus constrains meaning-making, creativity and change, without which biosemiosis degenerates into mere computation or habit²⁹.

A shift in attention is a meta-process, not a regulatory value, although it may be constrained by regulatory values that are relevant to specific reconfiguration processes, including (but not limited to) thoughts and beliefs. Cognitive representations of values are proposed by Ongaro and Ward, from an enactivist perspective, to have some causal power in adaptive dynamics at least for humans: "we have some say in the nature of these optimal dynamics, in virtue of our partial capacity to set the goals and projects that we take to be constitutive of our well-being" although they also emphasise that in a relational ontology, being "attuned" bodily and cognitively to "distal properties" in the environment is critical for optimising relationships and health³⁰.

Given the oscillatory nature of attention, and the importance of awareness of endogenous responses, it is reasonable to assume that optimal attunement oscillates between endogenous sensation and exogenous perturbation, a dialectical relation of self and not-self. Likewise, shifts in attention, especially in self-reflective awareness, help provide continuity and communication to 'levels' of mereological organisation: relating cognitive and

²⁸ Ibid p.27

²⁹ In K Kull 'Semiosis stems from logical incompatibility in organic nature: why biophysics does not see meaning, while biosemiotics does'

³⁰ G Ongaro and D Ward 'An enactive account of placebo effects' p. 15

physiological, deep and surface, abstract and concrete, specific and general, memory, present and anticipation, and so on.

Observing the “wandering” nature of attention, Godwin et al flag the need for further research to explore whether regulatory values mediate the difference between healthy wandering attention and unhealthy distraction. They suggested that healthy wandering is regulated by an individual’s motivation to stay focused on a specific task, and that this motivation will “naturally” tune attention back from wandering³¹. However, specific tasks may be maladaptive, and this can only be known in relation to something else: another need, or a desired outcome. Godwin’s formulation of healthy wandering makes little sense unless the creative play of wandering attention itself is valued, such as enabling a reappraisal of specific tasks or problems rather than simply returning to them.

Values that constrain the reappraisal of oneself in the world might include those that encourage or accept anticipation of change and uncertainty such as curiosity and open mindedness, while those that inhibit reappraisal include values for control, defence against uncertainty, and dogma. The former set of values are commensurate with the paradigm of creative becoming, and a definition of intelligence that includes playfulness and imagination, while the latter reflect the assumptions of the mechanistic world view.

There is evidence that values that support creative reconfiguring in a world that is always beyond comprehension have an evolutionary basis. In his discussion of semiotic scaffolding, Hoffmeyer uses the term *semiotic freedom* to denote the evolutionary tendency for organisms to expand the repertoire of signs they can interpret, as a process of natural selection³². At high levels of semiotic sophistication, at least at human levels, the value for semiotic freedom itself, for greater awareness and learning in the world around us, can emerge. Humans have an enhanced capacity to imagine future possibilities and thus reconfigure ourselves creatively in our life worlds.

Regulatory values may function to constrain reconfiguration simply by redirecting attention, interrupting hypersemiotic feedback loops. The higher-level values of moral principles that Rappaport suggests are essential to functional hierarchies are an example. Rappaport argues that their vague and general nature is the key to their function, providing flexibility to the rigidity of systems dominated by special purposes. Their vague nature is open to interpretation, constituting the condition of uncertainty and therefore the possibility of choice that prompts the redirection of attention in the moment.

Despite the important role of higher-level ‘abstract’ regulatory values (in humans), it should not be assumed that regulatory processes are limited to, rely on, or must be mediated by cognitive events or moral principles. Rather, cognitions are representations of more fundamental semiotic processes, of noticing differences that make a difference. Consider the pre-cognitive regulatory processes of self-similarity described by Deacon. Self-similarity has features of dialectical dynamics: simultaneously “sameness” and differences. According to Deacon, it is these gradients of difference that allow information to be created, and work or

³¹ C A Godwin et al, ‘Functional connectivity within and between intrinsic brain networks correlates with trait mind wandering’

³² J Hoffmeyer ‘Biology is immature semiotics’ in C Emmeche and K Kull (eds) *Towards a Semiotic Biology: Life is the Action of Signs* (Imperial College Press, London 2011) pp. 43-66; p.54

change to happen in biological systems. This includes the work of reconfiguration that enables healing. But differences must first be noticed to make a difference.

Attention and Control

Recall Rappaport's argument that the basic maladaptive anomalies of self-regulation consist of errors in the interpretation of, and the magnitude and duration of responses to, perturbations. I suggest that a more accurate understanding of error involves considering the factors that may oppress reconfigurative processes. While humans have the capacity to imagine future possibilities with an acceptance of uncertainty, we can also convince ourselves that we can predict and control the world to a greater degree than is realistic. At least some forms of dysfunction and maladaptation in inclusive systems such as societies and ecosystems have been identified to occur when control as a special purpose is perpetuated, and emergent processes (entailing unpredictable variability) are devalued or ignored.

At the broad level of cultural organization, Gare argues that the values for control over natural processes espoused by mechanistic materialist science are important causes for social and environmental problems. Similarly, McLaren argues that "the signs we anticipate for creating and maintaining our integrity as living organisms... are being distorted or overwhelmed by other signs which compromise our integrity"³³. He identifies over-simplified causal mechanisms promoted in health and fitness industries as examples of cultural signs that obscure the nature of the complex processes involved in health.

The special purpose for control may emerge from misinterpretation: a failure to apprehend the nature of emergent processes, and/or the consequences of devaluing them. Here, control is mistakenly thought to be the best option in the face of uncertainty. The argument that mechanistic materialism entails this kind of misinterpretation is detailed extensively in previous chapters.

However, control as a special purpose may also be an adaptive response to apprehended uncertainty. Uncertainty is often linked with risk and even danger, and anxiety is strongly associated with attentional bias towards identifying, controlling and avoiding threats. There is much evidence from behavioural and neuro-cognitive research that anxiety as a dispositional tendency³⁴ induced experimentally³⁵ or as an acute and chronic reaction to trauma³⁶ affects the processing of stimuli so that attention to potential threats is enhanced compared to neutral stimuli. This has obvious survival value.

While researchers variously promote cognitive, emotional and neural mechanisms underlying attentional bias, there is evidence that attention itself should be understood as a

³³ G McLaren 'The obesity crisis and biosemiotic corruption: Towards a unifying semiotic understanding of obesity' p.186

³⁴ See K Mogg and B P Bradley for a review: 'Anxiety and attention to threat: Cognitive mechanisms and treatment with attention bias modification' *Behaviour Research and Therapy* 87 (2016) pp.76-108

³⁵ See A.T. Beck, D.A. Clark 'An information processing model of anxiety: Automatic and strategic processes' *Behaviour Research and Therapy*, 35 (1997), pp. 49-58 and S.J. Bishop 'Neurocognitive mechanisms of anxiety: An integrative account' *Trends in Cognitive Sciences*, 11 (7) (2007), pp. 307-316

³⁶ C R Brewin and E A Holmes 'Psychological theories of posttraumatic stress disorder' *Clinical Psychology Review* 23 (2003) pp. 339-376

self-perpetuating mechanism of bias³⁷. Interestingly, anxiety tends to be self-perpetuating only in the presence of efforts (mental or behavioural) to control or avoid threats, whether these threats be exaggerated, illusory, or realistic. In short, special purposes entrained towards anxiety and control tend to perpetuate themselves via attentional bias. If attentional bias is maintained after the threat has passed, this may explain how control purposes can become incongruent with current needs and therefore dysfunctional.

The example of panic disorder (previous chapter) refers to a transient or acute hypersemiotic state: one with physiological correlates, but nevertheless easily re-organised with both a shift in attention and the presentation of more adaptive regulatory values.

It might be assumed that a healing process defined as reconfiguration of a self in the lifeworld might only apply to such transient states with “psychological causes”. Or, it might be assumed that reconfigurative healing processes may apply to more chronic states with structural changes, but only regarding concomitant psychological symptoms, such as the transcendence of “spiritual” suffering, as Egnew suggests. However, an autopoietic model of organisms transcends mind/body distinctions by showing that body, physiology and consciousness emerge from the same self-organising processes. In contrast to standard cognitive-behavioural models, anxiety is not mediated by mental representations, but is rather an embodied perception. Reconceived thus, anxiety is a whole-body phenomenon caused by the biosemiotic processes of interpretation.

The bodily response to trauma or infection involves an isolating response, creating a focal area around the area of trauma, insulated from the rest of the whole. This response is analogous to an avoidance regulatory value. Insulation/avoidance can be seen as part of an adaptive sequence that helps prevent pathogenic effects multiplying throughout the system. Yet avoidance of aversive sensations has the effect of further entraining behaviour around avoidance, running the risk that a positive feedback process may perpetuate the special purpose of avoidance towards incongruency with needs of the whole. This forms a vicious cycle.

The processes involved in managing this risk of entrainment can be clearly demonstrated by examining mindfulness-based pain management interventions. These can be understood as strategies for encouraging attention to and acceptance of aversive sensations, as a necessary precursor to adopting active pain relief strategies, rather than attempting to avoid aversive sensations. These and similar interventions conceived in the light of managing adaptive sequences are detailed in the next chapter.

So far, the examples offered to illustrate the role of attention in healing have been limited to psychotherapy and meditation. Can the apparent effect of attention on experience be just a matter of subjective perception or belief, with no “real” physiological effect? Are interventions using mindfulness just a psychological placebo? On the other hand, the placebo effect is not just a subjective belief in recovery, but involves physiological changes. The

³⁷ L. Pessoa, M. McKenna, E. Gutierrez, and L. G. Ungerleider ‘Neural processing of emotional faces requires attention’ *Proceedings of the National Academy of Sciences* (2002); 99(17): 11458-11463. 10.1073/pnas.172403899

causal power of the placebo effect itself can be understood as a fundamental shift in attention focused at a level of physiological sensation and interpretation.

Attention and the placebo effect

Despite widespread acceptance that beliefs concerning the effectiveness of treatments have a measurable impact on outcome, some reviewers of placebo research maintain a highly skeptical stance on whether it exists at all, or can be explained by normal variations in recovery in untreated samples³⁸. Others claim that the “true” placebo effect can be discerned only by subtracting other non-medical factors involved in recovery (using a no-treatment control group)³⁹, assuming that the healing effect of placebo can be separated out from other “natural” healing processes. One thing the researchers can agree on is that there is no generally accepted definition of the placebo effect, let alone explanation for it⁴⁰. These problems obtain because the placebo effect, viewed from a mechanistic perspective, is incomprehensible⁴¹. While most studies treat it as some kind of trigger to entrain physiological healing processes, the effect of the placebo itself cannot be explained in terms of a material or efficient cause. The causative anomaly is particularly pertinent when intrinsic healing processes are contraindicated by prognosis, in other words when patients are not expected to recover without material intervention, and yet they respond to a placebo. I offer only a brief review of the main findings of placebo research here. Unless otherwise stated, all cited research involved placebo conditions compared to both active treatment and no treatment to control for variations in normal recovery.

Most researchers focus on comparing different conditions for manipulating belief, the measurement of neurobiological processes that are associated with the application of these conditions, and the strength of placebo effects on various health problems. Research suggests that greater expectations of recovery enhance the placebo effect, however significant effects can still be obtained even when study participants are given only a 50% expectation of receiving effective treatment⁴². Expectations can be strengthened with the use of classical conditioning: pairing an active treatment with a dummy treatment, then using the dummy treatment alone⁴³. No reliable psychological indicators have been established for determining who is likely or unlikely to respond to placebo treatments: suggestibility and intelligence

³⁸ R Hrobjartsson and P C Gotzsche ‘Is the placebo powerless? An analysis of clinical trials comparing placebo with no treatment’ *New England Journal of Medicine* 24;344(21) (2010) pp.1594-602

³⁹ E Ernst and K L Resch ‘Concept of true and perceived placebo effects’ *British Medical Journal* 311 (1995) pp.551-553

⁴⁰ Ibid

⁴¹ G Ongaro and D Ward ‘An enactive account of placebo effects’ *Biology and Philosophy* (2017) pp.1-27

⁴² S Vits, E Cesko, S Benson, A Rueckert, U Hillen, D Schadendorf and M Schedlowski ‘Cognitive factors mediate placebo responses in patients with house dust mite allergy’ *PLoS ONE* 8(11) (2013) e79576. doi: 10.1371/journal.pone.0079576

⁴³ D G Finniss, T J Kaptchuk, F Miller and F Benedetti ‘Placebo effects: biological, clinical and ethical advances’ *Lancet* 375(9715): (2010) pp.686–695.

appear to play no role⁴⁴, however there is some evidence that extraversion and openness to experience can enhance the placebo effect⁴⁵.

Most researchers agree that the strongest effects are seen in pain reduction⁴⁶. Measurement of neurobiological processes indicate that physiological effects mimic those expected by a specific treatment, such that opioid pathways in the brain are affected by the expectation of an opioid treatment, but the expectation of a non-opioid treatment triggers non-opioid pathways⁴⁷. Strong effects (up to 30% reduction in symptoms) are also observed in disorders involving all kinds of autonomic sensations, nausea, depression, and disorders involving neurohumoral control, including blood pressure and bronchial airflow⁴⁸. Most studies focus on disorders that are transient and believed to be affected by rates of autonomic arousal (e.g. anxiety). Also, most studies observe placebo effects over a relatively short period of time (e.g. 2-3 weeks).

Few studies exist that specifically examine placebo effects compared to no treatment in diseases caused by pathogens, although clinical trials for infectious disease treatment generally include a placebo-control. Vits et al found a strong positive result in reduction of inflammation caused by dust mite allergy by placebo alone compared to no treatment⁴⁹. Few studies examine placebo effects in chronic degenerative disease. A study of placebo treatment in osteoarthritis of the knee conducted by surgeon Dr Bruce Moseley yielded particularly dramatic results: patients in the placebo condition received “sham” surgery (superficial incisions below the kneecap) but enjoyed identical rates of recovery to those who underwent full corrective surgery (scraping and flushing out affected cartilage). Improvements in the placebo group were maintained for years afterwards⁵⁰.

The outcome of virtually any health condition can be affected by manipulating expectations, including increasing negative outcomes by suggesting that an “active” treatment is ineffective, or inducing side effects by suggesting an inactive treatment can cause them. These negative outcomes are termed the nocebo effect⁵¹.

The placebo effect, therefore, is widely considered to be evidence that belief has a powerful effect on physiological functioning, and there is evidence that this holds even in

⁴⁴ V M S Oh ‘The placebo effect: can we use it better?’ *British Medical Journal* 309 (1994) pp.69-70

⁴⁵ D G Finniss et al ‘Placebo effects: biological, clinical and ethical advances’

⁴⁶ R Hrobjartsson and P C Gotzsche ‘Is the placebo powerless? An analysis of clinical trials comparing placebo with no treatment’ and E Ernst and K L Resch ‘Concept of true and perceived placebo effects’ *British Medical Journal* 311 (1995) pp.551-553

⁴⁷ D G Finniss et al ‘Placebo effects: biological, clinical and ethical advances’

⁴⁸ V M S Oh ‘The placebo effect: can we use it better?’

⁴⁹ S Vits et al ‘Cognitive factors mediate placebo responses in patients with house dust mite allergy’

⁵⁰ Moseley’s experiment did not include a no treatment group for comparison to the placebo treatment and active treatment groups; J B Moseley, K O’Malley, N J Petersen, T J Menke, B A Brody, D H Kuykendall, J C Hollingsworth, C M Ashton and N P Wray ‘A controlled trial of arthroscopic surgery for osteoarthritis of the knee’ *New England Journal of Medicine* 347(2) (2002) pp.81–88

⁵¹ E Ernst and K L Resch ‘Concept of true and perceived placebo effects’ *British Medical Journal* 311 (1995) pp.551-553

conditions caused by pathogens and those with degenerative structural changes. There is no rationale for suggesting that belief can only affect some physiological processes but not others. Nor is there any justification for defining the placebo effect as dependent on the manipulation of expectations, as though patients are merely passive recipients of instructions. There is variability in response of patients to placebo interventions, pointing clearly to an active process of interpretation by the patient as being critical to the effect. While there is no strong evidence of psychological traits affecting outcomes, the identification of openness to experience in particular is interesting given the argument that re-configuration requires a kind of openness to reinterpret experience.

To conceptualise the placebo effect according to a model of dialectical biosemiosis places the active interpretation by patients as the central concern in understanding the effect. According to the model of adaptive sequences described above, what is being observed in the placebo effect can be described thus: first, the disease state: a hypercoherent organization entrained around a special purpose that is no longer congruent with the needs of the organism. A placebo representing a sign of possible change from this state is offered. This may trigger a shift in attention to anticipate what might instead be possible.

Two further aspects of the placebo effect require explanation. The first, general aspect of the placebo effect concerns how beliefs, or expectations of change, can affect physiological processes. This causal relation is identified as an inexplicable phenomenon of mind ruling body in placebo research. I believe the answer lies in a biosemiotic and hierarchical view of living systems that overcomes the mind/body duality. Biosemiosis is not limited to conscious interpretations but is a basic function of biological systems or fields at every organizational level. Disease is generally characterized by a focal level of the disorder: the affected organ or physiological system, with involvement of subserving and regulatory levels. The living system tends to keep the disturbance insulated as much as possible from the rest of the system, limiting effects on general functioning of the whole. However, it is mistaken to consider that disease affects only a part, just as it is mistaken to assume that consciousness is separate from physiology. Both consciousness and physiological structure emerge from the same dynamic organizational processes on which all life depends. Therefore, the question is not really “how can belief affect the body?” but rather: “what organizational processes create both beliefs and bodies, and how does a placebo condition effect a causative power on these processes?”

While both the disease state and healing from the disease state appears to target the focal level, healing involves processes that re-establish general regulatory functions. It is a process of re-establishing dialectical adaptivity throughout the whole system, as a function of the whole system. Some kind of higher-level regulatory process, which I have speculated depends on a shift in attention and may also depend on or be enhanced by general regulatory values, downwardly affects multiple hierarchical levels and operates as an anticipatory model for change. This conception does not describe merely the actualization of a belief in being symptom-free, or attaining a “state” of health. It is not enough to simply believe that you will recover. The processes of healing are also those of living generally, comprising the ceaseless activity of maintaining an enduring self within an ever-changing world⁵². This must consider the sensitivity, awareness, and responsiveness of the whole: taking biosemiosis as a fundamental causal power in organisms. If a patient interprets a placebo in such a way as to

⁵² M A Schwartz and O P Wiggins ‘Psychosomatic medicine and a philosophy of life’ *Philosophy, Ethics and Humanities in Medicine*. 5 (1) (2010) pp.1-5

reconfigure her relationship with her disease, and with other relevant properties of her world, her whole self may move on from entrained pathology.

This view is consistent with the “enactivist” account of placebo offered by Ongaro and Ward, who contend that a placebo works by prompting an exogenous shift in attention: “placebos afford healing by shifting attention from mal-adapted parts of our bodies to (an expanded range of) things we can achieve with them”⁵³ They add that from an enactive perspective attention “is an active and bodily, or somatic, relation between organism and environment”⁵⁴.

However, this view does not explain why patients should respond to placebo as a prompt for exogenous shift in attention, rather than a reinforcement of endogenous preoccupation, or no response at all. The second, more patient-specific aspect of the placebo effect that requires further explanation concerns the variability in the placebo effect. Why do some people respond to placebo with healing, while others do not?

Ongaro and Ward contend the answer lies in culturally-shaped and somatically enacted beliefs which influence the perceived effectiveness and potency (“affordances”) of interventions⁵⁵.

The healing affordances of placebos, then, obtain in virtue of the meaning we perceive them to have in virtue of our history of enculturated embodied interaction, and the fact that being intentionally directed towards a meaningful structure in the environment is a bodily and affective relation that entrains specific somatic and attentional patterns⁵⁶.

Research supports this view: in both experimental and real-world applications, placebo works best when its presentation reflects culturally-derived expectations of potency⁵⁷, when it mimics treatments specific to a disease, and especially when treatment providers tailor specific treatments to the disease experience or expectations of individual patients⁵⁸.

However, the argument that variations in effects are due to culturally derived or manipulated interpretations does not explain how placebo might prompt exogenous attention rather than endogenous preoccupation, or why these responses vary so much within a similar cultural demographic. As Ongaro and Ward assert, an enactivist view of the entangled “web” of organism-environment dynamics shows how “tinkering with cognitive or social aspects of this dynamic system should have bodily effects”, but further elucidation of “specific bodily and interactive processes underlying the somatic and attentional patterns” is needed⁵⁹. I argue

⁵³ G Ongaro and D Ward ‘An enactive account of placebo effects’ p.8

⁵⁴ Ibid p.13

⁵⁵ G Ongaro and D Ward ‘An enactive account of placebo effects’ p.21

⁵⁶ Ibid

⁵⁷ Ibid

⁵⁸ In D G Finniss et al ‘Placebo effects: biological, clinical and ethical advances’ and V M S Oh ‘The placebo effect: can we use it better?’

⁵⁹ G Ongaro and D Ward ‘An enactive account of placebo effects’ p.23

this can be achieved when these processes and patterns are considered semiotically as part of an adaptive sequence.

Attention and biosemiosis

One of the tasks for research in biosemiotics is to develop models that can represent the organism in their own meaningful lifeworld: capturing their semiotic niche⁶⁰. To achieve this, it has been suggested that the sign rather than the molecule or cell should be taken as the basic unit in biology, bringing to attention the relations between systems themselves rather than between subject and observer⁶¹. Moreover, this view is fundamentally biological, not cognitive: the cell is proposed to be the simplest unit of semiotic agency⁶² that is, the most basic unit capable of generating end-directed behaviours⁶³.

The previous chapter highlighted semiotic processes in a causal field of relations between endogenous semiotic agents with different perspectives or purposes, developing a conception of a complex pathology as a field of semiotic agents locked in antagonistic relations towards each other, maintaining a complex form of entrained, fragmentary organisation that reinforces an unmet need state. What are the implications of this conception for biosemiotic processes in healing?

To fully address the placebo effect, it is necessary to consider the triadic nature of semiosis: the sign, what the sign stands for, and the interpretant (the interpretive processes). The effect derives from the placebo's ability to stand for something: a curative event, a non-curative event, or even a noxious event, from the perspective of the interpretant: being a realization or manifestation of what the sign is interpreted to stand for. Moreover, just as entrained frequency patterns constrain heightened frequency-selective sensitivity, hypersemiosis entails heightened sensitivity to signs specific to that state, with important implications for both attentional processes and probable interpretants (from the point of view of the patient).

Ongaro and Ward contend that “natural” or non-mechanical healing involves interventions that shift bodily and cognitive attention away from preoccupation with internal states and processes, toward attunement with the environment, thus presenting opportunities to engage in “adaptive interactions.”⁶⁴ Building on this, the concept of an adaptive sequence places the salience of signs and their causal power to prompt change within the context of

⁶⁰ K Kull, T Deacon, C Emmeche, J Hoffmeyer and F Stjernfelt 'Theses on Biosemiotics: Prolegomena to a Theoretical Biology' in C Emmeche and K Kull (eds) *Towards a Semiotic Biology: Life is the Action of Signs* (Imperial College Press London, 2011) chapter 2 p.38

⁶¹ J Hoffmeyer and K Kull 'Theories of signs and meaning: Views from Copenhagen and Tartu' in C Emmeche and K Kull (eds) *Towards a Semiotic Biology: Life is the Action of Signs* chapter 14 p.271

⁶² J Hoffmeyer in C Emmeche, J Hoffmeyer, K Kull, A Markoš, F Stjernfelt and D Favareau 'A roundtable on (mis)understanding of biosemiotics' in C Emmeche and K Kull (eds) *Towards a Semiotic Biology: Life is the Action of Signs* chapter 13 p.244

⁶³ J Hoffmeyer 'Biology is immature semiotics' in C Emmeche and K Kull (eds) *Towards a Semiotic Biology: Life is the Action of Signs* chapter 3 p.53

⁶⁴ G Ongaro and D Ward 'An enactive account of placebo effects' p.16

sensing, perceiving and responding to needs or problems. Changes in attentional processes are critical to this, yet entrainment is not always easy to interrupt.

When attention becomes automatic, and/or bound by control values deriving from secondary responses, inattention and/or resistance to change can ensue. Biosemiosis becomes “degraded” in the sense that interpretive processes are “entrained” or automatically repeated rather than adaptive. The difficulty in applying directive interventions (or even placebo) to prompt reconfiguration in the biosemiotically degraded state is that the reconfigurative process requires attention to be paid to salient signs of change, but attention has been entrained to ignore, avoid or misinterpret these very signs. The organism’s stance towards the world maintains a “blindness” or even antagonism to certain signs that might otherwise prompt change. Varela et al describe the chronic effects of this:

In the ontological view, a character disorder can be understood only in terms of a person's entire mode of being in the world. A theme, such as inferiority and dominance, which is usually only one dimension among many used by an individual in defining his world, becomes fixated, through an early experience, such that it becomes the only mode through which the person can experience himself in the world. It becomes like the light by which objects are seen-the light itself cannot be seen as an object-and thus there is no comparison possible with other modes of being in the world⁶⁵.

Even when patients are cognitively aware that their habits are implicated in maintenance of their disorders, they often seem unable to change them. Patients can be aware that their phobias are irrational or that their behaviours are excessive. Likewise, our bodies may be somatically aware of excessive responses⁶⁶ yet unable to shift attention from, or otherwise transform these. It is as though an inner conflict ensues: between fixed special purpose needs, compensatory needs, and general-purpose needs, creating polarisation or stalemate.

A shift in attention may be prompted by a placebo, enabling reconfiguration by variation in exogenous relations as described by Ongaro and Ward, but for most patients, placebo does not prompt healing. I argue that the “natural” (non-mechanical) healing response of the organism is constrained by relational properties of interpretation: these concern sensitivity to specific signs in relation to need states.

Relation of patient and sign: salience and valence

The ecological model takes into account how semiotic agency constrains sensitivity and responses to interventions. Biosemiotic medicine as a form of intervention requires ascertaining which signs are salient and in what way to whom. Not every difference makes a difference, a meaningful sign for someone somewhere means something else, or perhaps nothing, to another someone.

This discussion of sign saliency includes the value or valency of signs with respect to the interpreting agent or subject, and identifies four basic kinds of sign valency: neutral, antagonistic, agonistic, and analogic, in relation to needs: special purpose, compensatory, transformative, and normal functioning. A sign is not antagonistic or agonistic in itself. It depends on the point of view of the organism (or semiotic agent) considering felt needs. It is

⁶⁵ F Varela, E Thomson and E Rosch *The Embodied Mind: Cognitive Science and Human Experience* p.64

⁶⁶ For example food allergies, cancer or automimmune diseases

assumed in this discussion that any event or intervention has a semiotic aspect, and therefore the valency of signs obtains as a causal relation even in conventional medicine.

Considering the situation of a patient who has suffered trauma and has developed an entrained special purpose to avoid danger: a sign interpreted as neutral with regards the special purpose *from the perspective of the patient* would not evoke any change in her pathological state. The sign is not salient to a change in the special purpose state, so there is no enabling interpretant, no moment of choice or recalibration, to re-establish adaptive processes. There is also nothing to reinforce the self-perpetuating pathology or to push, prompt or otherwise constrain any “compensatory” responses. A patient who believes a treatment is inactive may not even engage with let alone respond to treatment. A neutral sign that is subtle may not even come to her attention. There is neither a placebo or nocebo effect. (Of course, the mechanical force of a treatment itself can still have gross biochemical effects, prompting their own responses).

A sign may stand for something *antagonistic* in relation to the special purpose. For instance, if the special purpose is to avoid danger, anything that is interpreted to diminish or interfere with vigilance to danger threatens perceived needs and is antagonistic to the special purpose. This threat may be rejected, controlled or avoided. The patient may feel unable to rest even if she notices signs of fatigue (a secondary or compensatory response in relation to the special purpose state of vigilance). She may try to control the sensations of fatigue, perhaps by using stimulants, rather than acknowledge or meet the need for rest. In this way, the threat to the special purpose, fatigue, reinforces entrainment to vigilance via this defensive response. If, on the other hand, the patient wishes to rest, she may use a sedative. This is also antagonistic to the special purpose of remaining alert, and the state of vigilance is likely to recur once the sedative has worn off.

A sign may stand for something *agonistic* to the special purpose. In this example, such a sign might be thought to represent safety, but in an entrained state of pathology, semiosis is degraded and the need to avoid danger has overcome the ability to notice signs of safety. In a state of pathological vigilance, agonistic signs are those events that represent a means of hiding from or otherwise defending oneself from danger, or maintaining vigilance such as the use of stimulants. In a state of pathology, agonistic signs relative to the special need will also reinforce pathology.

Considering the organism as a field of semiotic agents, a sign can have multiple valencies in relation to various semiotic agents. Recall the discussion of multi-morbidity in the previous chapter, wherein the development of compensatory responses can occur. These compensations can conflict with both special purpose needs and with general system values to restore coherent variation. Consider the special purpose response to a deep splinter in your foot: inflammation. This painful but adaptive process eventually forces the splinter out of the dermal tissue of your foot, meeting needs to restore normal functioning. The special purpose need can be considered the primary response, while a compensatory response might be to decrease discomfort. A painkiller or anti-inflammatory is *agonistic* to this secondary response, but is antagonistic to the primary response. It may also be antagonistic to needs for completing the adaptive sequence in trauma: promoting inflammation helps to immobilise injuries, reduce bacterial invasion, and stimulate dermal tissue regrowth.

While antagonistic signs relative to the special purpose in an adaptive sequence can be seen as obstructing healing, we can be highly receptive to them as agonistic to secondary responses. This receptivity might be enhanced when painful or inconvenient symptoms are misidentified as pathological or at least unacceptable. In other words, if we interpret suffering itself as the problem, our prevailing need then becomes to avoid suffering. Likewise, if the

adaptive changes of healing are perceived to be unacceptably dangerous, difficult, uncomfortable or painful, medicines that stand for something in opposition to these changes may appear as desirable rather than noxious.

When the danger is real, alertness as a special purpose is clearly desirable, and rest undesirable, for the viability of the whole organism. Rest can only be agonistic in relation to general-purpose needs of the viability of the whole when it has first been established that the danger has passed. As long as there is potential for exploration for the signs of danger or the passing of danger that makes reconfiguration towards general-purpose functioning possible, there is no fixed pathological state. The meaning of the patient's problem space: the who, where, when and why, needs to be considered to establish the sign that may prompt reconfiguration: that is, a signal that the danger has passed.

Unlocking this stalemate whilst avoiding any antagonistic relations with any semiotic agent may be a necessary precursor to freeing the patient's attention to signs of change sufficient to enable endogenous healing of the kind discussed in this thesis: broadened awareness of potentials (including higher-order regulatory values), making choices, and trialling variations, and in doing so, transforming the problem space. The fourth basic category of sign relation, an analogic sign, represents a resonant relation between a need state and a perturbation. The causal properties of resonant frequencies in life fields have previously been discussed (see chapter 4) largely in terms of the sensitivity of organisms to resonant frequencies, and their role in energy transfer and communication between agents or domains. This prior research suggests that there is a potential for analogic signs to unlock entrainment.

Edge-of-chaos and entrained frequencies

It has been previously argued that the sensitivity and responsiveness of living organisms, made possible by coherent life-fields, can be considered to comprise the fundamental awareness of the organism, making consciousness and cognition possible as higher-order levels of awareness. A special purpose need represents a reduced set of causal variables in the organism's problem space and entrains organisation of the life-field, including sensitivity and responsiveness, rigidly in self-perpetuating patterns. This fundamental biological process constrains a narrow focus of awareness, affecting but not limited to conscious behaviour.

I have introduced Chladni patterns as a means of conceiving these entrained states as nodal patterns of standing waves organising energy and matter via their sensitivity to perturbations⁶⁷. An organism's responses to salient perturbations sets up the field characteristics, comparable to the Chladni plate, which then constrain the selective sensitivity and formation of nodal patterns in response to subsequent perturbations. In short, organisms form their own nodal patterns in response to needs, and these patterns then govern dissipative structures until the organism reforms itself into a normal chaotic pattern.

Some theorists propose that measuring the frequencies of biofields might provide diagnostic information, and that interventions could be developed based on altering or restoring frequencies⁶⁸. Theories concerning the entrainment of dynamics in life-fields suggest that some oscillatory frequencies could prompt healing responses either by "re-tuning" frequencies, or by displacing fixed frequencies and prompting edge-of-chaos oscillatory frequencies in the organism. This research highlights the sensitivity of organisms to very weak electromagnetic fields and suggests that this sensitivity plays a crucial role in

⁶⁷ See chapter 4

⁶⁸ B Rubik and H Jabs 'The human biofield: opportunities and challenges'. *Cosmos and History: The Journal of Natural and Social Philosophy*. 14, 1, (2018) pp.153-162

biological regulation. It is hypothesised by these researchers that oscillatory frequencies, by means of specific resonance rather than signal strength, alter or restore endogenous frequencies of life-fields to trigger specific biological processes, including restoration of normal edge-of-chaos functioning.

At the basic level of living organization are strongly buffered, highly entrained developmental and metabolic regulatory pathways. Corresponding to these are a range of viable coherent excitation modes, from temporary metastable states to limit cycle oscillations. At this basic level, specific resonant frequencies are found to have predictable effects to support or disrupt functioning. Mae-Wan Ho emphasizes the very high efficiency and speed of energy transfer by resonant vibration between molecules in living systems when specific intrinsic frequencies are excited, giving the examples of ATP hydrolysis and photosynthesis⁶⁹. Hyland cites Russian research findings of very specific resonance frequencies associated with triggering yeast and bacterial cell division. There is evidence for specific frequencies affecting general metabolic functioning and regulatory systems. An example is the Schumann resonance of 7.83 hertz: the lowest peak in the oscillatory frequency range of the Earth, and also the oscillatory frequency of human alpha brain waves. An experiment depriving people of the background frequency of the Earth by keeping them in a concrete bunker for a few weeks appeared to result in symptoms of lethargy, irritability and headaches, and disruption of circadian rhythms. Exposing them to 7.83 hertz appeared to resolve these symptoms⁷⁰. So it seems that strongly buffered biological processes may have a preferred frequency at least to meet specific needs, and that exposure to specific exogenous frequencies could have a salutogenic effect.

Compare this hypothesis with Hyland's description of the effects of microwave resonance therapy, which involves exposing patients to ultra-low energy microwave frequencies.⁷¹ The therapeutic frequency, termed the oscillatory similitude, is identified by measuring the patient's responses to a sweep or broadband of 52 to 78 Ghz source frequencies. The oscillatory similitude elicits what Hyland terms a "sharp resonant response" which he proposes "switches on" normal coherent excitation, which reverses and prevents pathogenesis⁷². Hyland claims this therapy results in significant improvement in 80% of cases.

Hyland proposes that there is a preferred coherent excitation for each organ and regulatory system that can be switched on by "topping up" or recalibrating the necessary frequency at the corresponding acupuncture meridian or node⁷³. Drawing from Frohlich, both

⁶⁹ M W Ho *The Rainbow and the Worm* (World Scientific, London 2008) p-10

⁷⁰ R Wever 'ELF-effects on human circadian rhythms. In M A Persinger (ed). *ELF and VLF Electromagnetic Field Effects*, (New York, Plenum Press 1974) pp.101-144

⁷¹ G J Hyland Physical basis of therapeutic and adverse effects of low intensity microwave radiation *Indian Journal of Experimental Biology* 46 (2008) pp.403-419

⁷² *Ibid* p.413

⁷³ *Ibid* p.414

Hyland⁷⁴ and Ho⁷⁵ use a metaphor of a properly tuned radio receiver to illustrate how organisms discern and respond to electromagnetic perturbations.

However, unlike a radio, an organism changes its own sensitivities, and there is no simple retuning process in microwave resonance therapy. Hyland acknowledges that there is no toxic or ideal frequency, and that it is harmful for frequencies to entrain biorhythms to “an unnaturally high degree of regularity”⁷⁶. He emphasizes the importance of variation and “deterministic chaos” in biorhythms⁷⁷, as others have emphasized edge-of-chaos oscillations in normal functioning. Moreover, I emphasise Hyland’s observation that following exposure to the oscillatory similitude, the patient is no longer sensitive to that resonant frequency⁷⁸. This suggests that rather than there being a preferred frequency to retune the organism, the organism is sensitive to a frequency resonant with its entrained frequency, and this relation interrupts or displaces entrainment. Being resonant with the need state of the organism, I term this the analogic sign.

My interpretation of all this is that processes involved in maintaining or changing oscillatory frequencies (or patterns) depend on salient perturbations, the salience of which depend on felt needs. Entrained patterns are produced in response to specific needs, and these patterns are highly responsive to resonant frequencies that displace them. This may enable transformation towards a self-similar coherence pattern associated with edge-of-chaos general-purpose functioning, wherein stability is maintained by coherent variation.

It is the ability to notice, adapt or transform oneself according to changing needs, from specific need entrainment to more general-purpose need organisation, that I conceptualise as healing and the maintenance of health.

Diagnosis and interventions

By studying the state (problem space) of a living system, it should be possible to make some predictions regarding key causal variables as primary and secondary need responses, and therefore what kind of sign can make a difference: what is needed (or more accurately, what needs the sign should stand for) to prompt a healing response according to the needs of the patient. In other words, by inferring the nature of regulatory values (including special purpose values) it should be possible to infer the set of signs salient to that organism (the set of differences that might make a difference). Amongst the sign relations that might be modelled by studying the problem space are the set of special purposes, including those represented by compensatory purposes, and the agonistic signs relative to these, which are also the antagonistic pushes or prompts (relative to the whole) which may obstruct healing of the whole.

Signs that are antagonistic to special purposes and/or regulatory values can reinforce need states by provoking defensive or compensatory responses. The fixed patterns of behaviour entrained by hypercoherence can be interrupted by reflective attention, bringing awareness into the moment wherein choice and change are possible. However, pathological states, comprising an array of semiotic agents locked in compensatory and antagonistic

⁷⁴ Ibid p.404

⁷⁵ M W Ho *The Rainbow and the Worm* p.180

⁷⁶ G J Hyland ‘Physical basis of therapeutic and adverse effects of low intensity microwave radiation’ p.407

⁷⁷ Ibid

⁷⁸ Ibid p.412

relations to each other, may block or distort these relations. Research suggests that exogenous resonant frequencies might displace endogenous entrained frequencies that obstruct healing: such signs can be termed analogic in relation to the need state of the patient. Again, the notion of reflective awareness is key to enabling transformation, albeit on a more basic level.

“Control” interventions

According to the autopoietic perspective explored in this thesis, interventions should aim to support self-organisational processes. Those that do not run the risk of further obstructing them. I agree with McLaren that: “Reductionism flourishes due to an over-emphasis on controlling natural processes which, as I have argued, then leads to a greater need for control and ultimately, fragmentation”⁷⁹. McLaren argues that the failure of reductionist approaches to addressing chronic obesity is due to a failure to appreciate self-organisational processes in societies: “The obesity crisis is, or is quickly becoming, a wicked problem. This is because we continually seek to solve such problems by applying the cause of the problem; the need to control natural processes by over-simplifying them”⁸⁰.

Control interventions are based on an over-simplified view of pathology and are designed to control symptoms by simply countering them. Control interventions, being antagonistic, often entail the application of force needed to overcome the efforts of the organism itself. Obstructions to healing processes may result from the application of sheer force, which itself constitutes a potentially damaging perturbation that the organism must accommodate⁸¹. Control interventions tend to be antagonistic to the need state produced by the patient, and this may prompt a defensive response out of proportion to the degree of force involved in the intervention itself. It is often necessary to add further interventions to counter these iatrogenic compensations or “side effects”. This may lead to the complex pathology comprised of compensatory side effects, treatments for those side effects, compensations for those, and so on, producing iatrogenic syndromes. Not to mention failing to address the original problem.

Indeed, some interventions act by inducing insensitivity to unpleasant sensations or experiences, such as that achieved with analgesics. This may also obstruct healing by distorting or dampening awareness of needs. Patients on strong pain medication are at risk of neglecting injury without noticing, at least until the effects of the medication wear off.

To briefly consider selective serotonin reuptake inhibitors. These commonly used antidepressants, long thought to be well-tolerated by most patients, are taken by 10% of Americans: 60% of whom have been taking them for more than two years, and 14% for over ten years⁸². A recent study found that patients taking SSRI’s experienced more symptoms of depression over the long term than did depressed persons not taking the medication⁸³. The

⁷⁹ G McLaren ‘The obesity crisis and biosemiotic corruption: Towards a unifying semiotic understanding of obesity’ p.211

⁸⁰ Ibid p.210

⁸¹ M Dix ‘Living and knowing’ p.17

⁸² L A Pratt, D J Brody and Q Gu ‘Antidepressant use in persons aged 12 and over: United States, 2005-2008’ *NCHS Data Brief*, 76, (2011) 1-8. <http://www.cdc.gov/nchs/data/databriefs/db76.pdf>

⁸³ Attenuation of effectiveness of antidepressant therapy alone would not account for this result. J R Vittengl ‘Poorer Long-Term Outcomes among Persons with Major Depressive Disorder Treated with Medication’ *Psychotherapy and Psychosomatics* (2017) pp.302-304

author concluded that the iatrogenic effects of antidepressants may outweigh their benefits over the long term. The proposed mechanism of action of anti-depressants involves increasing positive mood by manipulating serotonin regulation. The artificial elevation of mood, to the extent that it is effective, may temporarily reduce awareness of problems and likelihood of their resolution. Strategies aimed at achieving this are termed experiential avoidance by therapists⁸⁴. Neglect of these needs means that problems remain unsolved, and symptoms may even recur and intensify over time. This interpretation is supported by a study conducted in Hunan, China⁸⁵, which found that although treating patients with antidepressants provided symptomatic improvement, many patients did not see themselves as better. They conceived their state of unhappiness as caused by the losses and suffering endured in the Cultural Revolution. As Kirmayer puts it “the biomedical treatments they received failed to address the personal, social, and existential dimensions of their suffering”⁸⁶.

Other iatrogenic effects of antidepressants are more physiological. A 2017 meta-analysis found an increased risk of death of 33% in depressed but otherwise healthy persons taking these drugs compared to depressed persons not taking them⁸⁷. The researchers concluded that SSRI’s block serotonin reuptake in major organs of the body, changing their metabolic and vascular functioning. Lead researcher Paul Andrews concluded: “We shouldn’t be taking anti-depressant drugs without understanding precisely how they interact with the body”⁸⁸.

The issue is not simply whether, or how much, these effects are caused by direct biochemical force, or resistance, accommodation, or compensation for these, or even induced insensitivity: it is acknowledging that the responses of the patient to perturbations, including stressors, losses, and medicines, are what create symptoms.

Forceful psychological interventions can have similar damaging effects to those of forceful physiological interventions. Directive forms of psychotherapy, such as “cognitive restructuring” which seeks to identify so-called “negative” or “erroneous” thoughts and replace them with “positive” ones, have been reported to produce paradoxical reactions in the form of increase in negative cognitions and rumination. The paradoxical effect of thought suppression has been consistently replicated in laboratory studies and observed clinically⁸⁹. A

84 See Mindfulness Interventions below

85 A Kleinman *Social origins of distress and disease : depression, neurasthenia, and pain in modern China* (Yale University Press, 1986) cited in L J Kirmayer ‘Revisioning psychiatry: toward an ecology of mind in health and illness’ pp.624-625

86 L J Kirmayer ‘Revisioning psychiatry: toward an ecology of mind in health and illness’ p.625

87 17 studies of mortality amongst antidepressant users over any length of time were reviewed with a total sample size of about 350,000: in M M Maslej, B M Bolker, M J Russell, K Eaton, Z Durisko, S D Hollon, G M Swanson, J A Thomson, B H Mulsant, and P Andrews ‘The mortality and myocardial effects of antidepressants are moderated by pre-existing cardiac disease: a meta-analysis’ *Psychotherapy and Psychosomatics*, 86, (2017) pp. 268-282

88 P Andrews cited in ‘Antidepressants associated with significantly elevated risk of death, researchers find’ *Science Daily* (Source: McMaster University, September 14, 2017) retrieved 2/12/2017 <https://www.sciencedaily.com/releases/2017/09/170914152238.htm>

89 Reviewed by Rassin et al; who found that target thoughts in “thought suppression” tasks resulted in more frequent intrusion of thoughts, while target thoughts in “forget” tasks did not, compared to control. They

review of this research posits various explanations, each of which identifies factors that affect attentional processes such as saliency (especially aversive) of thoughts, and the effects of distraction. The common mechanism to each explanation is attention. Thought-control (or thought suppression) interventions tend to place increased attention on these thoughts and emotions, and increased attention tends to reinforce rather than dissipate behaviours, including cognitive behaviours. Meanwhile, labelling mental and emotional sensations as negative or dangerous increases aversion to them, increasing their saliency. Combining the reinforcing effects of increased attention and the pathologising of these behaviours can be understood as promoting a positive feedback loop and fixed dysfunction such as obsessive thoughts and increased anxiety about the thoughts.

Biosemiotic interventions

To emphasise, the autopoietic conception of disease I have discussed does not consider symptoms, as reactions or responses to stressors and pathogens, as “pathological” or even “dysfunctional”, even if they severely limit general functioning. Dysfunctional behaviours or responses are defined as such because they continue to be repeated past any adaptive value (relative to needs for the organism to remain viable in its lifeworld) they may once have had. In this dysfunctional state, organisms may appear “blind” to the possibilities of transformation.

The typical repetitive behaviour in these states, albeit punctuated by catastrophic chaotic fluctuations, means that organisms in a dysfunctional state do behave more like machines than the creative, problem-solving living systems described in chapter 4. But despite the mechanical appearance of pathology, enabling the needs of the whole to be met, rather than controlling the symptoms of the parts, should be considered as the ideal target of interventions. In this way, interventions can be aimed at restoring salutogenic processes of the organism.

Paying attention to (and not suppressing) unresolved problems may be necessary but not yet sufficient to re-establish healing processes. Paying attention to memories and symptoms of trauma (“re-living” or exposure therapy) can exacerbate symptoms of Post-Traumatic Stress Disorder. Littrell argues that:

Revisiting painful emotion has the potential to improve health and psychological functioning. However, success is not explained by a purging/discharge mechanism or because the opposite of attending to emotion, viz., inhibition is precluded. Mere attention to feelings of distress can enhance distress. In order to preclude increasing distress as a consequence of revisiting trauma, some new response to the negative-emotion-eliciting stimulus must be found.”⁹⁰

Could this ‘new’ response be a reconfigurative biosemiotic process? Living and healing processes rely on gentle and efficient biosemiotic processes in interpreting and responding to perturbations, and in anticipating, trialling and transforming models of the self in the

suggest these results may be explained by the more specific attention given to “important” thought suppression targets compared to the “trivialised” forget targets. E Rassin, H Merckelbach and P Muris, P ‘Paradoxical and less paradoxical effects of thought suppression: A critical review. *Clinical Psychology Review*, 20 (8) (2000) pp.973-995

⁹⁰ J Littrell ‘Is the re-experience of painful emotion therapeutic?’ *Clinical Psychology Review*. 18, (1998) pp. 71-102, p.96

lifeworld. Proposed as a fundamental causal process of both mind and body, biosemiosis avoids the incoherencies of dualist and mechanistic metaphysics, which cannot account for the relationship between higher-order interpretants, such as beliefs or meanings, and physical bodily processes (the mind/body problem). Biosemiosis has been suggested in this thesis as an explanation for the placebo and nocebo effects, demonstrating that self-healing can be prompted by no more than signs. The ubiquity, efficiency and potency of biosemiotic causation argues for the desirability of low energy biosemiotic interventions to support self-generated reconfigurative processes, compared with forceful attempts to override, control and desensitize to symptoms. These are instead seen as necessary sensations and responses in the causal processes of living systems.

The following chapters identify and examine therapies compatible with the ecological model to further explore the roles of awareness and the manipulation of attention, the use of higher-order regulatory values, and analogic relations or signs in interventions, and review evidence for the validity of the model.

Propositions concerning the re-establishment of general functioning (healing) by transformation:

1) a sequence of adaptive responses can be seen as a narrative, which takes its unique meaning only from the perspective of the organism. This narrative, like the organism itself, has a hierarchical structure including core problems and core regulatory and adaptive values, and felt needs deriving in part from these values.

The story of the organism defines its problem space against all other possible problems and selves. This narrative may or may not be congruent with needs to maintain ongoing adaptive functioning. An autopoietic model of functioning can achieve the task of parsimony and coherence by placing the narrative organizational processes of meaning and purpose at the centre of causation. Special purposes emerging from a narrative can be understood generally in the context of this adaptive sequence: they represent the organism's felt needs. By definition, special purposes entrain functioning around a smaller set of causal variables compared with general-purpose functioning.

2) special purpose needs entrain a hypercoherent state in the organism with enhanced sensitivity to signs related to the special purpose of that state. Signs may be neutral, agonistic, antagonistic, or analogic in relation to special purpose needs, but may have a different valency in relation to general-purpose needs.

3) In chronic pathology, secondary responses to the special purpose need may develop in compensation. Compensatory responses may be avoidant, conflictual, paradoxical and so on, in relation to the original special purpose. Compensations to these compensations may arise, and so on. Pathogenesis can be seen as an array of entrained relations between semiotic agents in a field.

For this reason, healing can be obstructed when signs agonistic to general-purpose functioning are antagonistic relative to other agents and their entrained relations.

4) Reconfigurative processes depend on reflective engagement with a problem space as a whole.

By bringing sensory as well as cognitive awareness to the needs of the whole, both the therapist and the patient can perceive which compensatory values and needs are obstructive to the needs of the whole, and what potential signs and values enabling change may be

present. Unlike compensation, avoidance or transcendence, healing involves transformations of the problem space.

5) Reconfiguration occurs across the organism as a whole, but is organized hierarchically.

This is not only because different hierarchical levels operate at different rates, but also because pathology involves a focal level related to the special purpose, and secondary responses emerge in relation to the focal level. Reconfigurative changes are likely then to manifest first at this level, spreading outwards to subserving and constraining levels. Treating the secondary responses is likely to result in eventual relapse as the original special purpose is not addressed.

Together, these and the propositions from Chapter 5 form the basis of a model for health and illness based on autopoietic processes. I have termed this model an ecological model, rather than an autopoietic model, to represent a core characteristic of living systems whether considered as vast ecosystems of many species or as single individuals. The prefix *eco* derives from the Greek *oiko*, meaning household. The logic of the *oiko* entails that each household member, while seemingly a separate “part” also takes its identity from membership of the whole. The contemporary usage of *ecological* is also referenced, with its emphasis on spatio-temporal relationships of household members rather than defining boundaries between organism and environment. Rather, the problem space of the organism, or the more inclusive living system as the case may be, is the “household”. The problem space of healing and disease includes the whole organism, it cannot be reduced to diseased parts or to symptoms. It includes the life-world of the organism, not just the external environment, but the anticipated and interpreted life-world created by the organism. Characteristically, healing involves transformations: the expansion of a problem space from a narrow focus (and narrow sensitivity/responsiveness) to a broader space of increased possible causal variables and potential change. This conception of adaptability is comparable to autopoietic theories of species evolution.

CHAPTER 8

Evaluation of the Model: Comparison with Mind-Body Therapies

Thus far, I have attempted to show that the very qualities of life that are most critical to understanding pathogenesis and salutogenesis are those that the classic biomedical model, and even BPS models, fail to appreciate. These qualities include the creative and interpretive processes of living systems, and the unique expression of these according to an individual organism in its lifeworld: experiencing its own needs and its own problem space. While biopsychosocial models have attempted to address this, they have struggled to cope with complexity due to a failure to comprehend the self-simplifying qualities of living systems as they define and navigate their own problem spaces.

I have argued that assessment and diagnosis of disease can be more comprehensively and parsimoniously captured by the concepts of adaptive sequences and attractors. Attractors represent the organising “co-operative” patterns that emerge in relation to constraints, including boundary conditions and interpretations of salient perturbations. The concept of adaptive sequences organised around perceived needs (or problems) can capture these relations, and their variations and habits, over time.

Taken together, these processes are the *stories* of the organism, and the particular problems, values and needs around which stories are woven can be conceived as core *metaphors* from the point of view of the organism. This narrative view places symptoms in a wider context of meaning and experience.

Alternative or holistic therapies

The complex processes viewpoint assumes that all living systems have features, such as irreducible wholeness, in common. Every medical or healing engagement with these systems involves an interface, approach and interpretation of these features, even when a more mechanical view of their nature is assumed. This thesis has attempted to explicate what irreducible wholeness means in the medical or healing domain: not the many-related-parts version of wholes of BPS models, but the interwoven complex wholeness constrained by the self-organised simplification that emerges as organisms respond only to the differences that make a difference to them, and create their lifeworlds, problem-spaces and solutions accordingly. Having articulated an ecological model for health, it is now possible to compare it to existing holistic models. There are three aims for this comparison: testing the validity of the ecological model by comparison to already established models, examining evidence for the action of biosemiotic causation in healing, and providing a common paradigmatic understanding and language for seemingly disparate holistic therapies.

Conceptually there are major differences between reductionist biomedicine, and holistic approaches. But there are conceptual differences between holistic therapies too. The alternative terms that are often employed for self-organising processes refer to “energies” metaphysically akin to *elan vital*, conceived as a life energy or substance¹. In the main, the concept of energy in alternative medicine has either been treated as though it has properties of a material substance with powers of efficient causation that can be stored, depleted, blocked, and topped up, or a mystical force that somehow both transcends and transforms matter. Sometimes it is treated as both. This is not unlike the tendency in biomedicine to reduce mind to material substance or fall back on a Cartesian duality of mind and matter.

¹ Compare with Bergson’s definition of *elan vital* as a principle or force: see Chapter 3

Nevertheless, despite the conceptual difficulties with energy and causation, a claim to holism signals at least an attempt to overcome duality, while recognition of “energy” as an important concept in healing emphasises dynamic processes rather than mechanistic causes in living systems. These conceptual difficulties arise in part due to the lack of a widely known coherent theory of self-organisation in alternative medicine. The functional (processual) description of dynamic processes, and interventions aimed at these, are of interest for the purposes of this research.

I discuss several therapies that meet the following criteria: reliable research has been conducted with regards the effectiveness of the therapy, there is a clearly defined holistic philosophy that includes self-creative processes, and finally there is a claim to use non-control interventions to support, manipulate or otherwise restore the healing processes of the whole organism. Each is consistent with an ontology of similar causal processes in both mind and body. These include several mindfulness and body-oriented psychotherapies, and homeopathy.

Mindfulness Interventions- using attentional processes therapeutically

The previous chapter discussed mindfulness as a practice that may enhance the regulation of attention and orientation of oneself in the moment, a self-observational stance of attention that may enable choice-making and problem solving.

In the main, mindfulness therapies emphasise processes of awareness and attention and altered experiences of reality, even though terminology sometimes refers to changes in emotional or psychological *states*. For example, the meta-review conducted by Hoffman et al defines mindfulness largely in terms of process, as:

a process that leads to a mental state characterized by nonjudgmental awareness of the present moment experience, including one's sensations, thoughts, bodily states, consciousness, and the environment, while encouraging openness, curiosity, and acceptance.²

They acknowledge two “components” of mindfulness: self-regulation of attention, and orientation to the present moment.

Mindfulness interventions share the aim of teaching patients to be aware of their own thoughts and sensations as an observer rather than indwelling with them. In this way, thoughts and sensations are recognized to be transient entities in the present, rather than models of reality representing the past or future³. Crucially, a distinction is made between mindful or reflective attention, which is defined in terms of observing oneself and one's reactions or responses (including sensations and internal dialogue), and non-reflective automatic attention (attentional bias) which is implicated in the perpetuation of dysfunction. Through mindful attention, as Jon Kabat-Zinn puts it:

we glimpse our own completeness in the stillness of any moment...a new and profound encountering and coming to terms with our problems and our suffering begins to take place. We begin to see ourselves and our problems differently, namely from the

² S G Hofmann, A T Sawyer, A A Witt and D Oh 'The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review' *Journal of Consulting and Clinical Psychology* 78 (2010) pp.169–183, p.171

³ In S Salzberg and J Kabat-Zinn 'Mindfulness as Medicine' In D Goleman (ed) *Healing Emotions*. (Boston, Shambala, 1998) pp.107-144, p.108

perspective of wholeness....It is a perceptual shift away from fragmentation and isolation and toward wholeness and interconnectedness.⁴

For Kabat-Zinn, healing is the process of becoming whole, allowing us to relate differently to our experience of suffering. This transformation enables us to reduce distress by accepting painful or limiting experience rather than fearing or trying to control or avoid it. It enables us to literally open our minds and senses to experience beyond limits and pain. In *Full Catastrophe Living*, Kabat-Zinn provides several case examples of patients in his stress reduction clinic who report that not only is their psychological distress reduced by practicing mindfulness meditation, but new possibilities for overcoming limitations and enhancing life, without needing to “fix” their problems, occur to them during or shortly after their practice.

The ‘qualities’ of mindful attention practices are described as having a therapeutic value in themselves, without any instruction, analysis or attempt to change thoughts, feelings or behaviours⁵. However, it is more accurate to say that mindfulness has a therapeutic value without the need for control strategies. Rather, it entails the adoption of regulatory values of acceptance and curiosity towards experience, and arguably autonomy as well, given that the experience of mindful practice is self-guided and self-reflective.

Some approaches are combined with more clearly distinguished and directive regulatory values, including cognitively oriented interventions such as cognitive restructuring (Mindfulness-Based Cognitive Therapy, MBCT) and values-based decision-making (Acceptance and Commitment Therapy, ACT). Other approaches are specifically aimed at awareness of specific behaviours (such as addictions or eating disorders) or specific traumas.

In traditional cognitive therapy (Beck), patients are first taught the difference between “negative” or “irrational” beliefs, and “positive/rational” beliefs, and second, encouraged to reject the negative beliefs in favour of the positive ones. In Mindfulness-Based Cognitive Therapy, patients are likewise presented with “realistic” or “adaptive” beliefs as alternatives to “negative” beliefs, but rather than instructing patients to reject negative beliefs, the aim is to assist patients to realize that they have a choice regarding which beliefs they pay attention to, and to observe how paying attention to different thoughts can affect how they feel and behave⁶. The emphasis lies on the transformative nature of conscious choice-making, rather than controlling experience.

Hofmann et al⁷ conducted a meta-analysis of 39 studies using mindfulness-based therapy in treatment of symptoms of stress, anxiety and depression in patients with a wide range of disorders. The most common disorder was cancer (n=9), other physical disorders included chronic pain, chronic fatigue, fibromyalgia, arthritis, diabetes, and stroke (n=13), and psychological disorders including anxiety, depression, bipolar disorder, ADHD, social

⁴ J Kabat-Zinn *Full Catastrophe Living* p.193

⁵ R Kurtz *Body-Centered Psychotherapy: The Hakomi Method*. (Mendocino, Life Rhythm, 1990) p.56

⁶ Z V Segal, J M Williams and J D Teasdale *Mindfulness-based Cognitive Therapy for Depression – A New Approach to Preventing Relapse*. (New York, Guilford Press 2002)

⁷ A meta-analysis of 39 studies with clinical samples only, totalling 1,140 participants: in S G Hofmann et al ‘The Effect of Mindfulness-Based Therapy on Anxiety and Depression: A Meta-Analytic Review’

anxiety disorder, and panic disorder (n=17). Their results showed a moderate effect of mindfulness therapies in reducing stress, anxiety and depression.

Hofmann et al propose that the mechanism of action in mindfulness involves preventing “excessive orientation toward the past or future” and at the same time countering “experiential avoidance strategies” which “are believed to contribute to the maintenance of many if not all emotional disorders”. Consistent with this view, and suggesting that anti-depressants might act as an experiential avoidance strategy, there is evidence that mindfulness-based therapies are more effective in reducing symptoms of depression in patients who are not taking anti-depressant medication compared to those who are⁸.

Hofmann et al argue that increased mindful attention to aversive events is qualitatively different to “excessive” but automatic attention to these same events, the latter process being constrained by reactive efforts to control or avoid the events (including one’s own sensations and cognitions), reinforcing their negative appraisal and associated affect, leading to further attempts to control and avoid, and so on. The meta-review concluded that the mechanisms responsible for reduction of depression and anxiety are not specific to particular disorders, but involve processes that “underlie general aspects of wellbeing”⁹, reflecting a trend for proposing general processes in psychopathology and healing.¹⁰

Are the effects of mindfulness limited to psychological benefit via the transcendence of physical suffering? If the reconfigurative processes involved in healing are enabled by reflective attention to the automatic reactions we call symptoms or problems, then the effects on health should be greater than merely the adoption of a more positive attitude to one’s suffering, beneficial though this may be. Reduction in psychological distress has long been recognised to moderate physiological arousal. More recent research in the new field of psychoneuroimmunology shows that stress reduction moderates immune functioning and metabolic processes¹¹. According to Kabat-Zinn, many patients experience positive changes in physiological markers of stress such as blood pressure, improvements in physical health generally, including unexpected remission in cancer cases. Kabat-Zinn et al found that psoriasis sufferers practicing mindfulness during phototherapy sessions (a brief intervention

⁸ J M Bakker, R Lieverse, N Geschwind, E Peeters, F Myin-Germeys and M Wichers M. ‘The Two-Sided Face of Antidepressants: The Impact of Their Use on Real-Life Affective Change during Mindfulness-Based Cognitive Therapy, *Psychotherapy and Psychosomatics* (2016) pp180-182

⁹ S G Hofmann et al ‘The Effect of Mindfulness-Based Therapy on Anxiety and Depression: A Meta-Analytic Review’ p.179

¹⁰ Discussed in G H Eifert and J P Forsyth *Acceptance & Commitment Therapy for anxiety disorders: A practitioner’s treatment guide to using mindfulness, acceptance, and values-based behaviour change strategies.* (Oakland, CA: New Harbinger Publications 2005)

¹¹ J K Kiecolt-Glaser, J M Bennet, R R Andridge, J Peng, D Habash, C P Segundes, R Glaser, W B Malarcky and M A Belury ‘Yoga’s impact on inflammation, mood, and fatigue in breast cancer survivors: a randomised controlled trial. *Journal of Clinical Oncology* 32. 10 (2014) pp.1040-1049; J K Kiecolt-Glaser Stress, food and inflammation: psychoneuroimmunology at the cutting edge. *Psychosomatic Medicine*, 72, (2010) pp.365-369; and J K Kiecolt-Glaser, R McGuire, T Robles, and R Glaser, Psychoneuroimmunology: psychological influences on immune function and health. *Journal of Consulting and Clinical Psychology*. 70, (2002) 537-547

of only a few minutes!) experienced improved skin condition four times faster compared with a control group¹².

An ecological perspective on mindfulness

Mindfulness practices appear to interrupt degraded biosemiosis, bringing awareness to blind reactions: repetitive sensations and behaviours, fixed cognitions and emotions, and the “pull” of past experience. At the same time, mindfulness promotes the experience of presence, variation in sensation and behaviours, and values for awareness of the whole of experience, with curiosity and acceptance. These can be considered higher-order regulatory values with a broader scope of constraint compared to control values. It is possible to accept anything, it is not possible to control everything. They offer an observation or interpretation of the self in the world from a different stance (or multiple possible stances): the stepping out of automatic processing that is necessary to allow the reappraisal of available signs. Mindfulness and its regulatory values helps enable the re-establishment of chaotic, fractal oscillations in the mind-field.

Mindfulness practices support awareness of the self in the world, not any self but one’s own self. The process of change creates its own model and evaluates itself, there is no need for an a priori diagnosis or any other assumption about what should happen with treatment. Mindfulness is profoundly holistic: while Buddhist tradition distinguishes categories of experience, they refer to one’s relationships with oneself and the world and do not assume fundamental ontological distinctions such as that between mind and body.

In sum, mindfulness practices and research support the argument that the redirection of attention into the moment can be achieved by employing practices and values for being present with, and curious and accepting of the whole of experience, and that these attentional processes have a salutogenic effect on the whole person, perhaps by helping re-establish normal edge of chaos functioning, at least at the level of consciousness and psychological functioning.

Acceptance and Commitment Therapy

Acceptance and Commitment Therapy (ACT) draws from functional contextualism, described as a pragmatic philosophy that argues behaviour can only be understood according to 1) the environmental, social and psychological context, and 2) the function for which the behaviour has been ‘selected’ for by reinforcing contingencies¹³. Selection by consequences is assumed to be the causal process of species evolution, and social and behavioural evolution¹⁴. The history of this selective process underlies and maintains the biological, social and psychological context within which consequences occur and are evaluated. According to this view, cognitions and emotions are behaviours that (historically) comprise the context of

¹² J Kabat-Zinn, E Wheeler, T Light, A Skillings, M J Scharf, T G Cropley, D Hosmer and J D Bernhard ‘Influence of a mindfulness meditation-based stress reduction intervention on rates of skin clearing in patients with moderate to severe psoriasis undergoing phototherapy (UVB) and photochemotherapy (PUVA)’ *Psychosomatic Medicine* 60 (1998) pp.625-32

¹³ J T Blackledge ‘An introduction to relational frame theory: basics and applications’ *The Behaviour Analyst Today* 3, 4 (2003) pp.421-433

¹⁴ Drawing on B F Skinner’s behaviorialism; in W M Baum *Understanding Behaviorism: Science, Behavior and Culture* (HarperCollins College Publishers 1994) p.64

‘mind’, within which relations between ongoing cognitions and contingencies continually recreate the context of mind. In short, behaviour can reinforce itself by creating its own reinforcing context.

For functional contextualists, no cognition or emotion is inherently pathogenic or salutogenic. It is the manipulation of contingencies (manipulable variables) that is of interest in changing or influencing behaviour, according to a functional truth criterion. However, there is no ontological distinction between psychological event and contextual variable, as psychological events and contingencies become part of an historical context. Indeed, functional contextualism rejects ontology altogether¹⁵.

Developed from functional contextualism and originally conceived as a theory of language and cognition, Relational Frame Theory (RFT) is a psychological theory that focuses on the relational networks (frames) between behaviours¹⁶. According to RFT, the meaning of any experience is both changed by, and changes, any other related experience. Termed “derived relational responding”, this process describes behavioural regulation as not merely learned by direct contingencies, or even by stimulus equivalence, as earlier forms of behaviourism conceived it, but as derived relations and transformations of these relations¹⁷. As Blackledge puts it:

In fact, the act of relational framing is thought of as a process, an ongoing way of responding to stimuli as they are presented. People *frame events relationally* in the moment as an active process that is a function of their extensive learning history and stimulation in the present environment. “Storage” of these frames as structures is not implied and not required¹⁸

Relational responding is divided into two categories: mutual entailment, which refers to a simple one to one derived reciprocal relation between two stimuli, and combinatorial entailment, which builds upon mutual entailment with other interrelated stimuli comprising an interrelated network of relations. The example given by Blackledge¹⁹ describes a mutual entailment between “snakes” and “woods”, such that one stimulus cues the other, while combinatorial entailment might include “danger”, “fear”, “accelerated heartbeat” and “running away”. Blackledge observes the hierarchical structure of relations, and emphasises that causal relations depend on the context of the subject. In the context of the combinatorial entailment described above, “accelerated heartbeat” might be perceived as a cause of “running away”, while once out of the woods and in a new context, the relational frame adjusts to conceive “accelerated heartbeat” as the effect of “running away”. This adjustment is termed ‘transformation of stimulus functions’ in RFT²⁰.

This approach explicitly rejects the cognitivist notion that content (including cognitions and any other behaviours) can be considered meaningful in isolation from

¹⁵ S C Hayes ‘Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies’ Behavior Therapy 35, 4, (2004) p.647

¹⁶ J T Blackledge ‘An introduction to relational frame theory: basics and applications’ pp.422-423

¹⁷ Ibid p.425

¹⁸ Ibid p.429

¹⁹ Ibid p.426

²⁰ Ibid p.427

“historically and situationally defined contexts”, and retains the functional truth criterion of behaviour that is the basis of functional contextualism²¹. However, because learned associations can create and reinforce their own contexts, supported by multiple derived relations, they tend to become both automatic and robust to situational changes.

The functional outcome of this is that behaviour (including cognition) is regulated primarily by prior learning, that we are often not aware of these learnt “frames” that give meaning to our experience, and that they continue to dominate behavioural regulation despite evidence that contradicts their usefulness²². Frames are reinforced by the “socio-verbal community”²³, for example the framing of persistent feelings of sadness as pathological depression reinforced by the biomedical community, or more colloquially as personal weakness. This formulation of created yet automatic behavioural regulation is consistent with the notion of pathology as fixed automatic responses that perpetuate themselves and define our experience of reality, despite changing needs or conditions.

Developed from RFT, Acceptance and Commitment Therapy (ACT) comprises a set of interventions designed to increase cognitive flexibility by changing behaviours, rather than targeting symptoms²⁴, primarily by altering the context, and therefore the meaning, of psychological events. In particular, ACT targets “cognitive fusion”: the term given to the domination of verbal rules and evaluations over “here-and-now experience and direct contingencies”²⁵ and experiential avoidance, the mechanism that is argued to maintain cognitive fusion. Specifically, interventions include mindfulness practices to defuse cognitive rules and experience, and to consciously identify and choose values as truth criteria to guide decisions and evaluate outcomes. ACT conceives mind, or self, as context, and consciously identified and chosen values as manipulable (independent) variables, positioning verbal rules and other psychological events as depending on mind-as-context for their meaning and causal power. In a state of cognitive fusion, thoughts can have strong causal power, even when attempting to refute or avoid them. For ACT therapists:

What the client is feeling, thinking, remembering, or otherwise experiencing is never assumed to be the core difficulty, even though human beings will initially focus on difficult content as the core of their problems. For instance, “anxiety” is not assumed to be the problem in “anxiety disorders”; “mood” is not assumed to be the problem in “mood disorders”; “thought” is not assumed to be the problem in “thought disorders,”

²¹ S C Hayes ‘Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies’ p.646

²² Ibid p.651

²³ Ibid p.431

²⁴ K E J Hann and L M McCracken ‘A systematic review of randomized controlled trials of Acceptance and Commitment Therapy for adults with chronic pain: Outcome domains, design quality, and efficacy’ *Journal of Contextual Behavioural Science*, 3, (2014) pp.217-227

²⁵ S C Hayes ‘Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies’ p.650

and so on. In ACT, it is the tendency to take these experiences literally and then to fight against them that is viewed as harmful.²⁶

In mindful defusion, thoughts are accepted as just thoughts, and may be evaluated for their usefulness according to conscious values. In this way, acceptance rather than control is developed as mind/context, while personally identified values are adopted as guides for decision making. Importantly, values are not assumed or prescribed by the therapist, but are derived from what is of importance to the client in their life. Values are often elicited by exploring with the client how they want to be, rather than want they think they must or should be, for example by asking clients to consider “what you want your life to stand for”²⁷. Hayes proposes that this constitutes a dialectic of acceptance and change that encourages transformation, rather than the conflictual relations with self, and with self and world, that is established by attempts to control or avoid experience²⁸.

A review of research indicates the applicability of ACT interventions is broad, including anxiety, depression, psychosis, eating disorders, chronic pain, addictions, and work-related stress, and its effectiveness is at least equivalent, if not superior, to currently accepted disorder-specific therapies including cognitive-behavioural therapy²⁹. Meta-analyses of published randomised controlled trials indicate promising results in reducing emotional distress, improving symptom control and enhancing quality of life in chronic disease including HIV, cancer and epilepsy³⁰ and reducing pain and “enhancing physical functioning” in chronic disease³¹ (10 RCT’s, Hann & McCracken, 2014, p-217).

Comparison of ACT with the ecological model

RFT is a theory of language and cognition, and its derivative therapy ACT assumes that language (verbal rules and evaluations) is largely responsible for pathologising psychological events by providing a context of cognitive fusion. Hayes claims that psychopathology is limited to humans because animals lack language³². This position would appear to contradict the notion that psychological and physiological phenomena in disease and healing operate according to the same processes. However, Hayes’ position could be seen as a socio-verbal frame in itself. Language itself rests on broader experiential processes, according to its parent philosophy, functional contextualism, which describes learning as a process of contextualised experience, not limited to the attainment and functioning of verbal rules and valuations. The pragmatic stance claimed by functional contextualists conceives these language functions as

²⁶ Ibid p.651

²⁷ Ibid p.656

²⁸ Ibid p.657

²⁹ Reviewed in S C Hayes, V M Follette and M M Linehan *Mindfulness and acceptance: Expanding the cognitive behavioral tradition*. (New York: The Guilford Press, 2004)

³⁰ 18 RCTs reviewed in C D Graham, J Gouick, C Crahe and D Gillanders ‘A systematic review of the use of Acceptance and Commitment Therapy (ACT) in chronic disease and long-term conditions’ *Clinical Psychology Review*. 46, (2016) pp.46-58

³¹ 10 RCTs reviewed in K E J Hann and L M McCracken ‘A systematic review of randomized controlled trials of Acceptance and Commitment Therapy for adults with chronic pain: Outcome domains, design quality, and efficacy’

³² S C Hayes ‘Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies’ p.650

both ongoing psychological events and historical context by which these events are understood, dissolving ontological dualism between language-as-content and language-as-context, but not negating ontology itself if a relational ontology is fully embraced. RFT almost manages to be a fully developed theory of relational causation with regards psychological phenomena at least, perhaps needing only to admit an ontology of relations including but not limited to language, rather than rejecting ontology.

The description of pathology in RFT is otherwise consistent with that presented here: a self-reinforcing, automatic and learned response to a context, that has become dominant and generalised across contexts, resistant to contradictory evidence. The proposed self-creating process in RFT is derived relational responding, a hierarchical process that is not merely stimulated by a given context, but that creates its own contexts. Reconfiguration of relations occurs in a process of defusion, described as a change in mind-context that engages attention in the here-and-now, facilitating the possibility of choice and the transformation of meaning of experience. There is an emphasis on holism with regards meaning deriving from context, rather than contents.

In comparison to mindfulness, ACT expands the notion of functional values in behavioural regulation and claims to do so in a non-prescriptive (or non-controlling) manner. Interventions for exploring and accessing values involve engaging the client's own perception of her needs, comprising a repertoire of values from which the client may choose. While values are conceived as cognitive phenomena, in the sense that they are verbally defined and labelled, they are considered functionally as behavioural regulators. This broader conception of the function of "cognitive" values has implications for enhancing behavioural possibilities in moments of choice and therefore transformation. Socio-verbal community notwithstanding, there is a recognition that individuals can construct their own idiosyncratic meanings according to these general processes, such that any "psychopathology" and also healing can be understood as a personal process of framing according to meaningful values.

Hakomi

Mindfulness has been combined with non-cognitive interventions in an holistic model of mind/body interactions: the Hakomi method³³. Hakomi, a Hopi Indian word meaning "How do you stand in relation to these many realms"³⁴ is described as a somatically and experientially oriented psychotherapy, having its conceptual roots in Buddhism and Taoism, as well as systems theory, especially that espoused by Gregory Bateson³⁵. Kurtz explicitly links the ontological assumptions of Hakomi with an autopoietic paradigm in his discussion of the organization of experience "People are self-organising systems, organised psychologically around core memories, beliefs and images"³⁶. The organisation of experience

³³ R Kurtz *Body-Centered Psychotherapy: The Hakomi Method*. (Mendocino, Life Rhythm, 1990) p.14

³⁴ Ibid

³⁵ G J Johanson 'Psychotherapy, Science & Spirit: Nonlinear Systems, Hakomi Therapy, and the Tao' *The Journal of Spirituality in Mental Health* 11, 3, (2009) pp. 172-212, p.177

³⁶ R Kurtz *Body-Centered Psychotherapy: The Hakomi Method* p.2

provides pre-cognitive, embodied knowledge comprising 'reference points' for knowing ourselves and relations with the world:

perceptions of the world such as "life is a fight and you have to be ready to win at all times" or "life is a wonder to be enjoyed" mobilize the body in different ways that are congruent with these differing beliefs.³⁷

For Hakomi practitioners, the activity of historical "core material" is of therapeutic interest. This historical material, while not usually present in conscious awareness, nevertheless continues to express itself through all behaviours: habits and attitudes, feelings actions and perceptions³⁸. Core material is commonly organised around major themes including safety, and protection from loss and pain, that were "initially born in the service of meaningfully addressing the situational needs of a particular context"³⁹.

Historical needs can continue to control present experience: "past events establish our patterns and still control what it is possible for us to experience to this day"⁴⁰. These strategies, developed in response to past events, are not considered "wrong" in themselves, but are "over-developed and dominant, leaving other strengths or directions undeveloped"⁴¹. Johanson states they exclude effective adaptive strategies "when we have constructed our core beliefs in such a way that they unconsciously and habitually organize out needed possibilities (support, intimacy, authenticity, inclusion, etc) even when they are realistically available"⁴². Clients experience their "patterns" as dysfunctional because they conflict with other needs, causing discomfort and turmoil⁴³, yet "clients seem to defend against the very thing they long for, such as safety, help, good news..."⁴⁴

Several reasons are offered for this self-organised pathology, including the automaticity of habit, resistance to forced change, lack of resources to support change, and fear of change. Core material is considered habitual and self-perpetuating, and effectively blind to conscious awareness: "Defence systems are habits that manage the flow of

³⁷ G J Johanson 'Non-linear Science, Mindfulness and the Body in Humanistic Psychotherapy' *The Humanistic Psychologist* 37 (2009) pp.159-177, p.171

³⁸ A Fischer 'The role of core organising beliefs in Hakomi' In H Weiss, G Johanson and L Monda (eds) *Hakomi: Mindfulness-Centered Somatic Psychotherapy: A comprehensive Guide to Theory and Practice* (Norton, New York 2015) pp.66-75

³⁹ Ibid p.69

⁴⁰ R Kurtz *Body-Centered Psychotherapy: The Hakomi Method* p.11

⁴¹ Ibid p.40

⁴² 'Organise out' meaning excluding. G Johanson 'Hakomi principles and a systems approach to psychotherapy' In H Weiss, G Johanson and L Monda (eds) *Hakomi: Mindfulness-Centered Somatic Psychotherapy: A comprehensive Guide to Theory and Practice* pp.41-57, p.43

⁴³ A Fischer 'The role of core organising beliefs in Hakomi' p.69

⁴⁴ J Hull 'Exploring the barriers: a Hakomi perspective on resistance and defence' In H Weiss, G Johanson and L Monda (eds) *Hakomi: Mindfulness-Centered Somatic Psychotherapy: A comprehensive Guide to Theory and Practice* 2015, pp.194-202, p.195

experience”⁴⁵. These habits that organise experience and behaviour are defended strongly against forceful attempts at change, whether originating with the experiencing subject or with the therapist (or other “external” forces). Practitioners also consider that the client’s resources are expended in maintaining the organisation of core material, and this expenditure is an obstacle to diverting resources towards desired change. Finally, when past attempts to meet needs have failed, anticipation of failure creates fearfulness around change.

Hakomi therefore conceives pathology in terms of habits controlling behaviour, to the extent of undermining our ability to respond to, and even perceive, changing needs and conditions. In this way, dominant habits compromise connectedness or wholeness. Wholeness, for Johanson, refers to communicative processes:

self-organisation depends upon communication between parts... we are actually entering into a complex **inner ecology** with parts that function like subpersonalities that might be polarized or cooperative with each other as are external family members... Trouble, therefore, for living organic systems often flows from a lack of communication⁴⁶.

Kurtz emphasises the conflict occurring between the stability of the organisation of core material, and change: which he defines as “the experience that wants to happen”⁴⁷. Kurtz also describes an innate “drive to unite through communication, the attention each part gives to each other, that transforms fractured parts into wholes” and that “communication between parts results spontaneously in the most effortless functioning”⁴⁸.

Hakomi practitioners do not attempt to correct habits or communication processes. They consider attempts to pathologise and control beliefs and behaviour as not only inefficient and potentially counterproductive, but as violent. “Non-violence means not forcing change”⁴⁹. Mindfulness interventions are designed to bring to awareness the historically bound and meaningful organization of experience, including cognitions, felt sensations, and even gestures and movements. It is considered necessary to bring “unconscious” material to awareness to enable change. The most important effects of mindfulness identified in Hakomi are that of increasing both awareness and sensitivity to one’s experience, thereby aiding the emergence of latent material to consciousness, which in turn provides further material to explore⁵⁰. Any behaviour or sensation is considered an “access route” to core material. Paraphrasing Freud, and emphasising the importance of somatic sensation and behaviour in Hakomi, Johanson suggests “The body is the royal road to the unconscious”⁵¹.

Interventions in Hakomi are described as “ways of managing experience” rather than attempting to control or change experiences. As Kurtz puts it: “we support these in an effort

⁴⁵ R Kurtz *Body-Centered Psychotherapy: The Hakomi Method* p.61

⁴⁶ G J Johanson ‘Hakomi principles and a systems approach to psychotherapy’ pp.45-6

⁴⁷ R Kurtz *Body-Centered Psychotherapy: The Hakomi Method* p.47

⁴⁸ *Ibid* p.33

⁴⁹ *Ibid* p.6

⁵⁰ A Fischer ‘The role of core organising beliefs in Hakomi’ p.66

⁵¹ G J Johanson ‘Non-linear Science, Mindfulness and the Body in Humanistic Psychotherapy’ p.172

to give the client a safe way to explore these experiences more deeply and completely”⁵². Hakomi includes interventions that can be described as directive. These include “evoking latent sensations related to past events and exploring the meanings attached to them”⁵³. Evoking involves the therapist introducing an external influence (a “probe”) in the form of a word, image, touch or sound, or even directing a movement of the client’s body. Probes are intended to reflect a key theme associated with a specific felt emotion or behaviour. Emergent material then becomes the object of further mindful observation.

Another, somewhat more cognitively oriented intervention, is verbally naming the objects of observation. Again, this is done collaboratively with reference to the client’s sense of meaning of the experience (the client’s “truth”). Naming is considered to help more clearly distinguish objects of awareness from the observing subject. This act of distinguishing object of awareness from observing subject is termed defusion in ACT, and is compared by Johanson to desubjectification processes in the mindfulness-based cognitive therapy of Segal⁵⁴.

Hakomi therapists recognise two further “state-specific” kinds of processing in therapy: emotional and childlike. These are considered the emergence of core material characterised by more automatic behaviours, organised by historical rather than present-oriented meaning. Childlike processing is managed (fairly conventionally, according to psychotherapeutic traditions) by addressing “the needs of the child”. Of greater interest, an intervention unique to Hakomi, called “taking over” may be employed during emotional processing. Taking over involves the therapist observing the attempts of a client to control or change their own behaviour, then substituting their own efforts for those of the client’s⁵⁵. Kurtz describes developing this intervention after observing a client’s efforts to contain or avoid a frightening experience by adopting a physically tense posture. He experimented with physically supporting the behaviour and observed that apparently underlying unwanted experience then emerged spontaneously. He recounts this event:

A woman in a therapy process was getting very close to some extremely painful memory. She was lying on her back and as she came closer and closer to remembering this thing, she arched up off the floor, supporting herself on her heels and the back of her head. I felt so bad watching her that I decided to help her. I put my hand underneath her back and offered to take the weight of her body. When she relaxed and let me do that, the experience that she was keeping outside her consciousness immediately flooded her whole being. It came up as soon as she relaxed. Instead of feeling fear and anxiety, which she had just been experiencing—feelings that were being managed by the involuntary arching of her back—she now experienced only an overwhelming sadness. This sudden transition was a great surprise

⁵² R Kurtz *Body-Centered Psychotherapy: The Hakomi Method* p.47

⁵³ *Ibid* p.9

⁵⁴ G J Johanson ‘A survey of the use of mindfulness in psychotherapy’ *The Annals of the American Psychotherapy Association*, 9(2), (2006) pp.15-24, p.21

⁵⁵ S Lavi ‘Experiments in Mindfulness’ In In H Weiss, G Johanson and L Monda (eds) *Hakomi: Mindfulness-Centered Somatic Psychotherapy: A comprehensive Guide to Theory and Practice* pp.178-193

to me (and I think to her). It surprised me how easily the feared experience could be brought into consciousness, just by helping a person manage her avoidance of that experience”⁵⁶.

Kurtz hypothesised that when the therapist takes over, the “organising core...is no longer needed, and habits attached to that core no longer need to be organised by it”⁵⁷. He suggests that when the therapist takes over the dominant defending “part”, the client’s resources are freed to experience what had been avoided, and this “promotes movement into consciousness of material that has long been unconscious”⁵⁸. Because parts tend to have conflicting or compensatory relationships to each other, a meaningful link can be made between specific defences and defended material. The narcissist defends against awareness of his limitations, and when the defence is taken over by the therapist, this awareness can move to consciousness, making acceptance and integration of this awareness possible: “the experience that wants to happen”. It is worth noting that Kurtz considers taking over to be the essence of non-violence in therapy⁵⁹.

Hakomi practitioners believe that healing is a reorganizing process facilitated by the therapist but understood to be a “power in each of us” described as a “moving on” in contrast to a correction or catharsis⁶⁰. Kurtz describes a “drive” to unite the parts of the self through “communication”, although bearing in mind that the main intervention in Hakomi is mindfulness, communication here should be understood as a process of increased awareness of the whole of one’s experience. Johanson also emphasises sensation and meaning in the re-organisation of fragmented parts into wholes: “When the communication and information exchange is happening, the system is self-organizing, self-directing, self-correcting, and characterized by complex, non-linear determinism, which means it has a mind of its own based on its own internal wisdom”⁶¹.

In application, it is believed that bringing core material to one’s conscious awareness enables one to integrate conflicted material and make new choices, thus transforming experience and behaviour “non-violently”. The emergence of a transformed totality occurs via the integration of conflicted material, but is not limited to an increased awareness of, or rearrangement of material. Healing appears to be understood to involve the emergence of novel organization, a “moving on” from past rigid patterns to new modes of adapting. These emergent ways of being cannot be predicted or controlled by the therapist⁶². Johanson defines core organization as a highly ordered, dominant attractor state, vulnerable to chaotic perturbations. He hypothesizes that the causal power of Hakomi interventions lies in increasing awareness of uncomfortable and ambivalent sensations associated with conflicted needs, and this experience amplifies “internal and/or external perturbations (that) sufficiently shake the system’s ability to satisfyingly operate out of old order parameters,” bringing the

⁵⁶ R Kurtz ‘Taking over’ <https://vancouverhakomi.ca/writings/writings-for-students/taking-over/> retrieved 4/6/2016

⁵⁷ R Kurtz *Body-Centered Psychotherapy: The Hakomi Method* p.105

⁵⁸ Ibid p.104

⁵⁹ Ibid p.110

⁶⁰ Ibid p.6

⁶¹ G J Johanson ‘Hakomi principles and a systems approach to psychotherapy’ p.45

⁶² Ibid p.44

system “to a critical or bifurcation point where transformation to new attractor states becomes possible”⁶³. Of course, these perturbations are neither trivial nor arbitrary, but meaningful. They tend to nudge the system as a whole towards the “freedom of possibility”⁶⁴ for new ways of meeting needs without conflict: “transformation occurs when clients, in this non-violent setting, are enabled to organise into their experience some aspect of life they had previously organised out”⁶⁵.

Hakomi interventions assume that mind and body share the same self-organising processes. Johanson agrees with other mindfulness researchers that attentional processes are key to working with wholes, connecting every level of experience: “Present experience is always the focus of mindful therapy because it is what is currently organized by the order parameters or core narrative beliefs, and immediately manifest in sensations, feelings, thoughts, memories, attitudes, relational ways of being, dreams, posture, breathing, movements, and so forth”⁶⁶. Meaningfulness is another key to understanding the whole. Experience, being organised meaningfully, is always meaningful: “a sensation is the translation of a physical change, such as pressure, heat or cold, into a neural impulse. That impulse is immediately interpreted, perhaps as comforting or hostile, by the person receiving it. A person is a bodymind system, with mind (information) and body (energy and matter) so intertwined that they can only be thought of as one”⁶⁷. Despite this somewhat mechanistic conception of information, Johanson’s point is clear enough: body and mind operate according to the same self-organising principles involving awareness and meaningfulness.

Johanson notes that Hakomi practitioners are trained to formulate their cases according to a bio-psycho-social model with a multidisciplinary approach, with experts addressing each part of the patient according to their specific expertise⁶⁸. Apart from stress reduction, Hakomi interventions are not considered capable of directly enabling physical healing. Briefly discussing the notion of downward causation, Kurtz states “the lower sensory levels are not considered to be “the problem” in therapy, it is the higher-levels of organisation that can create unnecessary limitations”⁶⁹. Similarly, Johanson claims that “the body is a reflection of mental/emotional life”⁷⁰. Moreover, self-reflective attention is considered a feature of human beings alone of all species⁷¹. Self-organising processes in pathology and

⁶³ Ibid p.55

⁶⁴ Ibid

⁶⁵ Ibid p.52

⁶⁶ Ibid p.48

⁶⁷ Ibid p.48

⁶⁸ Ibid p.43

⁶⁹ R Kurtz *Body-Centered Psychotherapy: the Hakomi Method* p.19

⁷⁰ G J Johanson ‘Hakomi principles and a systems approach to psychotherapy’ p.46

⁷¹ Ibid p.48

healing are not limited to the psychopathology of humans, but for Hakomi practitioners, “non-violent” re-integrative interventions are.

Comparison of Hakomi with the model

Hakomi represents a holistic approach in the sense of grasping the totality of the organism in its lifeworld, with the same self-organising processes and patterns constraining the experience and behaviour of the whole. Meaning is identified as a core causation, manifest at every level of the hierarchy, conceived as both historical and creative. Hakomi does not pathologise symptoms themselves, but recognises these as manifestations of past adaptive strategies. Pathology is defined in terms of automatically self-perpetuating, and largely unconscious dominant states, with controlling, conflicting or compensating relationships with other “parts” or needs, leading to fragmentation. Hakomi involves following natural healing processes of opening up to awareness the rigid patterns of behaviour associated with past needs, identifying their redundancy, allowing present needs to emerge with greater clarity. All this is consistent with a biosemiotic view of symptoms as responses to perceived needs, and the reinterpretation of needs as fundamental to change.

Attention is identified as causal with respect to healing, and can be manipulated with mindfulness interventions that disrupt entrainment. More active interventions, including evoking and taking over, can be considered as gentle prompts towards awareness and wholeness, allowing the self to ‘reinterpret’: re-integrate and transform itself.

Despite a comprehensive description as a holistic therapy with an emphasis on somatic experience, Hakomi makes no claim to directly affect physical health. Nevertheless, Hakomi offers a unique intervention based on somatic and sensory experience: taking over, being a kind of behavioural analogic relation. The causal power of this intervention is in line with a biosemiotic view that interpretive processes occur at every level of the organism. In this case, the intervention is applied at the relational/behavioural level, involving a kind of mindful enacting of emotively charged, automatic behaviours organised by core material. It also supports the argument that, fragmentation notwithstanding, organisation is constrained at every level by a common value, in turn an interpretant of the perceived needs of the organism in its lifeworld. The intervention is chosen by observing the behaviour of the whole organism (in the moment) which is assumed to be a manifestation of core material that historically was an adaptive interpretation of past needs. The regulatory values in operation are therefore identified as past needs. Furthermore, the intervention is neither antagonistic nor agonistic relative to these needs. Rather, it is analogic: it reflects or mimics the efforts of the patient. This “non-violent” intervention supports the proposition that organisms are particularly sensitive, and responsive, to analogic signs, without limiting these to symbolic signs.

Returning to Johanson’s hypothesis, perhaps analogic signs prompt an increase in sensory perturbations, pushing the system as a whole to transformative bifurcations and new attractor states. This hypothesis is strengthened by considering Kurtz’s position, that taking over “frees” the system to manifest defended material, and this would presumably add to sensory/experiential “perturbations”. Bear in mind also that these interventions occur in a safe therapeutic relationship, wherein values for awareness and acceptance, curiosity and choice-making are explicitly and implicitly conveyed to clients. These values support a context wherein dialectical integration of conflicted needs and values can occur, and choices can be made considering the diversity of sensed needs and values belonging to the whole person.

In my view, the response to the analogic prompt of taking over allows a reprieve from the effort of self-sustaining the dominant defensive organisation (and therefore dominant

perception and experience), allowing fluctuations in the problem space (wherever the focal level may be) that represent suppressed needs, and moreover an experience of the self as a whole in the present moment. The deeply defended 'core material' that emerges can then be related to the whole self in the present, allowing this past need to be resolved or habitual strategies to be changed. The gentleness of this intervention is essential for self-reflective awareness. It is not a pushing, but a supporting. It is not claimed, nor is it likely, that a forceful form of this intervention (i.e. inducing the emergence of subconscious material and challenging its validity) would constrain similar transformative processes.

Embodied approaches to therapy: Body-focused and Narrative Therapy

Narrative practices are recognised by philosophers and psychologists as a fundamental means by which humans organise experience cognitively: making sense of events, defining themselves and their relationships, and even making memory and identity possible⁷².

Stories...establish the frames within which we become aware of self and others, within which we establish priorities, claim or disclaim duties or privileges, set the norms for appropriate and inappropriate behaviour, attribute meanings and order events in time...Each given story is, in turn, embedded in a complex network of reciprocally influencing narratives. Individuals, families and larger collectives inhabit this system of multiple stories and organise their lives around making decisions in accordance with dominant narratives⁷³.

Traditional narrative-oriented psychotherapy assumes an information-processing perspective of mind, and attributes narrative-making to a separate "mode of thought" compared with cause-and-effect cognition: "...that deals with human wants, needs and goals...rather than physical or logical causes"⁷⁴ Despite this contrast with causally oriented thinking, narrative is acknowledged to have its own causal power: "Good stories seem to *give birth* to many different meanings, generating "children" of meaning in their own image"⁷⁵ Nevertheless, this cognitivist perspective accords the causal power of narrative practice to its cognitive content⁷⁶

The importance of narrative, originally proposed by Freud as the most appropriate means of assessing and conducting psychoanalysis, is assumed in many forms of psychotherapy. A narrative assessment elicits and examines patients' narratives for content that reinforces negative self-beliefs, relational or competency deficits, and this may simply be used to guide cognitive or other interventions toward correcting this content⁷⁷. Narrative

⁷² According to M Schechtman 'The narrative self' In S Gallagher *The Oxford Handbook of the Self* (Oxford University Press 2011) pp.394-417

⁷³ C Sluzki 'Transformations: a blueprint for change in narrative therapy' *Family Process* 31 (1992) pp.217-230, p-219

⁷⁴D McAdams *The Person* (Harcourt Orlando 2000) p.623

⁷⁵ Ibid, p.624 (emphasis original)

⁷⁶ According to S Gallagher and D Hutto 'What's the Story with Body Narratives? Philosophical Therapy for Therapeutic Practice' In H Payne, J Tania, S Koch and T Fuchs *Embodied Perspectives in Psychotherapy* (London: Routledge 2018)

⁷⁷ R Dallos *Attachment Narrative Therapy: Integrating Systemic, Narrative and Attachment Approaches*. (Open University Press 2006) esp. chapter 3

interventions more directly target impaired or distorted narratives themselves for intervention, which can be aimed at a simple cathartic effect of disclosing trauma, or more actively working toward “making sense of our lives through story” by rewriting and revising important events. Commenting on Freud’s narrative practices in therapy and their widespread influence, Steven Marcus concluded:

Human life is, ideally, a connected and coherent story, with all the details in explanatory place, and with everything accounted for in its proper causal or other sequence. Illness amounts at least in part to suffering from an incoherent story or an inadequate narrative account of oneself⁷⁸

Narrative practices, then, are acknowledged as being some kind of causal constraint on the way meaning is created, sustained or changed. Narrative therapists contend the content of narratives is implicated in impaired or disordered meanings, such as the delusions in schizophrenia⁷⁹. Traditional approaches to narrative therapy concern themselves with verbally-based interventions aimed at the cognitive reorganisation of events, according to a theoretical framework that provides ideals for coherence, sense-making, and connection to a shared social reality. Dan McAdams contends that a central theme to these approaches is the act of positing the self and others as moral characters in stories, and the treatment of agency and communion (referring to power and intimacy respectively) according to these characters⁸⁰. Others suggest themes of competency are also central to narratives⁸¹

Overall, the aim of therapy is to identify and re-author incoherent or inadequate narratives to increase a sense of personal agency or empowerment in self-representations. This is achieved by engaging in an externalising conversation. As White puts it, this helps “open options for people to redefine or revise their relationships with a problem”⁸² and in this way, develop competencies, create new responses, and find new “options for self-formation”⁸³. Whatever the goal of change, it is important that clients can step out of their narrative by conceiving their problem as separate from themselves, rather than seeing themselves as the problem. The assumption is that externalising problems, patients can loosen the metaphorical grip of their existing dominant storyline⁸⁴. In contrast to most forms of trauma therapy, which focus on selected traumatic events, narrative therapy reauthoring makes it possible to “attach significance to ...previously neglected events”, conceive of

⁷⁸ S Marcus *Representations: Essays on Literature and Society* (Columbia University Press 1975) p.67

⁷⁹ S Gallagher and J Cole ‘Dissociation in self-narrative’ *Consciousness and Cognition* 20 (2011) pp.149- 155.

⁸⁰ D McAdams *The Person* pp.654-656

⁸¹ Particularly as regards themes of social competency in psychopathology and developmental disorders: S Gallagher and D Hutto ‘What’s the Story with Body Narratives? Philosophical Therapy for Therapeutic Practice’

⁸² M White ‘Folk psychology and narrative practices’ In L E Angus and J McLeod (eds) *The Handbook of Narrative and Psychotherapy* (Sage 2004) pp.15-51, p.32

⁸³ *Ibid*, p.43

⁸⁴ It is often assumed that dominant narratives are inherited or imposed via the patient’s socio-cultural milieu, and for this reason are inauthentic

alternate storylines, and ultimately develop a fuller and more realistic narrative with more possibilities for action.

While in claiming the truth value of narratives from a post-structuralist perspective, narrative therapy posits itself to be strongly anti-reductionist⁸⁵, it nevertheless retains a representation-based view of narrative practice consistent with an information-processing model. Hutto contends that a more fully developed enactive or embodied view of narrative does not limit narrative practice to modes of thought in which representations are organised and verbally shared. Rather, the starting point for narrative processes are the embodied experiences of consciousness and behaviour that comprise basic information-making for organisms.

Hutto points out that as patients rewrite their life stories, something more than mere narrative choices change. Ways of engaging in the world, including narrative therapy sessions themselves, will also change. This more basic process can give rise to more elaborate organisation/information including narrative practices and their content. Content here refers to anything that is of importance to a story-maker or story-makers, but can only be understood as a part of a whole complex pattern of emotionally charged and meaningful behaviour that grows “naturally” into narrative form from embodied activity⁸⁶. From this perspective, fundamental narrative organisation is telic yet pre-cognitive, or at least pre-representational, and is not limited to verbal expression or the manipulation of the contents of mind. Importantly, narratives can only be understood as emerging from experience as a whole organism living in a world, as posited in Gallagher’s theory of the self-as-pattern comprised by a complex of interwoven components and processes⁸⁷.

Therapies based on an embodied or enactive view of cognition and emotion focus on narrative processes rather than content, and often involve body-focused interventions to facilitate these into awareness and enhance their possibilities for learning, adapting and creating new ways of being. These therapies also share an interest in non-linear, relational causation, and ecological and dynamic systems approaches generally⁸⁸, to acknowledge the complex causal interaction of motor processes, brain functions and sociocultural/environmental factors. The content and form of stories enacted by patients indicate the salient features of their experience and form the core of assessment.

Largely in line with an enactive view of narratives, body-focused narrative therapy assumes that basic narrative organisation is pre-verbal: it occurs behaviourally, affectively, and somatically⁸⁹. Therapist Erskine believes that the story is how the body keeps

⁸⁵ It is sometimes dubbed “post-modern therapy” according to D E Polkinghorne ‘Narrative therapy and post-modernism’ In L E Angus and J McLeod (eds) *The Handbook of Narrative and Psychotherapy* (Sage 2004) chapter 3 p.54

⁸⁶ S Gallagher and D Hutto ‘What’s the story with body narratives? Philosophical therapy for therapeutic practice’ p. 11 and D Hutto ‘Radical Enactivism and Narrative Practice: Implications for Psychopathology’ In T Fuchs, P Henningsen and H Sattel *Coherence and Disorders of the Embodied Self*. (Stuggart, Schattauer. 2010) pp.43-66

⁸⁷ S Gallagher ‘A pattern of self’ *Frontiers in Human Neuroscience* 7 (2013) pp. 1-7

⁸⁸ S C Koch and D Fishman ‘Embodied enactive dance therapy’. *American Journal of Dance Therapy*. 33 (2011) pp.57–72.

⁸⁹ C Caldwell ‘Mindfulness and bodyfulness: a new paradigm’ *The Journal of Contemplative Inquiry* 1 (2014) pp.77-96, p.89

“unconscious score of emotional and physiological memories”⁹⁰. Awareness of this information is implicit and pre-symbolic: it is known by sensations such as tensions, pains, affect and mood: “Each of these emotional and physical symptoms may be the memories – often the only memories – of despairing loss, neglect, or traumatic events.”⁹¹ Not only do body-focused narrative therapists believe these symptoms are somatically remembered and expressed in body movements, gestures and postures, they also contend that bodies somehow generate narratives, or at least much of their content, through embodied sensation, motion and emotion. This belief appears consistent with neurologist Antonio Damasio’s view of the construction and maintenance of a “proto-identity” from proprioceptive, interoceptive, and exteroceptive stimuli, and the nature of body memory. He states: “What we normally refer to as the memory of an object is the composite memory of the sensory and motor activities related to the interaction between the organism and the object during a certain period of time”⁹². Damasio suggests that emotion, or more accurately the feeling of emotion, is the essence of the “proto-self” that is established and maintained with its primordial feeling of aliveness⁹³. For body-focused therapists, awareness of self is focused around the experiences of feeling, emoting and moving, a focus Caldwell terms “bodyfulness” in response to the emphasis on mindfulness and the observation of the contents of the mind⁹⁴.

Fuchs and Koch⁹⁵ cite a large body of evidence that emotions are strongly related to bodily sensations, behaviour and movement, and can be manipulated by encouraging or inhibiting certain affect-related behaviours. From this, they conclude that events and environments offer “affective affordances”: they appear to subjects as having importance in desirable or undesirable ways that are not determined by verbally structured appraisals⁹⁶. Moreover, they argue that affect has a relational characteristic between situation and subject that a cognitive judgement cannot provide. Fear refers both to an appraised danger (a stranger follows me home), and the affective response of the subject (I’m terrified). Emotions are always intentional: they are ways of “attending to the salient features of a situation”⁹⁷. This is not intended to be a linear relation. Fuchs and Koch posit a theory of embodied affectivity wherein emotions derive from a circular interaction between the affective affordances of the environment and the “bodily resonance” of the subject, generated by autonomic nervous activity, muscular activations, and interoceptive and proprioceptive feedback processes, and expressed as sensations, movements, postures, and gestures⁹⁸. “In emotions, there is no

⁹⁰ R Erskine *Relational Patterns, Therapeutic Presence: Concepts and Practice of Integrative Therapy* (Karnak, London 2015) p.316

⁹¹ *Ibid*, p.317

⁹² A Damasio *The Self Comes to Mind: Constructing the Conscious Brain* (Random House New York 2010) p.133

⁹³ *Ibid*, p.191

⁹⁴ C Caldwell ‘Mindfulness and bodyfulness: a new paradigm’ p.78

⁹⁵ T Fuchs and S C Koch ‘Embodied affectivity: on moving and being moved’ *Frontiers in Psychology* 5 (2014) doi: 10.3389/fpsyg.2014.00508 pp.1-12

⁹⁶ *Ibid* p.2

⁹⁷ *Ibid*

⁹⁸ *Ibid*

separation between an appraisal and a bodily component for they are only realized as a synthesis or “full circle” of all mutually interacting components.”⁹⁹ They compare this synthesis with the duality of physical touch, wherein the object being touched (the distal) and the subject touching it (the proximal) are both felt, although it is the distal object that tends to be appraised as important and becomes the object of awareness.

In social interactions, people become reciprocal affective object and subject to each other as they engage in interactive bodily resonance or inter-affectivity: modifying each other’s affective affordances and bodily resonance, often with minimal or no cognitive appraisal, let alone verbal communication. Fuchs and Koch compare their perspective on inter-affectivity with Merleau-Ponty’s concept of intercorporality, in that one’s own feeling, or affective intentionality, extends into the other, while the other’s feeling seems to inhabit one’s own body¹⁰⁰. Where this relation takes the form of empathic convergence of emotion, it can be termed affect attunement, a property studied in infant-mother relations and thought to be critical for healthy emotional development¹⁰¹.

Inter-affectivity is thought to be an important component of the therapist-patient relationship, itself an intervention of nuanced attunement. It can be enhanced in enactive engagements and provide thematic clarity to body psychotherapy work. In therapy it is the “touching” or the proximal bodily resonance that is targeted for intervention, by means of modifying movement, gesture and so on toward postures thought to enable different ways of feeling. These enactive engagements may include movement associated with anxiety (hypervigilance and arousal), depression (numbness, constriction) anger (tension, aggression) or the avoidances and disturbances of embodied inter-affectivity typical of autism¹⁰².

Body-focused therapy also aims to access memory and actualise affect in cases of trauma, based on the assumption that the body retains the memory and affective reality of the past trauma, and acts emotively toward this no longer present object. Therapy brings this engagement to awareness, often employing mindful-type strategies to increase focus on

⁹⁹ Ibid p.3

¹⁰⁰ Ibid p.6

¹⁰¹ Ibid p.7, see also D N Stern *The Interpersonal World of the Infant: A View From Psychoanalysis and Developmental Psychology*. (NewYork BasicBooks 1985) esp. p-132

¹⁰² Ibid p.6

sensation and movement, employing dance and structured dramatic engagements to practice new responses and engagements¹⁰³.

The role of the therapist is not directive but co-creative, and aimed at: coordination or attunement between patient and therapist who give and take as they engage in a variety of bodily expressions, including gaze direction, positioning, utterances and intonations, gestures, facial expressions, hands-on or other physical intentional interactions, leading to a mutual enactive coupling in instances of joint attention and joint action¹⁰⁴.

The point is not merely to engage in sympathetic motions and emotions, or to bring pre-cognitive affect to full awareness, but also to provide an engagement that allows non-verbal information to contribute to the understanding and interpretation of experience, increasing the possibilities for the co-creation of new or altered narratives. In short, body-focused narrative therapies use the non-verbal affective and emotive language and dialogue of the body to access and alter patient-constructed information about the world, building new ways of engaging self with other and constructing new meaning-relations.

The assumption that bodies create and retain historical and affective information in narrative form is controversial. An enactive/ecological view of cognition and emotion considers that a fully formed narrative practice requires a reflective process that transforms structured embodied activity into a sequential story organised around some form of purpose¹⁰⁵. In doing so, a transformation occurs: narrative distance, albeit bridged by reflection, is created¹⁰⁶. In *The Self comes to Mind*, Damasio discusses this process as the transformation of a feeling proto-self to a self-referential core-self. Being able to represent itself with images or language, the core-self can be extended into imagined situations, including the future. Deficits in this process result in partial or incomplete concepts of self and others¹⁰⁷.

This process minimally entails the selection of specific events and the defining of their relation to other specific events, usually those that are the most emotionally charged for the patient. Indeed, any causal power of narrative practice pre-supposes a sensing, acting being, selecting and defining events, and responding to these, all according to felt needs or goals.

This view of the embodied basis of narrative appears supported by research showing characteristic deficits in basic sensorimotor and proprioceptive processes in subjects with autism spectrum disorder (ASD)¹⁰⁸ compromising their ability to enact desired intentions, and

¹⁰³ T Fuchs and S C Koch 'Embodied affectivity: on moving and being moved' pp.8-9

¹⁰⁴ S Gallagher and D Hutto 'What's the story with Body Narratives? Philosophical therapy for therapeutic practice' p.14

¹⁰⁵ The main argument of S Gallagher and D Hutto: 'What's the story with body narratives? Also discussed in M White 'Folk Psychology and Narrative Practices'

¹⁰⁶ D Hutto and S Gallagher 'Re-authoring Narrative Therapy: Opening the Way for Future Developments' *Philosophy, Psychiatry and Psychology*. 24:2. (2017) pp.157-167

¹⁰⁷ A Damasio *The Self Comes to Mind: Constructing the Conscious Brain* esp. chapters 8 and 9

¹⁰⁸ S Gallagher and S Varga 'Conceptual issues in autism spectrum disorders' *Current Opinions in Psychiatry*. (2015) 28(2) pp.127-32

leading to symptoms of emotional distress, social isolation, and various compensations. Narrative therapy for those with these kinds of self-other concept deficiencies involves coaching or teaching more fully formed narrative practices.

Carol Gray's teaching approach, the "social stories" intervention, uses brief descriptions (not directives) delivered in verbal, written or pictorial form, of social situations to assist patients with ASD to practice skills and strategies for managing these¹⁰⁹. Gray's social stories take into account the perspective of the patient and are tailored to her unique difficulties and needs. They are focused on what responses to expect from others and why, and how to act with this understanding in social interactions.

The efficacy of this approach is usually interpreted from a cognitivist perspective as supplementing the ASD sufferer's impaired "theory of mind": her ability to predict the actions and assumptions of others¹¹⁰. However, social stories are social skills competency based and lack theory of mind content, and it is these properties that make them effective as simple but complete "narrative scaffolds" that assist with enacting complex social rules of interactions¹¹¹.

Gallagher and Hutto propose a model for enactive forms of body-focused therapy wherein an embodied dialogue between patient and therapist is engaged and then transformed fully into narrative in four stages:

- *Introduction or contract*: taken as response to an affordance – that which presents itself as a viable action in a particular context
- *Development or competence*: as part of the relational structure of affordance, what the actor is capable of, in terms that can be defined by skill, interest and focus
- *Climax or performance*: the actual doing of the action.
- *Resolution or sanction*: the resulting situation that can be judged or evaluated, by oneself or others¹¹².

The resolution stage comprises the transformation of the interactive embodied engagement into a narrative, in the process of patient and therapist reflecting on the engagement. The resolution can become the affordance of the next cycle of creating embodied narrative.

A literature review of body-focused psychotherapy concluded that the evidence supported its effectiveness in treating personality disorder, schizophrenia and depression (N=3, group-based body-focused therapy), and generalized anxiety disorder (N=1, affect-based body psychotherapy). The review concluded that body psychotherapies were an effective alternative to talking therapy in conditions such as somatoform disorders,

¹⁰⁹ C Gray *The New Social Story Book* (Future Horizons Arlington 1994)

¹¹⁰ D Hutto 'Radical Enactivism and Narrative Practice: Implications for Psychopathology' p.22

¹¹¹ Ibid

¹¹²S Gallagher and D Hutto 'What's the Story with Body Narratives? Philosophical Therapy for Therapeutic Practice' p-13

unexplained medical conditions, trauma, anorexia and chronic schizophrenia¹¹³. Another review including 34 studies covering a wide range of anxiety, mood, body image and trauma applications concluded the effectiveness of body-focused therapy is comparable to that of verbally-based therapy¹¹⁴. Three small studies found effectiveness for body-oriented therapy in treating recovery from sexual abuse¹¹⁵.

Little empirical research exists on the effectiveness of narrative therapy delivered in traditional verbal form, possibly because these therapists object to reductionist forms of assessment and evaluation¹¹⁶. In a study into effectiveness in treating depression, improvements in mood and interpersonal relations after eight sessions of narrative therapy were comparable to effects obtained with Cognitive Behavioural Therapy, although interpersonal improvements were not maintained¹¹⁷. There is evidence that self-reflective narrative practices, especially when rich in explanatory and emotional language, are associated with psychological and physical well-being, including improved immune functioning¹¹⁸.

A review of research into the effectiveness of Gray's social story intervention cited eleven case studies showing positive results for this intervention in ASD populations, including reduction in anxiety, improved social skills such as increased communication, positive interactions and reduced aggression, improved academic performance, and improved attention span. Many of these studies used social stories as an adjunctive therapy with other sensorimotor and behavioural interventions, and various forms of story medium were employed with similar results¹¹⁹

In Scandinavian countries, a form of body psychotherapy known as Body Awareness Therapy (BAT) is commonly used alongside physiotherapy for patients with pain disorders combined with mental health needs. Developed by French psychotherapist Jacques Dropsy and Swedish physiotherapist Gertrud Roendal, BAT is based on a premise of embodied identity and embodied wellbeing through awareness of body and harmony of movement¹²⁰,

¹¹³ A Bloch-Atefi and J Smith Effectiveness of body-oriented psychotherapy: a review of the literature *Psychotherapy and Counselling Journal of Australia* (2015) pp.1-20, p.11

¹¹⁴ J May 'The outcome of body psychotherapy' *The USA Body Psychotherapy Journal* 4 (2005) pp.59-70

¹¹⁵ C Price 'Body-oriented therapy in recovery from child sexual abuse: an efficacy study' *Alternative Therapies in Health and Medicine* 11(5) (2005) pp. 46–57

¹¹⁶ D Hutto and S Gallagher 'Re-authoring Narrative Therapy: Opening the way for future Developments' p.61

¹¹⁷ L P Vromans and R D Schweitzer, Narrative therapy for adults with major depressive disorder: improved symptom and interpersonal outcomes *Psychotherapy Research* 21 (2011) pp.4-15

¹¹⁸ R Fivush, J G Bohanek and W Zaman 'Personal and intergenerational narratives in relation to adolescents' well-being' In T Habermas (Ed.), *The development of autobiographical reasoning in adolescence and beyond: New Directions for Child and Adolescent Development*. 131 (2010) pp.45–57.

¹¹⁹ J Foster 'A review of the effectiveness of Social Stories among children and adolescents with Autism Spectrum Disorders' (Digital Commons SUNY Plattsburgh 2015) Psychology Master's Theses. Paper 4

¹²⁰ A L Gyllensten , C Ekdahl and L Hansson 'Long-term effectiveness of Basic Body Awareness Therapy in psychiatric outpatient care. A randomized controlled study' *Advances in Physiotherapy* 11 (2009)

BAT was developed to support patients' sense of self-efficacy and harmony with their bodies. A Norwegian summary of research in BAT effectiveness claims positive effects for anxiety, mood and trauma disorders, body image and eating disorders, and schizophrenia (N=12), as well as separate studies supporting benefits for pain disorders (N=7)¹²¹.

A review of mind-body therapies for treatment of pain, including body psychotherapy and body awareness interventions, concluded that these are effective as conjunctive therapies in a wide range of pain related disorders including osteoarthritis, lower back pain, migraine, and pain associated with medical procedures (N=6)¹²².

Bodies, narratives and the model

Body-focused therapies share common ontological assumptions about the construction of meaning and selfhood consistent with an enactive or embodied approach. Body-focused therapists believe an important component of psychopathology or psychosocial deficit is the incomplete, distorted or fragmented body narrative. In cases of trauma, body narrative organisation is distorted by an orientation to the past, with the result that resolution is compromised. The incompleteness of these narratives is perhaps reflected by the pre-narrative emotive expressions and affective sensations by which these incomplete stories of trauma are "told" by the body. In cases of deficient selfhood, such as ASD, incompleteness is reflected by a poverty of narratives concerning self in relation to other, poorly developed relations between self and other, and inability to extend or create relations beyond present functioning.

Assessment and formulation of patients assumes several neurological, biological, socio-cultural and environmental causes are interwoven dynamically in body narratives. Assessment organizes this material holistically and narratively: it identifies the body's story in the patient's bodily sensations and responses, or movement and affect. This leads to an understanding of the incomplete or distorted narrative that may be linked to a past unresolved trauma or event, or to a deficit in the kinds of narrative growth needed to understand the meanings of self and social interactions.

Therapy involves an enactive coupling relation between patient and therapist, itself an important intervention laying the ground for useful and more complete narratives emerging from the therapeutic relationship. Therapy includes creating a space for (pre-representational) embodied-narratives to manifest. Therapists may engage with this material by mirroring the movements and gestures of patients, a kind of enacted analogic relation, or writing them into a story, literally a narrative analogic relation. This is usually following by more directive interventions to correct movement or teach by trialling new responses, to enable different ways of engaging and sensing that support narrative development.

Mindful interventions are often used in conjunction with body psychotherapy, with a focus on increasing awareness of sensations and movement. The therapeutic work accepts that patients construct their ways of being according to their own felt sensations, and that this

¹²¹ L H Skjaerven and M A Sundel 'Basic Body Awareness Therapy (BBAT): movement awareness, everyday movements, and health promotion in physiotherapy' *Fysioterapeuten* (2016) English version at <http://fysioterapeuten.no/Fag-og-vitenskap/Fagartikler/Basic-Body-Awareness-Therapy-BBAT-Movement-Awareness-Everyday-Movements-and-Health-Promotion-in-Physiotherapy>; retrieved 14/01/2018

¹²² J A Astin 'Mind-body therapies for the treatment of pain' *The Clinical Journal of Pain* 20 (2004) pp.27-32

can be built upon and/or modified only by engaging the patient in acts that are meaningful in an enacted or bodyful, as well as mindful, sense.

Embodied narratives are seen as primordially enactive and feeling-based, even while the development of representations might be considered essential for fully formed narratives capable of extending and creating self-other relations as a part of the kinds of socio-cultural-environmental and temporal networks described above. When narrative is understood as an enactive process that grows from a cycle of sensation, emotion, engagement, reflection, sensation and so on, the emergence of more abstract forms of narrative supported by and feeding back to body narratives makes sense. This reciprocal process of interpreting the self enactively includes a sense of self identity. In body-oriented psychotherapy, complexity is managed non-reductively by conceiving it as being organized in the form of story, however undeveloped this may be. Therapy invokes the body as the primary interpretant, and involves increased awareness to body narratives, and gentle prompting towards change that resembles an opening up of experience to new forms, rather than imposing control strategies.

Limitations in support for the ecological model

The foregoing sections on mindfulness-based therapies propose, on the one hand, a strongly holistic position, including the self-creating nature of pathology and healing, and the involvement of the whole of “experience” in these processes. On the other hand, each largely limits its sphere of causation to psychological events, felt sensation and behaviour, as though only the psyche can respond to prompts and changes in awareness. With the exception of reduction in muscular tension and stress associated with reduced anxiety, and associated benefits for the “psychoneuroimmunological” system, the only self-organised healing causal process implied in physical pathology alongside those claimed at a psychosocial level is perhaps a re-interpretation of symptoms, or a transcendence of physical limitations at best. Even body-focused therapies aimed at pain management report reduced stress, improved bodily coping and efficacy, and greater overall well-being as the main beneficial effect on pain. While in some ways this is non-reductive: it reflects a non-directive or non-control approach to therapy, and in this way supports a mind-body connection. Yet it does not fully embrace physiological processes and organic changes involved in pathology. One would not attend a body psychotherapist for treatment of flu or allergies, and there is little evidence to suggest that these therapies are effective in other than psychological, behavioural and pain-management applications.

The ecological model proposes that mind and body are organised by similar processes of semiotic relations. Mind and body, then, should respond in similar ways to salient semiotic prompts. The previous chapter presented evidence for the causal power of this at the physiological level in the discussion of analogic resonance (the ‘oscillatory similitude’ frequency) employed in microwave resonance therapy. The next section explores further evidence that analogic resonance can prompt healing processes by examining another therapy claiming a self-organising ontology: homeopathy.

CHAPTER 9

Evaluation of the Model: Comparison with Homeopathy

Homeopathy claims to be a system of medicine with a self-organising dynamics ontology, employing low energy analogic interventions to treat mind and body. This controversial therapy has generally been assumed to be a vitalistic approach due to its assumption of an intrinsic “vital force”. However, in this chapter I show that the vital force is not treated as a special substance or energy, but was developed as a theory of dynamic responses to poisons, pathogens and stressors, producing all symptoms, from cellular to psychological levels. Disease is identified as derangement of the normal functioning of this vital force. Healing involves the whole person moving in a “direction of cure” that is hierarchical and dynamic, moving from resolution of the most dysfunctional “parts” or most critical symptoms, to the least, eventually restoring health to the whole person.

The development of the homeopathic method

German physician Samuel Hahnemann (1755-1843) wrote in his ‘Essay on a new principle for ascertaining the curative powers of drugs’¹ that accepted medical practice was to remove symptoms by means of “medicines which produced an *opposite* condition”² but argued; “medicines have more than one action; the first a direct action...the second indirect action...is generally a state exactly the opposite of the former”³ and “palliative remedies do so much harm in chronic diseases, and render them more obstinate, probably because after their first antagonistic action they are followed by a secondary action, which is similar to the disease itself” and thus, according to Hahnemann, reinforces the original pathology⁴. He added that while discoveries as “(cinchona) bark for pure intermittent fever”⁵ were invaluable, a “more methodical discovery of medicinal powers” is required, including an explanation for the highly variable effects of medicines: “why, for example, of the seven-fifteenths of all the so-called agues...bark was useless”⁶.

Hahnemann introduces a third approach for medical practice, which he claims was inspired from his observation that toxicological symptoms appeared to be correlated with symptoms of diseases known to be cured by those same toxic substances⁷. He writes “In my additions to *Cullen’s Materia Medica*, I have already observed that (cinchona) bark, given in large doses to sensitive, yet healthy individuals, produces a true attack of fever, and for this

¹ Reprinted in R E Dudgeon *The Lesser Writings of Samuel Hahnemann* (Pratap New Delhi 1970) pp.295-352

² Ibid p.307

³ Ibid p.312

⁴ Ibid p..313

⁵ Bark from the *cinchona officinalis* tree is a source of quinine

⁶ Ibid p.306

⁷ Ibid pp.307-310

reason, probably, it overpowers, and thus cures the latter” in patients suffering from fever⁸. Hahnemann claimed that this approach of *similia similibus*⁹ imitates processes in nature: “which sometimes cures disease by superadding another”¹⁰. Elaborating on this in his 1805 essay ‘The medicine of experience’¹¹ he proposes two “maxims”:

When two abnormal general irritations act simultaneously on the body, *if the two be dissimilar*, then the action of the one (the weaker) irritation will be suppressed and suspended for some time by the other (the stronger); and... *when the two irritations greatly resemble each other*... the weaker irritation, together with its effects, will be completely extinguished and annihilated by the analogous power of the stronger¹².

Hahnemann experimented with reducing the dose to minimize damaging effects, and claimed that “astonishing is the truth that there is no medicinal substance which, when employed in a curative manner, is weaker than the disease...for a curative purpose incredibly small doses suffice”¹³. In the same essay he emphasises that the *sensitivity* of the patient to the artificial disease is critical for this powerful response to a tiny amount of the substance:

None but the careful observer can have any idea of the height to which the sensitiveness of the body to medicinal irritations is increased in a state of disease. It exceeds all belief, when the disease has attained great intensity. An insensible, prostrated, comatose typhus patient, unroused by any shaking... will be rapidly restored to consciousness by the smallest dose of opium, were it a million times smaller than any mortal ever yet prescribed”¹⁴

Hahnemann proposed that a cure for a specific disease could be effected by prescribing a substance that causes similar symptoms in a non-diseased person, even in a vanishingly minute dose. He adds that his approach has the advantages of being amenable to methodical investigation of the symptoms produced by substances on humans, of employing any substance capable of producing symptoms medicinally, and of avoiding the damage of large doses¹⁵.

Hahnemann’s observations concerning primary and secondary reactions eventually provided the basis for his theory of vital force, later considered a core concept in homeopathy. In his 1813 essay, “Spirit of the homeopathic doctrine of medicine”¹⁶,

⁸ Ibid p.314 (in reference to William Cullen’s *A Treatise of the Materia Medica*, 1789)

⁹ Like with like; also referred to as *similia similibus curantur*: cure like with like

¹⁰ Ibid p.311

¹¹ Reprinted in R E Dudgeon *The Lesser Writings of Samuel Hahnemann* pp.497-543

¹² Ibid pp.510-511 (emphasis original)

¹³ Ibid p.518

¹⁴ Ibid p.528 Homeopathic remedies are produced by preparing a tincture of the original substance, then alternating dilutions with water and “succussions” (shaking by means of vigorous tapping). In Hahnemann’s time, dilutions continued well past the point of Avogadro’s limit, indicating no molecules of the original substance remained. Hahnemann wrote this essay six years before Avogadro published his first paper on determining molecular mass and proportion, but was clearly aware of the extreme dilution of his preparations.

¹⁵ Ibid esp. pp.529-530

¹⁶ Reprinted in R E Dudgeon *The Lesser Writings of Samuel Hahnemann* pp.696-711

Hahnemann revised his earlier theory of the secondary action of drugs, and now viewed these as *the responses of the body itself to all morbid agents*, including drugs, rather than directly caused by the action of pharmacological agents¹⁷. Elaborating on this, he wrote that “what life is can only be known empirically from its phenomena and manifestations”¹⁸ and added that these were not due to mechanical causes:

to the explanation of human life, as also its twofold conditions, health and disease...with nought in the world can we compare it with save with itself alone; neither with a piece of clockwork nor with an hydraulic machine, nor with chemical processes, nor with decompositions and recompositions of gases, nor yet with a galvanic battery, in short with nothing destitute of life. The material substances of which the human organism is composed ... are regulated by the laws peculiar to vitality alone (which) maintains them in the condition of *sensibility* and *activity* necessary to the preservation of the living whole, a condition almost spiritually dynamic.¹⁹

Hahnemann refined his view on the cause of healing from the notion of the remedy acting on the patient to produce an artificial disease similar to the original “natural” disease, to the remedy provoking in the patient a primary response similar to the natural disease, followed by an opposite, secondary response relative to both artificial and natural disease: “The living human organism strives to develop by antagonism the exact opposite of the affection first produced in it from without... which may in many instances be termed the self-sustaining effort”²⁰, and “During homeopathic therapy the counteraction of the living organism to these small doses is only as great as is needed to re-establish the natural healthy state”²¹. Hahnemann identifies this tendency to produce an antagonistic, secondary response relative to the primary response as one of the characteristics that distinguish life from non-life^{22 23}

Hahnemann claimed that non-material forces frequently influence our physical bodies, giving this example of the causal power of thought: “Is it through taking substantial doses of an emetic to bring about antiperistaltic movements in the stomach that we feel nausea at the sight of something sickening? Is it not exclusively the dynamic action of seeing

¹⁷ Ibid p.699

¹⁸ Ibid p.696

¹⁹ Ibid (emphasis original)

²⁰ Ibid, p.704

²¹ S Hahnemann *The Organon of Medicine* 6th Edition, (1842): reprinted in J Kunzli, A Naude and P Pendleton (translators) (Victor Gollancz London 1989) pp.102-3

²² S Hahnemann ‘Spirit of the homeopathic doctrine of medicine’ p.709

²³ The non-linearity and opposing directions of these causal relations can seem confusing. An example to clarify primary and secondary responses is as follows: a patient in a state of hyperarousal in response to trauma is suffering insomnia. A conventional treatment would be to prescribe tranquillisers. The primary response to the drug is sedation, while the secondary response would be a rebound state of arousal. The homeopathic treatment might be to prescribe microdiluted coffee: a substance capable of producing hyperarousal and insomnia, thus the primary response to the remedy is similar to the original symptoms produced in response to the trauma, while the secondary response produced by the patient is to relax.

something revolting upon our imagination?”²⁴, and “It is possible to create a very grave disease by acting on the vital principle through the power of imagination and to cure it in the same way”²⁵.

Hahnemann denies an ontological duality of material body animated by a vital life principle: “the organism is the material instrument of life; but it is no more conceivable without the life-giving, regulating, instinctively feeling *dynamis* than this *dynamis* is conceivable without the organism. The two are one, even if thought separates them to facilitate comprehension”²⁶ Hahnemann accepted that a knowledge of disease categories was useful for prognostic purposes, but a far more detailed and subtle symptom picture of the individual patient should be obtained to find the most similar substance: the simillimum²⁷.

Hahnemann found that despite his new method, some acute diseases continued to return, sometimes with an altered symptom picture. He hypothesised that the acute symptom picture was a surface eruption: a “fragment of a more deep-seated original disease” he termed a “miasm”²⁸. Hahnemann believed the origin of the deep seated, fragmentary and historical miasm involved the internalisation of past, unresolved acute diseases, including suppression of disease by the primary action of conventional “allopathic” drugs. This deep disturbance of vital functioning remains somewhat dormant until excited by some agent or event, causing a return of past symptoms.

Hahnemann also stated that effective homeopathic treatment can excite the return of these past illnesses, as the pathogenic path of chronic illness is reversed in healing: “the latest symptoms are the first to yield, and the oldest ailments are the last to give way”²⁹. His protégé Constantine Hering emphasised this observation, now known as Hering’s Law of Direction of Cure:

The cure must proceed from centre to circumference. From centre to circumference is from above downward, from within outwards, from more important to less important organs, from the head to the hands and feet. Every homœopathic practitioner who understands the art of healing, knows that the symptoms which go off in these directions remain away permanently. Moreover... symptoms which disappear in the reverse order of their coming are removed permanently. If a homœopathic physician goes to the bedside of a patient and, upon observing the onset of the symptoms and the course of the disease, sees that the symptoms do not follow this order after his remedy, he knows that he has had but little to do with the course of things.³⁰

²⁴ S Hahnemann *The Organon of Medicine* p.19

²⁵ *Ibid* p.21

²⁶ *Ibid* p.20

²⁷ *Ibid* p.22

²⁸ *Ibid* p.21. The homeopathic term for chronic disease tendency, miasm, should not be confused with “miasma”, meaning polluted air or vapours

²⁹ S Hahnemann *The Chronic Diseases; Their Peculiar Nature and Homeopathic Cure* Vol 1 L H Tafel (translator) (Indian Books Syndicate New Delhi 1981) p.134

³⁰ This interpretation of Hering’s Law is offered in J T Kent *Lectures on Homeopathic Philosophy*. (B Jain New Delhi 1991) p.29. A Saine contends that this “Law” is better interpreted as a general tendency: Hering’s Law:

Hahnemann adds that in chronic disease it is important to allow this unfolding process of healing to continue without further prescriptions unless the process stalls. Unnecessary interference itself can stall the process.³¹

Homeopathic case taking entails taking into account the whole symptom picture. Symptoms are “sensations as expressed by the patient, the appearances in all parts of the body, the varied circumstances under which these symptoms are recorded” and “the relation between the symptom and its circumstance is in itself a symptom, or rather, a part of the symptom, the sensation being quite incomplete without the expressed relationship of circumstance”³². Some, known as modality or “general” symptoms “appertain in the same way to different parts of the body; they then become conditions of the man as a whole...even though they seemingly express themselves in local parts”. Any kind of individual variation in symptoms must be considered in understanding the total state of disturbance³³. Contemporary homeopathic theorists tend to focus on the difficulties of organizing symptoms in case-taking to develop an accurate reflection of the patient’s disease, so that a most similar remedy (similimum) can be found via a process of comparing the symptoms of the patient (natural disease) with those produced in tests or ‘provings’ of substances on healthy persons (artificial disease)³⁴.

Vital Force as defence mechanism

Vithoulkas emphasizes that persons are wholes, with many levels of functioning, and that disease, regardless of its primary microbial, genetic or traumatic cause, is a disturbance of the whole patient: “disturbance can be viewed as an imbalance in the organism’s ability to cope with internal and external influences. If we consider the individual as a totality, it is clear that the disturbances do not manifest themselves solely on the physical level of existence...the entire person is disturbed on all levels of existence, to varying degrees”³⁵. Noting the role of attention and how it is captured by needs, he takes into account the appearance of pathology in a focal part or level: “it is always the whole person that is acting, but his attention, his awareness, is centered upon the particular plane on which he has elected to function” in response to his particular needs or situation³⁶. The concerns of the patient, as foci of attention, are of far greater interest than are the physiological foci of symptoms:

“the symptom areas of most importance to the homeopath are those having to do with basic functions which occupy the attention of the person. Everyone of necessity pays considerable attention to things having to do with environmental comfort, food, sex, sleep, relationships with loved ones, financial issues, and influences of occupation. These areas of human existence are of much more fundamental importance to the

Law, Rule or Dogma? Presented at the Second Annual Session of the Homeopathic Academy of Naturopathic Physicians in Seattle, April (1988) Canadian Academy of Homeopathy
http://www.homeopathy.ca/articles_det12.shtml retrieved 2/9/17

³¹ S Hahnemann *The Chronic Diseases; Their Peculiar Nature and Homeopathic Cure* p.135

³² H A Roberts *The Principles and Art of Cure by Homeopathy* (B Jain New Delhi 1988) p.92

³³ *Ibid* p.37

³⁴ The homeopathic proving methodology is described further below

³⁵ G Vithoulkas *The Science of Homeopathy* (Thorsons Wellingborough 1986) p.15

³⁶ *Ibid* p.20

homeopathic prescriber than the actual clinical details of the patient's heart disease, lupus, migraines etc".³⁷

Vithoulkas emphasises the hierarchical and interrelational nature of symptoms at different levels within the whole, and notes three main levels: physical, mental and emotional. Like Roberts, Vithoulkas includes a level of morality and creativity, meaning all the acts and functions that promote happiness for oneself and others³⁸. The centre of activity may change between hierarchical levels, and there is always an interaction with the whole. This interconnectedness enables the whole to cooperate to meet the needs or objective according to the centre of activity.³⁹

Drawing on an earlier argument proposed by Hahnemann, Vithoulkas argues that the mental level is, generally speaking, more critical for health compared with a superficial physical ailment, given that a person can lead a creative, productive and meaningful life even with a physical disability. If physical symptoms are better with treatment but mental symptoms are worse, it would indicate deterioration of overall health⁴⁰. Overall, health is improving as long as the centre of gravity moves lower and towards the periphery in the hierarchy⁴¹.

Vithoulkas proposes that the vital force functions as a defence mechanism "to restrict the effect of the morbidic stimulus" to a given level in the hierarchy, within the limits of any hereditary weakness⁴². It does this by producing symptoms, and the practitioner must cooperate with this process because it is already responding with the best possible response⁴³. Vithoulkas implies a causal process in homeopathy that promotes the defence response of the body. Using a metaphor of electromagnetic frequencies, he argues effective treatment depends on prescribing a substance similar enough to the organism's main resonant frequency to produce resonance, which then strengthens, rather than extinguishes, the defence mechanism of the vital force:

Since the defence mechanism's only manifestation perceptible to our senses is the signs and symptoms of the person, it follows that we must seek a substance which can produce in the healthy human a similar totality of signs and symptoms. If a substance is capable of producing a similar symptom picture in a healthy organism, then the likelihood of its vibration rate being very close to the resultant frequency of the diseased organism is very good, and therefore a powerful strengthening of the defence mechanism can occur – through the principle of resonance"⁴⁴.

Likewise, Mangialavori states the "natural correspondence" between the artificial disease (induced by the remedy) and the patient can "induce a controlled therapeutic crisis which acts

³⁷ Ibid p.94

³⁸ Ibid p.27; as does H A Roberts *The Principles and Art of Cure by Homeopathy* p.51

³⁹ G Vithoulkas *The Science of Homeopathy* p.25

⁴⁰ Ibid p.27

⁴¹ Ibid p.39

⁴² Ibid p.58

⁴³ Ibid p.89

⁴⁴ Ibid p.91

in the same direction as the disease” based on a “principle of sympathy between two organised systems defined respectively as remedy and patient.”⁴⁵.

According to Vithoulkas, once a state of illness is established at a given level, the person will be relatively resistant, or non-responsive, to illness at other levels⁴⁶. Susceptibility, as Vithoulkas terms the sensitivity of organisms to specific influences, is dispositional, and includes heredity factors and the effects of environment, diet, and all kinds of stressors. Susceptibility “tends to vary within a narrow spectrum of illnesses” unless a major influence causes a “jump” to a deeper level⁴⁷. “All of us are exposed to potentially morbidic agents every day, but we only occasionally actually contract the disease – depending on our level of vibrational susceptibility and the degree of weakness of the defence mechanism”⁴⁸. The emphasis lies more in the similarity of stimulus to state, than in the strength of the disease. Vithoulkas suggests that the individual variation in responses to drugs, and to substances used in provings, shows that sensitivity to the mechanical or chemical influence of a drug varies between individuals, due to the degree of dispositional resonance between person and drug.

“This variable of resonance is utilised as a therapeutic principle in homeopathy, being somehow captured in the relationship between the dilute but similar remedy, and the patient”⁴⁹. If the disease is of extreme dissimilarity, the organism will simply not respond at all⁵⁰.

Pathogenesis

Sankaran emphasizes how the disease often concerns problems or situations of the past. Linking healthy functioning with an orientation to the present, Sankaran writes: “a situation only seems to become a problem when it is associated with the past, and when it confirms a false perception of reality, thus fixing it in our memory. So begins the process where each situation becomes a problem, connected as it is to a lifelong problem, a fixed and false perception of reality, a delusion that rules an individual life. Once a delusion is established, whatever the situation it will always be viewed in the light of this delusion, and the corresponding reaction will always be inappropriate”⁵¹. In short, experience and behaviour is organised as if a past situation is continuing. Sankaran also notes the metaphorical manner in which people tend to describe important aspects of their experience and situation⁵² and

⁴⁵ M Mangialavori *Praxis: Method of Complexity Vol 1* (Matrix Editrice Modena 2010) p.15

⁴⁶ G Vithoulkas *The Science of Homeopathy* p.83

⁴⁷ Ibid p.107

⁴⁸ Ibid p.109

⁴⁹ Ibid p.100

⁵⁰ Ibid p.109

⁵¹ R Sankaran *The System of Homeopathy* (Homeopathic Medical Publishers Mumbai 2005) p.7

⁵² Ibid pp.10-15

elaborates on metaphor as a means of organising the complex information gathered by homeopaths, including the compensatory symptoms observed in chronic disease cases.

Sankaran suggests that paradoxical or secondary symptoms might also arise from the inner conflict that patients experience to the extent that they are aware of the discrepancy between their “delusional” sensations, based on a past situation, and their current reality, including the set of their needs congruent with their present situation. According to him, this conflict brings about “turmoil and stress at every level”⁵³. Sankaran writes: “sometimes the sensation would be expressed directly. At other times it was expressed as a reaction that was equal and opposite to the sensation...in other cases it could be seen as the compensation”⁵⁴. Sankaran views Hahnemann’s theory of chronic disease: the miasms, as representing a sequence of pathological stages that may started out as an appropriate response to a situation, to becoming more compensated and conflicted over time, progressing into a deeper state of pathology that yet maintains the original response and its compensations.

Awareness

Sankaran writes that during healing the patient: “becomes aware of an abnormal sensation and energy pattern at his centre, and as the awareness of it increases the abnormal pattern fades away”⁵⁵ (2005: p- 260). He adds: “when you turn attention inwards, at first you become aware of your body and mind, the sensations from the various parts of the body, then the thoughts and emotions, then you get aware of a deeper world of imagination, somewhat like a dream state, then you get in touch with an overall experience of sensation...in the whole being, body and mind”⁵⁶. Sankaran describes a process analogous with the notion of defusion of awareness with experience described by mindfulness therapists: that the patient need no longer be trapped in the posture/experience of a past reality, but is able to increase self-awareness to encompass a greater reality of different potentials and ways of being. He argues that greater self-awareness enables people to respond to situations as they are in the moment, so that the posture can be appropriate to the needs of the situation⁵⁷. Sankaran emphasises that this is no mere intellectual understanding of delusion, nor fixed patterns of perception and behaviour. Like mindfulness theorists, he states that the awareness must be experiential to be curative. Thus for Sankaran, prescribing the simillimum is a means of raising experiential awareness of delusion of the fixed reality, freeing the patient to adapt to the changing situation, or changing needs, of his life.

Mangialavori emphasises that the ability to self-observe is critical to self-healing processes. For him, self-observation enables a living system to maintain its organised functional structures and “contend” with disturbances⁵⁸. He states that past a certain threshold of disturbance, the system will not return to its previous “equilibrium” but rather will develop compensatory strategies and “evolve or devolve” into another organisation. Functional

⁵³ Ibid p.6

⁵⁴ R Sankaran *The Sensation in Homeopathy* (Homeopathic Medical Publishers Mumbai 2009) p.134

⁵⁵ R Sankaran *The System of Homeopathy* p.260

⁵⁶ Ibid p.261

⁵⁷ Ibid p.7

⁵⁸ M Mangialavori *Praxis: Method of Complexity* p.22

polarisation and the suppression of some symptoms or behaviours from conscious awareness are possible features of the new state⁵⁹.

Assessment and case management

Like the psychotherapeutic approaches described previously, the homeopath is concerned with understanding the story and experience of the patient in order to understand the disease. Relational qualities of *connection* between homeopath and patient, rather than a directive or authoritarian relationship, are critical for this process⁶⁰. Like Sankaran, Mangialavori contends the therapist must be able to stand in as observer while the patient's self-observation is compromised or focused on a narrow set of symptoms, paying attention to "what is related and coherent between the various elements observed in and conveyed by the patient"⁶¹.

Vithoulkas states that case-taking should give most significance to the higher and deeper levels of the hierarchy, especially mental and emotional symptoms. He emphasizes that each patient must be approached as a unique case, and successful practice requires "drawing out of the patient the unique image of the pathological state" because "with each case, the homeopath faces a new variation on the many ways in which the fundamental laws are applied to individuals"⁶². The aim is to grasp the meaning of experience, including symptoms, from the patient's view: "The homeopath's sensitivity and imagination must be highly involved in the task of perceiving the patient's experience in his or her *own context*."⁶³.

Sankaran claims that it is the uncompensated feelings that are the most reliable in understanding the disease state, and that these symptoms can be revealed in behaviours that the patient is not consciously controlling, or not able to control, including dreams and fears⁶⁴. Each pattern of responses to situations can include variations on a primary theme, sensation or metaphor, and it is the correct identification of the theme that clarifies what otherwise appears contradictory and confusing secondary responses.

Mangialavori argues that remedies provide a close analogical relation between the *innate organisation* of the remedy substance, present as "information", and the organisation of the patient. Great emphasis is placed in homeopathy on finding a simillimum that matches the patient's symptoms in sensation, depth, pace, chronicity, intensity and so on. Failure of homeopathic treatment is assumed to be due to selection of a remedy that is not similar enough to the patient's state.

Mangialavori claims that the thematic organization of symptoms reflecting the "theme" of a patient's disease is not intended to be a superficial relation "on the level of

⁵⁹ Ibid p.64

⁶⁰ For further discussion of the therapeutic relationship in homeopathic consultation see C. Eyles, G. M. Leyden, G. T. Lewith, and S. Brien, 'A grounded theory study of homeopathic practitioners' perceptions and experiences of the homeopathic consultation' *Evidence-Based Complementary and Alternative Medicine*. 957506, 2011, pp1-12

⁶¹ Ibid

⁶² G Vithoulkas *The Science of Homeopathy* p.140

⁶³ Ibid p.173

⁶⁴ R Sankaran *The System of Homeopathy* pp.4-5

morphology and behaviour”⁶⁵, but is consistent with Maturana and Varela’s position that as a general principle, the identity and experience of a living system “coincides precisely with its modes of organisation”⁶⁶. Taking this literally, Mangialavori proposes that an identifying metaphor coincides with organisation at all levels⁶⁷. Like Sankaran, Mangialavori argues that the most effective, yet non-reductive means of organising information is to take a narrative approach in case-taking. This can reveal core metaphors for experience in the context of the patient’s life, and these metaphors are key signs for seeking the analogous remedy.

In sum, quoting his teacher Giovanni Marotta, as regards the observations made by the homeopath:

The point is to establish association not causation. Relating the symptoms to what the patient is experiencing allows for the development of a profound patient-substance analogy, which in turn helps one to profoundly understand the needs of the patient...and these make most sense if understood to reflect the situation of the patient, as he or she perceives it⁶⁸.

Health and disease as organizational processes

Claiming a complex self-organising systems perspective, pathologist Paolo Bellavite and homeopathic physician Andrea Signorini examine primary and secondary response processes at a cellular level in relation to the claims of homeopathy. Their examination of the ‘endogenous reactivity’ and phases making up the ‘disease history’ of the patient as regards inflammatory and immune responses in particular has been discussed in Chapter 6. To recap: disease is not defined by the presence of symptoms, pathogens or exposure to trauma. It is understood as primarily an endogenous process involving the creation of information as both cause and product of organisation. Pathogenesis occurs when the original aim of responses has gone awry, observed in the amplification or excessive production of symptoms, inhibition or suppression of symptoms, and vicariation and metastasis of symptoms⁶⁹.

Cellular responses, whether in pathogenesis, healing or normal functioning, are strongly non-linear, being prompted by minimal energy signals. They involve, at the most basic level, priming (hyperactivation) and desensitisation (hypoactivation) relations between cellular agents, and reference (or lack thereof) to the ‘memory’ of the whole represented in fractal organisation⁷⁰. In pathogenesis, the increasing tendency is for responses to forget or otherwise obstruct the needs of the whole. The dynamic balance between stability and change is disrupted, resulting in too much order punctuated by damaging chaotic transitions as allostatic load reaches critical thresholds.

The authors argue that at critical values, or bifurcation points, the system is very sensitive to state-specific information, meaning that very little energy may be needed to alter the behaviour and even the structure of the system. One means by which a system-level

⁶⁵ M Mangialavori *Praxis: Method of Complexity* p.24

⁶⁶ H Maturana and F Varela *Autopoiesis and Cognition; The Realisation of the Living*, p-33 Cited in M Mangialavori *Praxis: Method of Complexity* p. 25

⁶⁷ *Ibid* p.11

⁶⁸ *Ibid* personal communication cited p.53

⁶⁹ P Bellavite and A Signorini *Homeopathy: A Frontier in Medical Science* p.96

⁷⁰ *Ibid* p.94

transformation might occur is via a state-agonistic signal, which in homeopathy is supplied by the similar remedy. This signal, according to them, may function to re-activate desensitised receptors, or perhaps activate similar receptors, reactivating regulatory systems, and restoring the potential for the system to return to more general regulatory values⁷¹. Bellavite and Signorini note that this explanation is consistent with the observation that patients' responses to homeopathic treatment often involves the reappearance of previous symptoms, even to the extent of manifesting the entire history of the illness, going back in time in chronological order. This would occur if the resolution of pathology involves the re-activation of each original regulatory system⁷². The authors note that the homeopathic interpretation of the phenomena of re-emergence of historical issues resembles that encountered in psychotherapy⁷³. This is not to suggest that pathogenesis is a reversible process of a simple (or linear) kind, but rather that previous states and responses are revisited.

Bellavite and Signorini discuss the characteristic of complex systems to have the potential to take on multiple possible configurations, and that a low energy signal (including a homeopathic remedy, an acupuncture stimulus, or "psychological and cultural factors"⁷⁴) may prompt the system to choose a new configuration. Their discussion of this characteristic does not clearly state whether or not, or how, this prompting effect might lead to a more adaptive configuration⁷⁵. However, it is consistent with other points they emphasise to interpret this to suggest that the similar remedy may prompt the organism to re-experience moments of choice, choose and trial alternate configurations, including novel forms, with the opportunity for not just the reactivation of a previously blocked response, but the trialling of new forms that might better support general-purpose functioning.

Underlining the point that healing is not simply a matter of activating, or re-activating, responses, but rather regulating signals and response systems, Bellavite and Signorini state that in an acute phase of hypersensitivity, the state-similar signal may have an inhibitory effect, perhaps by competing or interfering with activated receptors⁷⁶. Many endogenous substances are known to have ambivalent regulatory effects, activating or deactivating various processes depending on the state of the whole. This kind of state-specific but ambivalent signal, they argue, fits the conception of a homeopathic remedy, this being selected on the basis of analogous similarity to the state of the whole organism⁷⁷. In this view, the homeopathic remedy mimics the ambivalent, but state-specific effects of endogenous regulatory signals, which may have lost their causal power due to interference, desensitisation or other deficiency.

Bellavite and Signorini assert that:

The homeopathic approach does not mean that reason gives up the ghost in the face of inextricable complexity, but adopts a realistic attitude towards it. The complexity is

⁷¹ Ibid p.198

⁷² Ibid p.200. The authors refer to Hering's Law.

⁷³ Ibid p.200

⁷⁴ Ibid p.206

⁷⁵ Ibid

⁷⁶ Ibid p.207

⁷⁷ Ibid p. 198

accepted as a basic fact of life, but, by knowing a number of general rules (nonlinearity, feedback, integration, analogy) we can make up for our ignorance of the details⁷⁸.

In other words, when the response set (reactive pattern) of a substance is known, by observing the processes of activation and deactivation of symptoms and regulatory systems of an organism exposed to that substance, it can be matched analogously to the response set (reactive pattern) of an organism in a state of disease. The substance can be effective in a low concentration or low energy form, exploiting the sensitivity of a system approaching critical values. The result is a restoration of dynamic balance between chaos and order.

The role of chaotic periodicity in *creatively* maintaining health is examined in nervous and immune system functioning:

Chaos may play a very important role, especially because this system needs to generate new forms of receptors to cope with all the possible antigens that the outside world and the inside of the body may present. *Fantasy*, then, is a fundamental property of the immune system, without which the body would lack the necessary adaptability to a world in a constant state of change and the ability to defend itself against potential aggressors. Chaos and fractals are essential in the dynamics of idiotypal networks, as modern immunology is increasingly demonstrating⁷⁹.

Moreover, as Goodwin has noted, a fractal organisation means that by examining parts, inferences can be made and tested concerning the functioning of the whole. Bellavite and Signorini argue that fractal organisation is the basis by which complex systems can be analysed by means of analogy, both in the sense of part-whole relations, and also comparison between similar systems. This process results in practical methods for “how to dominate complexity” at least in the sense of being able to assess the status of the system⁸⁰. The further claim of homeopathy is that by analogical comparison of one system (the patient) with another (the remedy) healing may be prompted.

Bellavite and Signorini identify limitations to the therapeutic potential of the low dose similia, notably in cases involving a strong genetic component, significant organic changes, continued strong exogenous perturbations, and significantly for their argument, cases with reduced reactivity of regulatory systems such that there are severely compromised and/or deficient receptors, including subjects taking narcotic drugs. Cancer is also a case in which regulatory systems are by definition less effective, however the authors suggest that homeopathic treatment for cancer may act by restoring neuroimmunoendocrine regulation of rogue cells⁸¹.

Evidence for effectiveness of homeopathy

Not unreasonably, given the extreme dilutions prescribed, there is much scepticism in the scientific community regarding homeopathy’s claims to effectiveness⁸². There is evidence

⁷⁸ Ibid p.201

⁷⁹ Ibid

⁸⁰ Ibid pp.180-182. Bellavite and Signorini cite G Nicolis and I Prigogine *Exploring Complexity: An Introduction* (Piper, Munich, 1987) p.251 to support this argument

⁸¹ Ibid p.213

⁸² The claim that water can retain a “memory” of substances under specific conditions began with the work of immunologist Jacques Benveniste, who was presented with an Ig Nobel Prize for his theory of the sub-

that placebo effects may especially confound results for homeopathy because complementary medicine trials tend to have higher “non-specific” or placebo effects in their control groups compared to conventional medicine control groups⁸³. Nevertheless, and despite difficulties applying RCT protocols to homeopathic treatment⁸⁴, a broad range of evidence for effectiveness exists.

In the 1854 cholera outbreak in London⁸⁵, a mortality rate of 16.4% (from 61 cases) was reported by the London Homeopathic Hospital, compared to 53.2% (231 cases) in nearby Middlesex Hospital⁸⁶. The Board of Health medical inspector Dr Macloughlin, a self-confessed “enemy” to the homeopathic camp, attested that the cases he observed being treated in the homeopathic hospital were “true cases of cholera in various stages of the disease” and further commented that had he been afflicted, he would seek homeopathic treatment⁸⁷. Goldacre commented on the apparent success of homeopathy in this epidemic, claiming that homeopathy achieved no better than placebo effect, and only appeared effective compared to the injurious practices of conventional treatments of the day⁸⁸. Goldacre did not report the actual figures, nor compare these to the mortality of untreated cholera: around 50%⁸⁹.

American homeopathic physician W.A. Dewey recorded the success rate of homeopathy in the 1918 “Spanish flu” epidemic⁹⁰. Dewey lists data for over 50,000 patients provided by homeopathic general practices and hospitals, including Dean W A Pearson of Philadelphia who collected 26,795 cases treated by homeopaths and reported an average

molecular organisation of water: G Watts Jacques Benveniste *British Medical Journal* 329 (7477) (2004) p.1290. Nobel prize winner (2008: for discovery of HIV virus) Luc Montagnier claims to have replicated and extended Benveniste’s work, showing that water carrying only the electromagnetic signature of DNA can make a replica sequence: L Montagnier, J Aïssa, C Lavallée, M Mbamy, J Varon and H Chenal ‘Electromagnetic detection of HIV DNA in the blood of patients treated by antiretroviral therapy’ *Interdisciplinary Sciences Computer Life Science* 1 (2009) pp.245-53.

Mae-Wan Ho notes the importance of Benveniste’s and Montagnier’s research for the claims of homeopathy on her website *Science in Society*:

http://www.isis.org.uk/DNA_sequence_reconstituted_from_Water_Memory.php retrieved 22/12/17

⁸³ In H Walach, W Jonas and G Lewith ‘Are the clinical effects of homeopathy placebo effects?’ *The Lancet*, 366, (2005) p.2081

⁸⁴ Notably: the patient-centred rather than disorder-based diagnosis, and the variability of healing responses

⁸⁵ in which the water-borne nature of cholera infection was first proven by tracing the source of the outbreak to a water pump in Broad St

Article I. ⁸⁶ Average mortality rates in cholera epidemics in the 19th century ranged from 40 to 80%. Other European homeopathic hospitals reported rates of 4 to 9% according to H Coulter (1982) *Divided Legacy*, Volume I: The Patterns Emerge Hippocrates to Paracelsus (North Atlantic Books Berkeley 1982) PP. 298-302

⁸⁷ According to P Morrel and S Cazalet *A History of the Homeopathic Hospital* (1999)

<http://homeoint.org/morrell/londonhh/outbreak.htm> retrieved 10/7/2017

⁸⁸ B Goldacre ‘Benefits and risks of homeopathy’ *The Lancet* 370 (2007) pp.1672-1673

⁸⁹ Figures reported in D A Sack, R B Sack, G B Nair and A K Siddique ‘Cholera’ *The Lancet* 363 (2004) pp.223-233

⁹⁰ Dewey, W. A. (1921) Homeopathy in influenza: A chorus of fifty in harmony. *Journal of the American Institute of Homeopathy*. 1038-1043: also see further examples of the use of homeopathy in epidemics in J Winston *The Faces of Homeopathy* (Great Auk Publishing, Tawa, 1999) pp.236-238

mortality rate of 1.05%. The same article mentions H A Roberts, who compiled data from 30 homeopaths in Connecticut, a total of 6,602 cases with an average mortality rate of less than 1%. This was compared to the mortality rate of about 30% achieved by what the homeopaths termed the “old school” approach⁹¹.

Epidemics tend to be treated with a small set of remedies specific to the typical presentation in that particular epidemic, and on this basis homeopathy has been used prophylactically. The homeo-prophylactic “nosoLEP” vaccine for leptospirosis⁹² was developed from four strains of leptospirosis bacteria by the WHO accredited vaccine manufacturer Finlay Institute in Cuba. The Cuban Ministry of Health, facing a severe 2007-2008 epidemic in the wake of four hurricanes, offered Finlay’s homeo-prophylactic nosoLEP to people in the three highest risk regions. In the intervention sample of 2.3 million people residing in high-risk regions, the incidence of infection in the 2007-2008 season was 84% lower compared with the rest of Cuba⁹³. These results are described by Dr Edzard Ernst as unreliable on the grounds that it is “little more than an observational study”, and noted that Finlay’s conventional leptospirosis vaccine, vaxSpiral, was also administered in high risk groups. However, even Dr Ernst added that vaxSpiral was available to only 0.6% of the sample, a figure surely far too low to significantly alter the results⁹⁴. A prospective trial conducted by the Faculty of Pharmacy at the University of Rio de Janeiro in 2011 found that children given an influenza-based homeo-prophylactic experienced a three-fold reduction of flu symptoms compared with a placebo group ($p < 0.01$)⁹⁵. Positive results are also reported in trials for dengue fever homeopathic prophylaxis in Brazil⁹⁶.

A trial for homeopathic treatment of sleep disorders found that sleep was significantly improved according to polysomnographic recordings for treatment nights (week 4) versus placebo nights (week 2). This study was inspired by previous trials of the effects of

⁹¹ According to J Winston *The Faces of Homeopathy* p. 263. The mortality figure in cases that progressed to pneumonia were reported to be 2% in homeopathic treatment, and with conventional treatment: 60%. Winston adds conventional treatment consisted of aspirin, and sometimes also quinine, morphine, codeine and iodised lime: pp.236-237.

⁹² A seasonal water-borne infectious tropical disease

⁹³ G Bracho, E Varela, R Fernandez, B Ordaz, N Marzoa, J Menedez, L Garcia, E Gilling, R Leyva, R Rufin, R de la Torre, R Solis, N, Batista, R Borrero and C Campa ‘Large scale application of diluted bacteria for leptospirosis epidemic control’. *Homeopathy*, 99, (2010) pp.156-166

⁹⁴ Ernst’s perspective on homeopathy and homeopathic research is expressed in a dedicated blog: website published 2014, <http://edzardernst.com/2014/07/homeopathic-immunisation-is-dangerous-unethical-madness/> retrieved 18/04/2017

⁹⁵ N=450, $p < 0.01$ In C Lyrio, C Monteiro Siqueira, V F Veiga, F Homsani, A L Marques, J Biolchini, F Dantas, H J de Matos, S R Lambert Passos, J N Couceiro and C Holandino ‘The use of homeopathy to prevent symptoms of human flu and acute respiratory infections: a double-blind, randomized, placebo-controlled clinical trial with 600 children from Brazilian Public Health Service’ *International Journal of High Dilution Research* 10/36 (2011) pp.174-176

⁹⁶ Rates of dengue cases in the treated population (n=158,000 approx) fell 93% in the year January 2007 to January 2008 compared with the previous year, while untreated populations in neighbouring areas experienced an 128% increase in infections: L De Souza Nunes Contribution of homeopathy to the control of an outbreak of dengue in Macaé, Rio de Janeiro *International Journal of High Dilution Research* 7/25 (2008) pp. 186-192. A similar trial reported a decrease of 83% (n=20,000) R Marino Homeopathy and Collective Health: The Case of Dengue Epidemics *International Journal of High Dilution Research* 7/25 (2008) pp.179-185

homeopathic microdilutions on the sleeping patterns of rats, which found alterations in sleep patterns according to EEG delta frequency⁹⁷. Two RCT's demonstrated effectiveness of homeopathy in critical care settings: improving long term survival in severely ill septic patients and hastening extubation in ICU patients⁹⁸.

An influential meta-analysis of clinical research in homeopathy published in *The Lancet* (the 'Shang' study)⁹⁹ reviewed 110 placebo-controlled trials, selected 21 "high quality" trials, and chose eight of these (none with individualised treatment) for comparison against six high quality allopathic trials. Shang et al claimed their results demonstrated that homeopathic treatment is no more than a placebo effect, and this provided the basis for that edition's editorial announcing the end of homeopathy. Others have challenged these results, claiming that Shang's review featured strong selection bias in favour of allopathic trials, and failed to meet the Lancet's own criteria for meta-analyses such as describing data for included trials and reporting excluded trials¹⁰⁰. When this data was made available, it was noted that heterogeneity effects were high in all trials, and cut-off values for larger, high quality trials were inconsistent between homeopathic and allopathic trials, without explanation. This means that comparisons between homeopathic and allopathic effect sizes are less reliable than claimed in Shang's review¹⁰¹. Most tellingly, sensitivity analysis showed Shang's analysis was sensitive to the specific trials selected. Results were skewed by the data of one homeopathic study: when this was excluded, the analysis of the remaining seven homeopathic studies revealed a significant and positive effect for homeopathy beyond

⁹⁷ G Ruiz-Vega, L Perez-Ordaz, P Proa-Flores and Y Aguilar-Diaz 'An evaluation of Coffea cruda effect on rats' *British Homoeopathic Journal* 89 (2000) pp.122–126; G Ruiz-Vega, L Perez-Ordaz, O Leon-Hueramo, E Cruz-Vazquez, and N Sanchez-Diaz 'Comparative effect of Coffea cruda potencies on rats' *Homeopathy* 91 (2002) pp.80–84; G Ruiz-Vega, L Perez-Ordaz, L Cortes-Galvan and F M Juarez 'A kinetic approach to caffeine-Coffea cruda interaction' *Homeopathy* 92 (2003) pp.19–29 and G Ruiz-Vega, B Poitevin and L Pérez-Ordaz 'Histamine at high dilution reduces spectral density in delta band in sleepingrats.' *Homeopathy* 94 (2005) pp.86–9. All cited in Bell et al.

⁹⁸ In the septic trial: n=35, survival rates after 180 were 75% for the homeopathic group and 50% for placebo, p= 0.043. In the extubation trial, significant decrease in secretions and shorter time to extubation were reported. M Oberbaum, S R Singer, H Friehs and M Frass 'Homeopathy in emergency medicine' *Wiener Medizinische Wochenschrift* 155/21 (2005) pp.491–497

⁹⁹ A Shang, K Huwiler-Muntener, L Nartey, P Juni, S Dorig, J Sterne, D Pewsner and M Egger 'Are the clinical effects of homeopathy placebo effects? Comparative study of placebo-controlled trials of homeopathy and allopathy' *The Lancet*, 366, (2005) pp.726-732

¹⁰⁰H Walach, W Jonas and G Lewith 'Are the clinical effects of homeopathy placebo effects?'

¹⁰¹ A L B Rutten and C F Stolpe 'The 2005 meta-analysis of homeopathy: The importance of post-publication data'. *Homeopathy*, 97, (2008) pp.169-177

placebo¹⁰². The negative study concerned the use of arnica for muscle soreness in long distance runners: a condition for which allopathic treatment also failed to provide relief¹⁰³.

The Shang review was the third meta-analysis to be published: the previous two found overall positive effects for homeopathy. A 1997 review, also published in *The Lancet*, found 89 homeopathic trials suitable for inclusion, and concluded:

The results of our meta-analysis are not compatible with the hypothesis that the clinical effects of homeopathy are completely due to placebo. However, we found insufficient evidence from these studies that homeopathy is clearly efficacious for any single clinical condition. Further research on homeopathy is warranted provided it is rigorous and systematic¹⁰⁴.

The British Medical Journal meta-analysis concluded that 81 studies showed a positive effect for homeopathy, while 24 studies did not¹⁰⁵. This study commented that many trials were of low quality, and further research was recommended. Since the Shang review, two further meta-analyses have been published in the meta-review specialist journal, *Systematic Reviews*. The first, studying RCT's of individualised homeopathic treatment, found 22 trials of sufficient quality for analyses, and these yielded a significant positive effect of homeopathy. The authors noted that these trials included some of "uncertain bias", with only three of sufficient quality to be deemed highly reliable. However, they also noted that it is common in medical trials for efficacy conclusions to be drawn from only two high quality RCT trials, and that the effect sizes found for homeopathy in these most reliable trials were equivalent to those found for accepted allopathic treatments¹⁰⁶. The second, analysing RCT's of non-individualised homeopathic treatment, found 54 trials of sufficient quality for analysis, and that the overall effect of these was positive and significant. However, the three most reliable trials from this analysis revealed a smaller and non-significant effect size¹⁰⁷.

¹⁰² $p < 0.039$; R Ludtke and A L B Rutten 'The conclusions on the effectiveness of homeopathy highly depend on the set of analysed trials'. *Journal of Clinical Epidemiology*, 61 (2008) pp.1197-1204

¹⁰³ It is worth noting for comparison the quality of evidence that supports accepted medical treatments: Smith et al quoted from the British Medical Journal's online *Clinical Evidence* that of 3000 commonly used NHS medical treatments, 11% were "shown" to be beneficial, 23% likely to be beneficial, 7% were rated as trade-offs between benefits and harms, with 6% rated unlikely to be beneficial and another 3% rated likely to be ineffective or harmful. The authors at BMJ Clinical Evidence rated the remaining 50% of medical treatments as being of unknown effectiveness. In Q Smith, R Street, R Volk, M Fordis 'Differing Levels of Clinical Evidence Exploring Communication Challenges in Shared Decision Making' *Medical Care Research and Review* 70 (2012) pp.3-13

¹⁰⁴ K Linde, N Clausius, G Ramirez, D Melchart, F Eitel, L Hedges and W Jonas 'Are clinical effects of homeopathy placebo effects? A meta-analysis of placebo-controlled trials'. *The Lancet*, 350, (1997) pp.834-843, p.841

¹⁰⁵ J Kleijnen, P Knipschild & G ter Reit 'Clinical trials of homeopathy' *British Medical Journal* 302/6772 (1991) pp.316-23

¹⁰⁶ R T Mathie, S M Lloyd, L A Legg, J Clausen, S Moss, J R T Davidson and I Ford 'Randomised, placebo-controlled, trials of individualised homeopathic treatment: systematic review and meta-analysis'. *Systematic Reviews* 3/142 (2014) pp.1-23

¹⁰⁷ R T Mathie, N Ramparsad, L A Legg, J Clausen, S Moss, J R T Davidson, C Messow and A McConnachie 'Randomised, double-blind, placebocontrolled trials of non-individualised homeopathic treatment: systematic review and meta-analysis' *Systematic Reviews* 6:63 (2017) pp.1-28

Both of these reviews reported low heterogeneity effects and were robust to sensitivity, however both recommended that more high-quality controlled trials of homeopathy should be conducted.

Research using longitudinal, observational designs, and subjective, general well-being measures are more appropriate than RCT's for evaluating homeopathy¹⁰⁸. Two hospital-based studies show that a majority of patients undergoing homeopathic treatment report moderate to high levels of satisfaction with symptom improvement and overall health over time (6-7 years)¹⁰⁹. Another followed 3,709 patients at homeopathic primary care practices receiving individualised treatment in Germany and Switzerland over a period of eight years, and reported a significant decrease in symptom severity (using non-specific measures of severity and quality of life) from baseline to two year and eight year follow-ups¹¹⁰. The most frequent diagnoses were allergic rhinitis and headache in adults (n=2,722) and atopic dermatitis and recurrent infections in children (n=819). Around half of the participants reported a symptom decrease of 50% or greater. Around 25% dropped out of the study between the two and eight-year follow-up, giving the reason that their symptoms improved so much that they did not require further treatment, and a similar number dropped out because they believed treatment was not effective (more than half of this group also used conventional treatment).

There are limitations to observational research designs, including the lack of a comparison group, and that self-selected samples may differ in important ways to other populations. Such samples may be predisposed to practicing a healthier lifestyle, or more likely to report improvement due to a placebo effect. The strength of these studies, however, lies in the evidence of real-world effectiveness, while on the other hand RCTs lack this external validity.

Three government-commissioned reviews of homeopathy have been conducted. The Swiss report, based on a "health technology assessment", concludes that homeopathy is safe, cost effective, and efficacious, leading to that government's decision to include homeopathy in the list of approved treatments covered by Swiss public health insurance¹¹¹. The British government reviewed homeopathy's status as a National Health Service treatment in 2010. The House of Commons Science and Technology Committee, drawing largely from the 2005 Shang review, concluded that there was no reliable evidence in favour of homeopathy. The conclusion was rejected by Parliament on the grounds that NHS clinicians were best placed to make treatment decisions and the NHS should continue to support patient choice with regards complementary therapies¹¹². In 2015, the Australian Government commissioned the National

¹⁰⁸ Given its individualised prescriptions and possible symptom aggravation during healing

¹⁰⁹ D Spence, E Thompson and J Barron 'Homeopathic treatment of chronic disease: A 6 year university hospital outpatient study'. *Journal of Alternative and Complementary Medicine* 11 (2005) pp.793-798; E Rossi, C Endrizzi, M A Panozzo, A Bianchi, and M da Fre 'Homeopathy in the public health system: A 7 year observational study at Lucca Hospital (Italy)' *Homeopathy*, 98, (2009) pp.142-148

¹¹⁰ p<0.001; C M Witt, R Ludtke, N Mengler and S Willich 'How healthy are chronically ill patients after eight years of homeopathic treatment? A long-term observational study' *BMC Public Health* 8, 413 (2008)

¹¹¹ G Bornhoft, U Wolf, K Von Ammon, M Righetti, S Maxion-Bergemann, S Baumgartner, A E Thurneysen and P F Matthiessen 'Effectiveness, safety, and cost-effectiveness of homeopathy in general practice – summarised health technology assessment'. *Forsh Komplementmed*, 13, (2006) pp.19-29

¹¹² Government Response to the Science and Technology Committee report 'Evidence Check 2: Homeopathy' United Kingdom Secretary of State for Health (TSO Norwich 2010) online: retrieved 14.10.17 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228707/7914.pdf

Health and Medical Research Council (NHMRC) to review the efficacy of homeopathy¹¹³. This review rejected all but high quality RCT design studies with at least 150 participants, leaving a total of 5 studies¹¹⁴. In addition, the NHMRC considered only those meta-analyses published between 1997 and 2013, excluding both reviews published in Systematic Reviews¹¹⁵. The NHMRC review concluded that there was no reliable evidence for the efficacy of homeopathy for any specific health condition. In response, three Australian professional associations of homeopaths and complementary medicine practitioners submitted a complaint to the Commonwealth Ombudsman on the grounds that several breaches of the NHMRC's own guidelines for conducting unbiased reviews occurred¹¹⁶.

On balance, it would be appropriate to conclude that statements claiming that there is no evidence that homeopathy works are not supported, and that results suggest at least that further research is justified.

Comparison of homeopathy with the ecological model

According to homeopathy, disease and healing are processes that can be understood according to the dynamic responses of humans over time to disturbances or to morbidic agents, rather than directly caused by the agents themselves. The organism is excited by disturbances, interpreting these as threats to needs, and producing symptoms in the opposite direction (antagonistic) to the force of the morbidic agent as interpreted by the organism. The counter-response of the body is aimed at overcoming the effects of the morbidic agent. Generally speaking, symptom production is considered to reflect the scalar organization of the organism: the organism responds to morbidic stimuli or deficiency by producing symptoms at the most superficial, least critical level possible, which corresponds to the fastest rates of change.

The disease state is characterised not merely by the presence of symptoms, but by the continual production of symptoms at the same focal level, and eventual shifts to a more critical level either by slow deterioration or sometimes by an acute shift if a major breakdown, disturbance or suppression occurs. Homeopaths claim that as the level of pathology advances to deeper and more critical levels, there can be a reduction of symptoms at more superficial levels that had previously been the focus of pathology. This might occur if “suppressive” therapies are targeted at superficial levels, but may also occur spontaneously as pathology develops over time. It is as if the focal level of pathology shifts (or vicariates, as Bellavite puts it) rather than merely spreading. This concept is comparable with the general argument that control strategies suppress the self-creative processes of social and ecosystems, resulting in the (sometimes catastrophic) degradation of these.

The general processes of pathology are considered to affect human minds and bodies in a similar way, and an individual's pathology should manifest in similar or interrelated

¹¹³ National Health and Medical Research Council, Information paper 'Evidence for the effectiveness of homeopathy' (Canberra 2015) online retrieved 2/8/16
https://www.nhmrc.gov.au/files/nhmrc/publications/attachments/cam02a_information_paper.pdf

¹¹⁴ Ibid p.21

¹¹⁵ Ibid p.11

¹¹⁶ Executive Summary: 'Complaint to the Commonwealth Ombudsman regarding the National Health and Medical Research Council (NHMRC) assessment of homeopathy, 2010- 2015'; Complementary Medicines Australia (CMA) - Australian Homœopathic Association (AHA) - Australian Traditional Medicine Society (ATMS). Online retrieved 13/10/16 <https://www.homeopathyoz.org/images/documents/Exec-Summary-to-Ombudsman-Complaint-re-NHMRC-Hom-Review-FINAL.pdf>

symptoms in that individual's mind, sensations, physiology and behaviour, comprising a common theme or metaphor at the core of the symptom portrait. This does not entail that mind and body are affected in a similar way at the same time, but like every other dynamic process may have different rates of responses and kinds of relations between these: compensatory, conflicting, desensitising, alternating, reactivating and so on. Accordingly, the progression of disease may involve the emergence of new focal levels of pathology, and new relations between foci. Symptoms are seen to occur in the dynamic field of the whole, so that change in any component affects the whole field.

The direction of cure proposed in homeopathy describes an overall tendency for progressing in the opposite direction of the complex pathogenic path, a kind of "unfolding" of the rigid, maladaptive organization as it returns to normal coherent variance. The direction of cure could be also described as progression towards greater adaptive, or creative, freedom, bearing comparison with Hoffmeyer's concept of a direction in evolution towards greater semiotic freedom. The adaptive value of this "direction" for an individual organism, as for a species, is clear. Greater semiotic freedom implies increased possibilities for sensing, interpreting and responding, and therefore greater variation and possibilities for adapting.

The temporality of healing is acknowledged in the concept of direction of cure. The homeopathic claim that patients effectively store a history of past states and symptoms is similar to the claim in psychotherapy that clients store a history of strategies for survival or "schemas", largely subconsciously. The presenting state of the patient appears to mask or defend these older states, which emerge during the process of therapy. The law of direction of cure is also hierarchical: past symptoms may be expressed as the focal level shifts from more to less critical functions, beginning with more critical levels with slower, deeper rates of change to faster, more superficial levels.

Sankaran considers temporal orientation and awareness to be critical factors in pathogenesis and healing. He argues that the remedy enables the patient to achieve an increased awareness *of* her pathology: a state rigidly maintained from a past situation, and *beyond* pathology: to her present (changeable) situation. Sankaran identifies a limitation of the patients' awareness such that they are stuck in a situation from the past and unable to respond to, or create, change. An increased awareness of present circumstances entails an increased awareness of possible responses, and perhaps an increased potential for creative responses: adapting, learning, and so on. This can be understood as an expansion of spatio-temporal semiotic freedom.

As regards the rationale and practice of homeopathic intervention (assessment and the prescription of a remedy) homeopaths always consider their patients' pathology in terms of the totality of symptoms and their dynamics. Case assessment and management methods rely on subtle and comprehensive observation of the total symptom picture. This task is recognised to entail some means of organising these observations, such as developing metaphorical representations of the posture of the patient in her world that may be conceived as a core delusion, situation, portrait, or persistent/pervasive sensation, which can be conceived as originating as an adaptive strategy produced by the patient's sensitivity and response.

The causal power of the body, the vital force, is considered responsible for the sensitivity (susceptibility) in disease to relevant stimuli relative to the disease state, even when this stimulus is very low energy. This quality of sensitivity is the basis of the homeopathic intervention of an analogical prescription. This kind of resonant stimulus can and preferably should be very low energy, due to the extraordinary sensitivity of patients to relevant disease-state specific information, and to the desirability of avoiding further counter

responses that could be excited by the damaging mechanical push of large doses. Importantly, the resonant stimulus is intended to match the “totality”: the whole presentation of the patient, not any part or presumed pathological entity. The whole patient (including their “external” circumstances, qualities of their relationships and so on) is the problem space. Likewise, the whole patient is sensitive to the remedy, and the whole patient responds.

Bellavite and Signorini argue that the analogic remedy acts by exciting a “counter-counterreaction”, in other words, to reactivate regulatory functions that have become desensitised after an initial counterreaction of the organism to a morbidic stimulus. According to them, restoring sensitivity more broadly, and thereby activating stalled regulatory processes, are the causal processes that resolve fixed symptoms and eventually allow the body to return to normal functioning. While they did not explicitly state this, the severed “information connection” they identify as a cause of pathology can be understood as a loss of sensitivity or awareness.

Biosemiotic causation as described by the complexity-oriented biologists reviewed previously seems to fit the description of the dynamics of the vital force, a causal power understood in terms of what it does rather than what it consists of. The vital force senses differences that make a difference to the organism, responds by producing symptoms, and may become entrained in that response, with the eventual development of complex pathologic forms as described in Chapter 6. The vital force may also be nudged out of entrainment, allowing a reconfiguration of the whole.

The following section further considers the homeopathic intervention itself, the similimum or most-similar remedy in analogic relation to the self-organised pathology of the patient, according to biosemiotic theory. Moreover, given homeopathy can be viewed as a biosemiotic medicine with two centuries of experience, some insights from homeopathy are considered concerning semiotic freedom.

The biosemiotics of homeopathy and some implications for semiotic freedom

A key question in biosemiotic research concerns the boundaries of biosemiotic and mechanical causation. Where lie the actual or metaphorical lines of demarcation between, for example, mechanical force and reaction, and more semiotically “free” interpretive responses? A related question is: To what extent is the causal power of “information” present in some innate organizational sense within an entity, force or sign, whether homeopathic remedy, or medicine, or pathogen, or mechanical force? Moreover, within semiotic relations, which causal effects pertain to the semiotic capacity of the sign, and which to the semiotic capacity of the agent? Favareau acknowledges the legitimacy of examining causes in the biological world in terms of both their non-semiotic “material” (or efficient) causation, and their semiotic “meaning”¹¹⁷. He phrases the question concerning semiotic capacity thus: “Is it “perception” and “awareness” on the part of some agent that *gives* a sign its representational efficacy – or does the agent merely “apprehend” a relation in the world that is already there, regardless of its apprehension?”¹¹⁸.

These questions have direct relevance to assumptions concerning the causes of disease: the relative causal effects of pathogenic forces acting on the organism, and the causal effects of its semiotic processes. Answers to these questions are required in order to grasp the

¹¹⁷ D Favareau ‘The Evolutionary History of Biosemiotics’. In M. Barbieri (ed.), *Introduction to Biosemiotics: The New Biological Synthesis*. Berlin: Springer, 2006 p.49

¹¹⁸ Ibid p.6

extent to which an organism can create its own causes in its interpretative processes, including the extent to which the patient may cause her own disease, and its healing. It is then possible to assess the power of biosemiotic medicine in helping patients overcome the “external” causes of disease: pathogens and trauma, and also to know when control of pathogens or biological processes might be necessary or preferable.

To consider first the concept of the threshold of semiotic activity: a recent survey of biosemioticians from various research fields indicated a lack of clear consensus regarding even the “lower threshold” between non-semiotic and semiotic processes, however definitions tended to converge towards triadic semiosis as necessarily involving some kind of embodied mind capable of creating interpretants, and semiotic thresholds being understood themselves as interpreted, established by means of habit, and evolved by living systems themselves¹¹⁹. My interpretation of the results of this survey is that Peirce’s conception of the boundary between Secondness: perceptions, reactions, and apparent actualities, and Thirdness as the inclusion of a third, mediating relation, is the most generally acceptable means to treat basic semiotic thresholds for most respondents. This suggests that causal force becomes semiotic in the presence of a mediating relation, consistent with the proposition that all living processes are semiotic to some degree.

Yet the magnitude of forces acting on organisms can destabilise, disrupt or entirely obstruct semiotic activity¹²⁰. Strong forces can overwhelm adaptive/interpretive responses of the agent, inducing a series of modifications characteristic of the inherent ‘information’ of the force¹²¹. A spoken word at high volume may deafen the listener. Exposure to flame will burn skin. Neurotoxins in snake venom cause paralysis. If semiotic thresholds are considered according to a continuum of semiotic freedom, then magnitude of force acting on a semiotic agent is negatively correlated with degrees of semiotic freedom. This would suggest that the magnitude and kind of pathogenic force undermines and overrides the semiotic capacity of an agent, especially if the organism’s ability to accommodate the effects of force is compromised (according to pre-existing allostatic load).

However, there are three (at least) further factors to consider as regards constraints on semiotic causation: agency, attention, and time. All four factors are likely to interact. This is most easily understood in the sense of the organism’s ability to “bounce back” semiotically from the brute effects of force, although this is not to suggest that this is the only or the most important interaction to consider. For example, even without the effects of mechanical force, the entrained attention, sensitivity, and responses of an agent in a need state entails a reduction in degrees of semiotic freedom, such that the organism is unable to move on from an unmet need. On the other hand, according to the ecological model, a mediating relation that increases awareness of the needs of the whole organism also increases degrees of semiotic freedom, improving the chances for resolving problems and enabling healing transformations over time. This healing relation may occur even while non-semiotic forces are still be acting on the organism.

A healing relation may be prompted by the semiotic capacity of the agent only, as in the placebo effect. A healing relation may also be prompted by the ‘semiotic capacity’ of the sign, in the sense that a sign vehicle is an organization of energy that represents information

¹¹⁹ J Higuera and K Kull ‘The biosemiotics glossary project: the semiotic threshold’. *Biosemiotics* 2017

¹²⁰ M Dix ‘Living and knowing: how nature makes knowledge possible’ p-17

¹²¹ P Bellavite and A Signorini *Homeopathy: A Frontier in Medical Science* p-84

salient to the agent in an entrained need state. The therapies discussed above employ analogic signs, presented in various ways, to assist the patient to apprehend a relation ‘that is already there’ between the patient and her pathological state. This already existing relation has been created at some time in the past by the agent. In other words, prompted by a sign analogical to the pathological state, the patient becomes aware that her pathology is a self-created reality, an entrained response to a need.

The analogic quality of the sign-relation is critical in homeopathy. This assumes a known semiotic capacity of the patient: the organization of her pathological state, and a known semiotic capacity of the remedy: an organisation derived from a substance and preserved in the medium of the remedy. The homeopathic remedy is an “icon”¹²²: the kind of stimulus pattern that resembles analogically what it stands for, belonging to the same category of signs as a portrait or an onomatopoeic word. The remedy is an organisation of energy that represents a force (usually a chemical force).

The homeopathic “proving” methodology assumes that substances, whether in biochemically “forceful” doses, or in low energy, very dilute form, will reliably reveal the action of that substance on symptom-free humans. Since Hahnemann’s time, provings have often been conducted using microdilutions not only to avoid toxic effects, but also to obtain more subtle emotional and mental symptoms¹²³. Resultant symptoms are maintained (effectively an artificially entrained state) until the prover ceases taking the substance. This means, as regards the semiotic capacity of agents and signs: a normal agent will respond like other normal agents to a low-energy sign, according to the sign’s innate form, and this response reflects a relation “that is already there”, and that is an identical but more nuanced relation than that obtained by the gross biochemical force of the object acting on the agent. An agent in an entrained state, on the other hand, will distort normal responses (and this is why unwell persons are not employed in provings), and amplify responses to signs salient to its need state. This last observation is of course the key to the causal power of the analogic sign representing the relation that is already there between patient and pathology.

An initial increase in semiotic freedom, even the one degree of freedom obtained by stepping out of and observing the entrained state for a moment, enables the apprehension by the patient of her relation to her unmet need as constituting her pathology. As argued in this and the previous chapter, this apprehension concerns embodied experience and energetic resonance rather than cognitive processing. This awareness nudges the patient out of entrainment, allowing variation in responses and further expansion of awareness and semiotic freedom. As semiotic freedom increases, she becomes increasingly aware of the whole originary agent or “envorganism” including, but not limited to, the original problem space and its field of agentic responses (see figure 5 below). It is this special analogical relation of self-similarity that captures awareness via resonance and re-orientes reactive, repetitive relations to a transformative response. This may occur regardless of the magnitude or even the ongoing presence of non-semiotic forces. Homeopaths claim curative results without any need to control the presence of pathogens. The close similarity of the remedy to the pathology is the critical factor, achieving the closest possible approximation of the patient’s disease.

¹²² “an icon represents whatever object it may represent by virtue of its own quality, and determines whatever interpretant it may determine by virtue of its own quality” C S Peirce (1902c, MS (R) 599).

¹²³ G Vithoulkas *The Science of Homeopathy* p-125

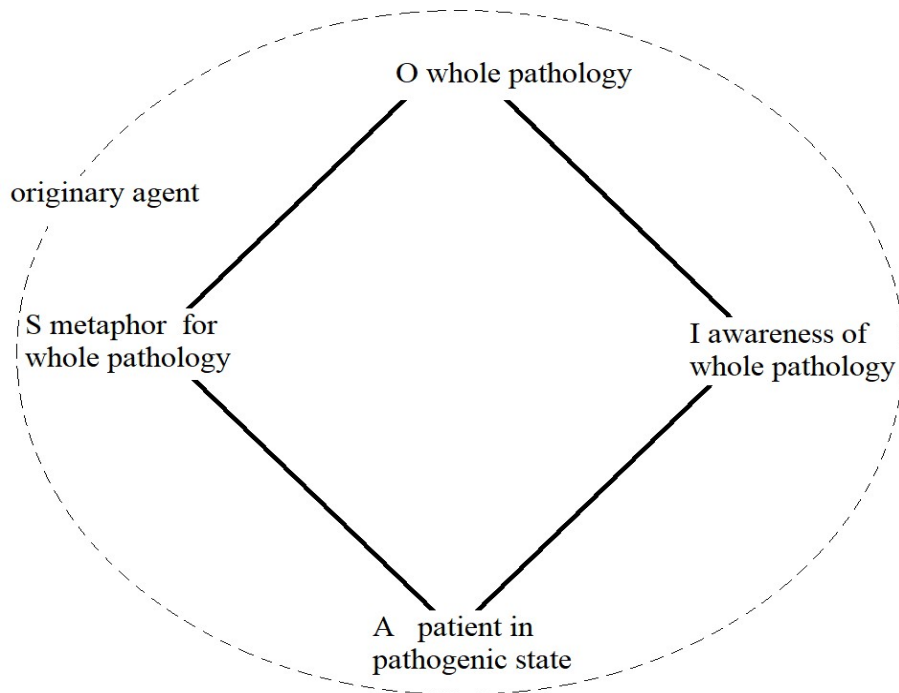


Figure 5. An idealised analogic sign relation. The agent A is a patient in a limited state of awareness, entrained by a need state. The sign vehicle S is a metaphor for O, the patient’s whole pathogenic organisation. The interpretant, I, is increased awareness of the whole organisation. The dotted line ellipse represents every endogenous and exogenous agentic relation bounded within the original problem space, and indeed the entire umwelt, from the perspective of A, the patient. An actual analogic sign relation approximates this ideal.

Where lies the temporal threshold between a reaction to a force and a semiotic response? If an organism is, or at least appears to be, responding to infection or trauma, how can the organism or the therapist know when symptoms are a necessary response to the force, or have become semiotically entrained? A semiotic perspective on living processes requires a concept of time that is, as Kull suggests, a “time of being”¹²⁴. This entails considering ‘the wisdom of the body’ and organismic time, rather than the clock or the medical expert. With reference to Peirce’s three ontological categories, temporal thresholds can be described as the instantaneous, the perception of instants, and the mediating relation of instants to one another. The organismic sense of time is agentic: it is for orienting the organism within a cycle or narrative: remembering, attending to the present, anticipating, forgetting. It is for varying rates of change: slowing, pausing, stopping, speeding up.

Entrainment is a temporal orientation that concerns fixed responses to a need that reduces semiotic freedom and variation in responses, whether the need state is acute or chronic, and whether an exogenous force is present or past. As stated previously, the analogic sign relation may stand, in part, for a memory of a need lost to awareness but still actively organizing experience. The analogic relation may prompt re-awareness, a remembering or re-sensitising as a whole, allowing the problem space as a whole to be reconfigured. In this

¹²⁴ K Kull ‘Organism as a self-reading text; anticipation and semiosis’ p-98

“moment” of organismic time, entrainment is paused and change is possible. An organism can rapidly alter its own degrees of semiotic freedom, even when tightly constrained by felt needs, by altering its attentional processes, regulatory values and sensitivity, in a moment. These changes to endosemiotic organisation then affect rates of change in behavior and finally organic changes. Consistent with this, the examples of homeopathy used in acute epidemics given above suggests that rapidity of onset of symptoms can be matched by rapidity of restoration of degrees of semiotic freedom. The homeopathic “law of cure” claims that the unfolding of chronic pathology approximates the reverse path of the development of pathology: level by level, part by part restoration of degrees of semiotic freedom until the whole is once more constrained by awareness of the needs of the whole.

If causation in living systems always includes the potential for powerful interpretive processes, regulated by sensitivity to changing needs and adaptability to meet those needs, then pathogenesis cannot be reduced to the causal power of pathogens, nor healing reduced to the power of medicines. There are no a priori pathogenic or salutogenic substances, symptoms, or situations, but only relational processes: sensing, varying, testing, learning, adapting, changing, transforming, forgetting, ignoring, and dying (even if these are mistaken for actualities of pathology or health). This means that attempts to control any such processes, even with low energy interventions, ultimately reflect the interpretation and ends of the controller. This may limit the possibilities for transformation and healing according to the timing and the “wisdom of the body”. Control interventions are neither incompatible nor complementary with an ecological model, but should be considered primarily as separate endeavors, such as palliation, mitigation, or compensation, with separate means and ends, to healing interventions.

Chapter 10

Discussion and Conclusions

The ecological model proposed in this thesis is based on a semiotic biofield ontology, wherein normal functioning in organisms is constrained by edge-of-chaos dynamics. Second order, endogenous responses to perturbations constrain each other, maintaining self-organised criticality, and stability through variation. According to this view, persistence and equilibrium are the properties that require explanation¹. Likewise, self-ordered states of persistent entrainment, including fragmentary states, require explanation.

The ecological model is intended to acknowledge the self-creative processes in pathogenesis and healing in terms of their dynamic formal and telic properties. Understanding the dynamics of these causal processes requires an autopoietic, biosemiotic paradigm wherein organisms respond as whole systems by interpreting events and forces. Variations in responses can be understood when taking into account the organism's state of needs, entailing sensitivity to relevant signs. These responses can reinforce, desensitize, and change sensitivities.

Pathogenesis according to an ecological model concerns self-sustaining response patterns to unmet needs. Acute, brief hypercoherent states are entered into continuously as organisms encounter challenges to their historically constituted needs: they enter into problem spaces. The production of symptoms indicates the nature and importance of particular problems for particular individuals. These hypercoherent states can simply be resolved when organisms sense (or cognise) that their needs are met. When felt needs are unresolved, perpetuation of the need-oriented state may lead to 'turbulence': compensatory, conflictual or avoidant relations between endogenous semiotic agents in a multidimensional field. A pathogenic sequence, from initial reaction to containment to compensation to avoidance and control responses, comprises a vicious cycle that obstructs the transformative processes required to move on from entrainment.

According to the ecological model, defensive responses, or compensations, develop in response to entrained need states. Compensations, which may include exogenous interventions and endogenous responses, can be considered pathogenic to the extent that they may result in entrainment and thereby obstruct variations in responses to the original need state: just as control strategies are argued to undermine creative, adaptive processes in societies and ecosystems. Organisms, like living systems at other levels, have causal powers to create and transform basic regulatory processes and boundary conditions. When a need cannot be met by existing strategies, a transformation of the problem space defined by changes in the organism's engagement can occur, allowing the re-establishment of edge-of-chaos functioning as a process of healing. For this to happen, entrainment needs to be interrupted without prompting defensive responses.

Transformation involves changes in awareness: a present-moment orientation of awareness, and an expansion of awareness, bodily and cognitively, of possibilities, initially via the creation of a self-observational distance between patient and problem. This relation is unique to the level of the individual as a unity of responses, and can be understood as a dialectic. Self-observant awareness means being aware of oneself as observer and observed: feeling and felt. Like other processes of living, awareness is not static but stable through variation: self-observation is an embodiment of edge-of-chaos dynamics. Awareness and

¹ See chapter 3 and R Levins and R Lewontin *The Dialectical Biologist* p.280

response are sensory and experiential interpretive processes involving the whole organism, from cells to cognitive representations.

The telic properties of pathogenesis concern the nature of the felt needs from the point of view of the patient: the meaning and significance of the problem and its temporal and ecological context. These core needs entrain form, or response patterns, which in turn entrain sensitivity. This approach simplifies the understanding of the patient's pathology as an unmet need organising behaviour, without the need for theories of reductive causation involving various forces acting on the patient, or complicated BPS models of interrelated forces.

It also suggests that the sensitivity of organisms to salient signs can be exploited to prompt transformations. A hypercoherent state organized around specific needs can be understood to occupy a highly coupled narrow oscillatory mode, and be exquisitely and selectively sensitive to very small energy inputs of a resonant frequency. This may prompt a highly similar resonance in the patient's biofield, interrupting entrainment. The resulting increase in oscillatory degrees of freedom makes possible trialled variations in the sensitive problem space. This means that healing is naturally attracted to the focal level of pathogenesis or entrainment.

According to the model, healing ultimately involves transformations of a problem space to enable a return to whole functioning: self-similar, edge-of-chaos organization, wherein variations of viability are naturally sensed, enacted and trialled. This increase in degrees of freedom makes possible trialled variations in the problem space. This means that healing is naturally attracted to the focal level of pathogenesis or entrainment.

This thesis contends that the ecological model provides coherence to the assessment and treatment of patients, including assessing the response to treatment, regardless of the type of intervention used. It also provides an explanation for the therapeutic effects of gentle resonance interventions. The model is developed with the aim of applying to individual patients, and in this context its concepts and practices are already embraced in many therapies, some of which are described above. However, the model is presented as a basis for future research and development embracing complexity, and especially an autopoietic and biosemiotic ontology. Potentially this model could be applied to improve the understanding of sensitive, responsive living systems in any particular field of study.

Applications of the model: Complex assessment

The ecological model is based on a semiotic biofield ontology. Disease categories and pathogens are replaced by observation of symptoms understood in the context of need entrainment, compensation and transformation processes, and this requires methodologies for observing symptoms and assessing processes.

Rubik and Jabs contend that understanding biofield dynamics, and possible applications of this knowledge in medicine, involves "mapping" the frequencies of the multi-dimensional biofield much like a genome, yielding a huge amount of data. Given that these frequencies are also constantly changing in response to perturbations, and creating their own perturbations, Rubik and Jabs contend that artificial intelligence is required to achieve the dynamic biofield map. They suggest normative data could form the basis of evaluation of health status, and that "distortions" or "deviations" in fields might indicate the early stages of

pathology, potentially giving detailed prognostic information of kinds that currently do not exist².

It is conceivable that devices can detect frequencies associated with pathology, and evidence for this exists³. However, there are deep issues around how to evaluate pathology and health relevant to this kind of technology. What would normative standards indicate when normal populations include a high proportion of chronic disease, including obesity, addictions, cardiovascular disease and so on? Potentially such devices might detect normal edge-of-chaos frequency patterns and rely on these as standard indicators of health. But deviations from normal occur as we respond to perturbations with the formation of need states. Even intense symptoms can be part of an adaptive sequence or cycle of problem sensing and solution-finding. Deviations from the edge-of-chaos may reliably indicate changes in formal dynamics, but this is not sufficient to reliably indicate pathogenesis.

Like Rubik and Jabs, Kirmayer states that understanding complex living systems means grasping huge amounts of data. He contends “there is simply no way to dispense with the need for multiple levels of explanation in research and clinical practice... while we need reductive models to advance the scientific study of specific mechanisms, we need more complex, hierarchically structured, systems models to understand many aspects of psychopathology and make clinically useful predictions and interventions”⁴. Kirmayer proposes formulating mental health problems in the form of vicious cycles: “psychophysiological feedback loops through which problems amplify and become self-sustaining”⁵. For Kirmayer, interventions can be nevertheless aimed at individual components or mechanisms with the view to “interrupt or change the vicious cycles that amplify and maintain symptomatology, disability, and distress”⁶. He asserts that no particular level of symptomatology in psychopathology should be assumed to take causal priority, and that an intervention at any level may interrupt vicious cycles. This position does not fully address an important limitation of bio-psycho-social models. While the complex information in pathogenesis can be usefully formulated as a vicious cycle, how can clinicians make decisions about how and where to intervene?

In arguing for the explanatory power of a biosemiotic perspective, Favareau contends:

...a system that is alive must maintain itself in a constant state of self-reconstruction – this means that it must simultaneously and incessantly negotiate the ordering of both of its own internal set of intra-system relations as well as its macro-system level interactions with an externality that is constituted by a whole other set of internal relations of its own, with a third set of “mediating” relations at the interface between the two. Merely to *survive* this incessant triadic existential demand (much less to *evolve* within it) necessarily introduces into the phenomena under examination the proximate and system-centric

² Discussed in B Rubik and H Jabs ‘The human biofield: New opportunities and challenges’. *Cosmos and History: The Journal of Natural and Social Philosophy*. (2018), p-157

³ B Rubik and H Jabs cite several references claiming support for detection of pathology with biofield technologies, including breast cancer detection: in Subbhuraam, V.S., Kaw, G., Ng, E.Y.K., Rajendra, A.U., Chong, B.K. Use of skin surface electropotentials for breast cancer detection—preliminary clinical trial *Journal of Medical Systems* 35; (2011): 79-86. Cited in B Rubik and H Jabs, p.157

⁴ L J Kirmayer, *Revising psychiatry: toward an ecology of mind in health and illness*, p. 635.

⁵ *Ibid*, p-641

⁶ *Ibid*

relations of function, use, purpose, and goal – as well as the superordinate relation needed to achieve all of these relations, the relation of substitution or “standing for” – the biological relation of *sign*.⁷

Acknowledging these telic properties of organisms, Favareau argues, in no way introduces pseudo-scientific or vitalist principles to biology, nor diminishes the need or success of examining the material aspects of biological phenomena. Rather, he argues, taking a biosemiotic perspective can add greatly to our understanding of living processes, although the onus lies with biosemioticians to demonstrate the “fruits” of this perspective⁸. The ecological model attempts this by exploring the potential of a biosemiotic perspective on the understanding and treatment of disease. The success of biomedicine in identifying and controlling biological phenomena associated with pathology is unquestioned. The detrimental effects of this approach on overall health as an autopoietic quality can be clarified from a biosemiotic perspective. Unlike the biomedical model, a biosemiotic model can account for, predict, and influence autopoietic variability and change for an individual patient.

The model emphasizes that a complex living system is also a self-simplifying system. Symptoms are the responses of organisms to differences that make a difference to them, even as participants in broader fields of social semiosis. Treatment plans need to identify these most important variables comprising the problem space from the point of view of the patient. Vicious cycles include avoidance and control compensations, and are entrained around need states. Conceived as loci or nodes of regulatory processes, hypercoherent states take over from fractal criticality. To understand these processes, both the formal dynamics and telos of pathogenesis need to be taken into account in assessment.

Disease categories and pathogenic forms

As stereotypical patterns of responses, often associated with specific events or pathogens, entrained pathogenic states been treated in biomedicine as disease entities (such as depression, diabetes or typhus) caused by pathogenic forces acting on the organism. An aim of this thesis is to apply a biosemiotic field ontology to multi-morbid pathology, considering formal and telic processes. Formally, a vicious cycle can be understood as a spatio-temporal structure. Its basin of attraction, comprising all symptoms, can be considered a locus of sensitivity or a focal level of responses. This level of response is maintained by subserving levels and constrained by supervening levels (including compensatory endogenous responses). Its characteristic repetitive behaviour (symptoms) may be punctuated with chaotic breaks or shifts, as critical subserving processes break down under the load of maintaining compensations. This may lead to the focal level of pathology dropping deeper toward more fundamental levels of organization, compromising more critical regulatory processes, and altering the boundary conditions of the whole. This in turn constrains the development of further compensatory responses, increasingly compromising the functioning of the whole.

Conceived as a Chladni pattern, this dynamic form is like a complex standing wave pattern, wherein nodes stand in for major regulatory processes and structures in the biofield hierarchy. In normal functioning, these nodes are local basins of attraction regulating semi-insulated processes⁹. In hypercoherence, they become foci of an entrained dominant

⁷ D Favareau ‘The Evolutionary History of Biosemiotics’. In M. Barbieri (ed.), *Introduction to Biosemiotics: The New Biological Synthesis*. (Berlin: Springer, 2006) pp. 50-51

⁸ Ibid

⁹ Recall the orchestra metaphor suggested by Ho (quoted in Chapter 4) suggesting that each component or node acts like an instrument in the orchestra, playing its own piece in tune or out of tune

frequency pattern, similar to the characteristic patterns formed by inanimate fields according to their sensitivity to specific frequencies (their natural harmonics).

Animate fields can alter their sensitivities and forms, but nevertheless they exhibit homeorhetic tendencies comparable to natural harmonics. This may explain why general patterns of symptoms may be observed in multiple patients responding to similar perturbations. Common symptoms associated with particular perturbations reflect the needs common to humans and the processes common to pathogenesis, as well as the perturbative force itself. How organisms initially accommodate or otherwise respond to these forces may tend to be typical of highly constrained adaptive sequences, like the typical stress response stages discussed by Selye and Kabat-Zinn. This view is consistent with Kauffman's contention that any developmental process, being constrained by similar dynamical principles, will generate some morphogenetic patterns more readily than others¹⁰.

Nevertheless, even typical responses are still the responses of the patient. Patients also inevitably have their idiosyncratic responses, based partly on their historical and contextual particulars, and partly on variations in responses as compensations develop. Inherent variation is noted in even highly heritable pathologies¹¹ These idiosyncrasies can aid rather than hinder assessment by pointing even more clearly and subtly to the important variables for that particular patient.

When organisms maintain a dynamic form in response to a specific need or problem, this form tightly constrains their information-sensitivities, sometimes to the point that awareness of themselves and their worlds narrow to a very small set of variables related to the problem. The unsolved problem causes form to be maintained via hypersemiosis: entrainment of sensitivity and responses to particular signs. Unawareness of other possibilities becomes a maintaining cause of vicious cycles. As compensations develop, and the centre of gravity shifts further from the edge of chaos, the original unsolved problem itself can be "avoided", forgotten, or obfuscated, yet may go on dominating organisation. It becomes "the new normal" and the patient desensitises or habituates to it.

The telos of pathogenesis: from sensation to narrative

The task of assessment includes noticing responses that the patient herself may pay little attention to. To achieve this, the assessor must enter the problem space of the patient rather than trying to fit the patient into a diagnostic category.

Both assessor and patient can organise and understand the problem space as a kind of embodied narrative process I term an adaptive sequence. As the patient engages with this story, the core variables concerning the unsolved problem emerge. Following the self-simplifying organisation of the patient, both assessor and patient gain a clearer idea of key needs and compensations from the viewpoint of self-observation.

A narrative understanding of pathology is not merely an epistemological approach. Many narrative theorists consider a narrative-process ontology essential for understanding lived experience and self-creative processes, yet the definition and causal power of narrative

¹⁰ Kauffman proposes mathematical principles governing the development of similar spatial patterns in diverse biological systems. *The Origins of Order: Self-Organisation and Selection in Evolution*. (New York, Oxford University Press 1993) p. 577. See also discussion of homeorrhexis in Chapter 4

¹¹ L Kirmayer, 'Re-visioning Psychiatry: Cultural Phenomenology, Critical Neuroscience, and Global Mental Health' p. 631

process remains controversial¹². Kirmayer claims narrative power obtains mostly from “higher-level” socio-cultural constraints, and phenomenological approaches including narrative assessment, and analogical or metaphorical representations of an individual’s pathology, are epistemological over-simplifications reflecting supervening social stories¹³. Hutto argues for an embodied narrative ontology wherein enacted relations of all kinds are causal in formation of self-other boundaries, identity, problems and solutions, emotions, cognitions and so on¹⁴. Narratives develop from the interactive unity of the organism, and the world sensed and lived by it: the *Umwelt*.¹⁵ The organism’s felt sensations comprise a basic level of coherence: self-similarity constraining the form of self as dynamic pattern formed across multiple components and processes¹⁶. Fully developed self-reflective narrative representations, and their telic and agentic power, develop from these more basic embodied information-sensitive processes¹⁷. Not every narrative is necessarily an adaptive sequence concerning felt needs: but every adaptive sequence, whether trapped in hypersemiosis or actively trialling variations, is an embodied, symptomatic narrative-in-process.

A narrative-based assessment is focused on the problem-space, taking into account not only verbal and physiological information, but bodily sensation, behaviour and movement, considering all symptoms as attempts to meet or compensate for an unmet need. The therapist’s task is not necessarily to identify the unmet need, but to assist the patient to bring salient features of the problem space to awareness. The patient’s narrative is a dynamic pattern that embodies and enacts problem spaces, their instigation, perpetuation, consequences and transformations.

A shared reflective narrative assessment process initiates the changes in awareness that accompany transformation of a problem space. Increased awareness of problems, or our responses (sensations, thoughts, behaviours) constitutes the expansion of awareness that occurs with self-observant attention proposed to be the basic causal process in mindful and embodied therapies that enables further change.

Intervention

The individual organism produces symptoms as responses to needs. To the extent that responses to needs can vary to find or create a viable strategy to meet the need or make the need redundant, healing occurs. The individual can obstruct her own healing by failing to recognize the meaning of her symptoms as responses to perceived needs, perhaps due in part to the influence of the biomedical perception of pathological entities caused by pathogens acting on her. Strategies will then tend towards control and avoidance, resulting in a lack of

¹² D Hutto discusses these controversies in ‘Radical Enactivism and Narrative Practice: Implications for Psychopathology’. pp. 43-66; also D Hutto, N M Brancazio, and J Aubourg. Narrative practices in medicine and therapy: philosophical reflections. *Style* 51, 3 (2017) pp. 300-317

¹³ L Kirmayer, ‘Re-visioning Psychiatry: Cultural Phenomenology, Critical Neuroscience, and Global Mental Health’, pp. 633-635

¹⁴ D Hutto, N M Brancazio, and J Aubourg ‘Narrative practices in medicine and therapy: philosophical reflections’ pp. 300-317

¹⁵ K Kull ‘Jakob von Uexkull: An introduction.’ p. 1-59

¹⁶ S Gallagher ‘A pattern theory of self’ *Frontiers in Human Neuroscience*, (2013), p-4

¹⁷ D Hutto, Truly enactive emotion. *Emotion Review*, 4:1., (2012) pp. 176-181

self-awareness of needs and therefore failure to address these, and likely development and maintenance of compensatory symptoms. Interventions may need to address this “complex” of self-generated and iatrogenic obstructions to healing by educating patients that symptomatic avoidance or control may perpetuate underlying problems and even create new ones.

Being mindful and accepting of symptoms/responses continues the therapeutic process. The therapist may stand in for the attentional deficits of the patient by co-creating a self-observant space. This could include observations offered by the therapist, enacted emotions or situations, or the collaborative development of experience into narrative, creating a narrative distance wherein transformations might be possible. Whichever methods are involved, collaborative self-observation is a kind of resonant relation between patient and therapist, noticing sensitivities or “what feels important” and avoiding defensive, compensatory responses.

In general, reflective openness towards one’s own experience, including unwanted experience, acceptance of uncertainty, and willingness to trial variations seem important higher-order values for therapists to embody and explore with patients to assist them to move on from entrained ways of being. These values are higher-order regulators of the non-specific (and therefore more open to interpretation) kind discussed by Rappaport¹⁸. From this therapeutic stance, there is little need for a therapist-as-expert to explicitly substitute specific “healthy” values in place of the assumed “unhealthy” ones. Rather the system is assumed to have an inner wisdom to decide for itself how to recognise, prioritise and meet needs, even when the therapist is acting as part of this system. Even in more directive therapies like ACT, therapists help identify the patient’s higher or more general values, and promote trialling of valued actions.

Homeopathy exploits the heightened and highly selective sensitivity of patients to resonant frequencies, using very low energy interventions. The “information” proposed to be present in a homeopathic remedy may provide a kind of resonant frequency relative to the state of the patient. The means by which a resonant frequency is identified is painstaking and the analogy must be close to be effective. The analogic intervention in microwave resonance therapy is far simpler: exposing the patient to a range of frequencies until a resonant response is felt by the patient, then repeating this exposure to the oscillatory similitude until the patient desensitises to this frequency. The patient’s bodily response, not the therapist’s values or comparative data, identifies the therapeutic signal. The response suggests an entrained endogenous frequency has been displaced.

These approaches seem to assume the power to change, and heal, resides firmly within the individual. The concept of problem space includes all salient variables and relations, any of which might be transformed, yet pathogenesis and healing are conceived primarily as endogenous adaptive processes. How can the limits to endogenous healing be known, or managed when they are not known? And what does healing by trialled variation mean when any given individual may be attempting to adapt in a noxious or impoverished environment?

The patient’s ‘environment’: an ecological perspective

A noxious environment is not merely a space in which dangers and pathogens dwell. Healthy environments are not those that are merely free from dangers. Environments are wider systems in which people participate, however dysfunctional, disengaged or enmeshed that

¹⁸ As discussed in Chapter 5, Rappaport argues that general values, or higher order regulators, have greater transformative power for whole systems due to their non-specificity. In *Ecology, Meaning and Religion* p. 154

participation might be. In *Nihilism Inc*, Gare argues that Western cultural values and practices are dominated by the mechanistic worldview, and this undermines the health of humanity and the entire ecosystem. He contends that to adapt to this is to participate in a vicious problem: perpetuating it and the inability to see beyond it¹⁹. The biomedical system alienates patients from their pathology and healing processes. Adapting to this in the sense of ‘getting used to it’ is to participate in one’s own disempowerment and increased ill-health. On the other hand, adapting may include awareness of needs for transforming self-other relations, and trialled variations aimed at achieving this.

Identifying and removing controls and conditions that obstruct healing may involve defining those general criteria and values considered indicative of healing. This is consistent with Gare’s argument for replacing dominant mechanistic values and practices with those that enable individuals to more fully participate in acts of responsibility toward their own and others’ wellbeing²⁰. This responsibility entails an appreciation of the interdependence of pathogenic and healing processes between different levels of the ecosystem. Gare describes the transformation of people “from seeing themselves as beings standing outside the world trying to control it to experiencing themselves as processes of becoming actively participating as cultural beings in the becoming of the world²¹”. At the level of the individual patient, this entails her active participation in the becoming of her illness and health. This participation is not limited to the physical boundaries of the body; indeed the boundaries of the problem space are distinguished by the patient herself.

Improving the health of living systems at any level is not simply a matter of identifying and imposing “healthy” interventions or values. Healing entails the ability to step out of entrainment and be present with one’s problem space and more fully aware of needs. It entails the freedom to vary: including making reflective observations and choices, and trials that may transform the patient’s experience and engagement in her lifeworld. Healing, and problem-solving generally, entails an ability to notice, evaluate and respond to the outcome of trials. This is an ongoing process that cannot be reduced to the mere presence or absence of symptoms. A critical variable in any patient’s problem space concerns relations with the healthcare culture. While ethical codes of conduct stipulate constraints on these relations, such as informed patient consent for procedures, this thesis argues for greater awareness of patient needs and more trialled variations in response to these within the wider healthcare system.

Biomedicine as entrained problem space

As described in Chapter One, much research exists to show that iatrogenic disease is a major health concern in developed countries, and its prevalence indicates it is a factor in the rising incidence of chronic multimorbid pathology. The control orientation of biomedicine invalidates symptoms as responses reflecting the needs of the patient. Instead, pathogens are targeted with forceful interventions. These interventions are antagonistic to the symptoms and therefore the underlying need state. They may obstruct self-healing processes by impairing the awareness of the patient, provoking defensive responses, and alienating patients from engaging in their own adaptive sequences and potentials for transformation. From the perspective presented in this thesis, this outcome should be considered a syndrome combining responses to the intervention with those of the original pathology, resulting in

¹⁹ A Gare, *Nihilism Inc*, Chapter 7

²⁰ *Ibid*, pp.403-405

²¹ *Ibid*, p.405

iatrogenic multi-morbidity. The ideal of biomedicine is overwhelmingly concerned with isolating and controlling parts and pathogens, and the more it succeeds, the more iatrogenic disease will result.

Integrated approaches using both biomedicine and complementary or alternative medicine were endorsed in a 2005 US government health board advisory paper as a means of improving outcomes by placing patient needs and preferences at the centre of healthcare²² Recognising that reductionist-type research practices are not appropriate for measuring the healing effects of many alternative therapies, the paper argues for greater acceptance and support for research focusing on real-world effectiveness in improving overall health rather than clinical efficacy in controlling symptoms²³, including single-patient based designs, observational and cohort studies, “case control” studies²⁴, and qualitative research to “help interpret the results of effectiveness studies”.²⁵ However, the main recommendations of the paper: increased focus on tailoring treatment to individual patient needs, and increasing the participation of patients in making healthcare choices, are undermined by failing to address the same limitations that apply to bio-psycho-social models. These are an attempt to address complex interrelated causes, however these are treated as multiple forces acting on the patient. The resulting multi-layered case formulations, like any other complex system, must find form and purpose to be coherently organised. Bi-psycho-social models, lacking a biosemiotic ontology, are organised by giving default priority to the most forceful causes and controls of pathology from a mechanistic viewpoint.

It is necessary to identify and challenge the ontological problems in the biomedical and BPS approaches in order to develop coherent models based on a shared ontological ground, such as that proposed as the ecological model. Likewise, merely combining biomedical and ecological approaches would confound the response of the patient and evaluation of the case. Is inflammation relieved due to the close resonance of an analogic intervention, or have pathogens been controlled by an antibiotic? Are the symptoms remaining after treatment to be understood as part of a healing crisis, or a failure of treatment? Of course, these kinds of distinctions may not matter to the suffering patient in the short term. Patients and therapists alike are motivated to see rapid relief of suffering, and rapid control of symptoms is sometimes essential.

The therapies discussed in Chapter 8 and 9 may require more time to assess and intervene compared to the conveyor-belt of contemporary medical care, and healing responses can be slow and uncertain compared with the rapid symptomatic relief often obtained with control interventions. If an ecological model is embraced, biomedical and biosemiotic interventions can be used pragmatically, with the view to managing severe or dangerous symptoms biomedically, whilst minimizing obstructions to healing processes. This could be achieved by using a least force possible approach and avoiding long-term symptom control interventions. Iatrogenic responses themselves can be treated analogically if they

²² *Institute of Medicine of the National Academies. Alternative and Complementary Medicine in the United States. Committee on the use of complementary and alternative medicine by the American Public Board on Health Promotion and Disease Prevention. S Bondurant (chair) (National Academies Press, Washington D.C. 2005) p.220*

²³ *Ibid*, chapter 4

²⁴ *Ibid*, p. 114. Case control studies seek to retrospectively identify factors, including treatment undertaken, and correlates with outcomes.

²⁵ *Ibid*, p. 119

become entrained. Patient education concerning pathogenic and healing processes, rather than pathogens and their control, would be essential and has already been developed in the use of mindfulness and other holistic therapies discussed here.

Limitations to this research

There is no question that the ecological model, and biosemiotic interventions, require a great deal of further research and validation. Indeed, the aim of this thesis is to argue the importance of further research. While there is a general acceptance of the critical need to develop new approaches in healthcare to manage complexity, substantial barriers to the development of these exist. The belief that the causes of illness can and should be isolated and controlled is so dominant, even in psychological medicine and alternative approaches, that the powers of self-pathogenic and self-healing processes are almost a complete mystery to science.

This thesis argues that interpretive processes are causal at every level of a living system, and that the information-sensitivity of the patient makes the concept of analogic interventions and transformative responses a plausible and important causation in biology. From a biomedical perspective, mindfulness interventions may only have an indirect effect on physiological health, such as supporting immune function by reducing the subjective experience of stress²⁶. Most of the evidence presented in Chapter 8 indicated only an indirect and limited causal power of self-observation, whether embodied or narrative, beyond the psychological level. Whatever physiological healing value attentional processes may have could be explained away as merely subjective transcendence of suffering, or a placebo effect. This argument could be made against self-observation and other kinds of resonant interventions.

However, these ‘explanations’ are based on a mechanistic ontology that cannot account for any kind of placebo or psychosomatic phenomena. From a biosemiotic biofield perspective, the placebo effect may be explained as an interpretation by the patient that gently interrupts entrainment. Low energy analogic interventions: self-observation, resonant microwave frequencies, and homeopathic remedies, can also be explained this way. Homeopathy claims effective treatment of patients with compromised consciousness, including comatose patients, infants, animals and even plants. This suggests that the analogic relation has a power to interrupt entrainment that is not reducible to the values, conscious interpretation, or even the awareness of the patient.

Even if this is accepted, a model of health based on felt sensation, gentle analogic interventions and whole-system response of the patient, wherein the limits to self-healing are unknowable, may seem inherently inadequate and unreliable to guide and evaluate health interventions. Employing the most reliable means of controlling disease by removing pathogens and controlling symptoms is the ethical priority underlying evidence-based medicine, and this is strongly reflected in healthcare policy and research funding²⁷. Criticisms of alternative approaches generally reflect concerns that more good quality supporting research is needed, however there exists a strong bias against developing the kinds of

²⁶ J K Kiecolt-Glaser, R McGuire, T Robles, and R Glaser, Psychoneuroimmunology: psychological influences on immune function and health. *Journal of Consulting and Clinical Psychology*. 70, (2002) pp.537-547

²⁷ I Kerridge, M Lowe, and D Henry. Ethics and evidence-based medicine. *British Medical Journal*, 316; (1998) p.1151

methodologies needed to achieve this²⁸. The contribution of this research lies in challenging the flawed ontology assumed in biomedicine that underlies this bias, and developing an alternative ontology and epistemology based on a dynamic process view of pathogenesis and healing.

A limitation to the research goal of validating the model by comparison with existing therapies is the limited space for the exploration of these. It is acknowledged that many other alternative therapies claim a dynamical systems ontology and use non-forceful interventions. Nevertheless, it is hoped that the examples offered are sufficient to illustrate the application of an ecological model, and to meet a related research goal: to develop a common conceptual ground and language for these diverse therapies based on self-organising complexity. According to the model, mindfulness-based and other low-energy resonant interventions can be considered biosemiotic medicine, in that these prompt dynamical changes by exploiting the sensitivities of a need state. Making these causal processes explicable is essential for the further development of these kinds of therapies and their increased acceptance in the biomedical community.

Conclusions

The focus in this thesis is on the sensitive, need-feeling, response-creating organism in the middle of perturbations and adaptive processes. At this level of biosemiotic organization, no necessary limits or distinctions between organism and world, nor inherently pathogenic or salutogenic forces or responses, are proposed. This position is consistent with a definition of semiotic thresholds as interpreted, established by means of habit, and evolved by living systems themselves²⁹. No symptom is seen as pathological, nor is an ideal or homeostatic concept of health proposed when healing is seen as process of living that includes the production of symptoms. Pathogenesis is neither exogenous nor endogenous, but a product (and cause) of the semiotic relations embodied by the patient, including relations with the self. These relations are intentional: conceived as *being about* felt needs, from basic biological metabolism and regulation, to special purpose formation, to narrative representations of selves engaged in problem spaces.

An important implication of acknowledging autopoiesis in medicine is that it is not possible to predict the outcome of external regulatory interventions, or to establish “normal” system values as standards for evaluating health³⁰. Individual variation in responses, including iatrogenic effects, is viewed as a problem from a mechanistic perspective, and therefore a legitimate target for control. In contrast, a core concept in biosemiotic theory is that organisms are sensitive to and respond non-linearly to differences that make a difference to them. This has important implications for understanding illness and healing, and developing new approaches in medicine. Variation in responses, and symptoms generally, should be taken to reflect formal and telic causal processes in the patient organized around

²⁸ For example, funding is overwhelmingly directed toward existing research programs in biomedicine on the grounds that “reasonably good evidence for their effectiveness already exists”, perpetuating this bias. In E Ernst, M J Cohen, and J Stone. Ethical problems arising in evidence based complementary and alternative medicine. *Journal of Medical Ethics*. (2004) p. 158

²⁹ This definition is based on a convergent definition suggested by C Higuera, and K Kull, The biosemiotic glossary project: biosemiotic thresholds. *Biosemiosis*. 10, 1, (2017) pp.109-126

³⁰ P Bellavite and A Signorini *Homeopathy: A Frontier in Medical Science* p.84

the patient's needs. Changes in these organizational processes can be identified as pathogenic or salutogenic.

This thesis presents further evidence that forceful interventions undermine healing processes in individual patients, much as previous research has argued that mechanistic control strategies undermine the health of societies and ecosystems. According to the ecological model, the absence of symptoms as a state of health is not only inadequate: it is applicable only to an inanimate object. Healing does not always mean the rapid disappearance of symptoms: indeed, symptoms may occur as part of self-healing processes and need to be understood and managed in this context. Pathogenesis and healing progress can be assessed according to an understanding of general dynamics in living fields: in particular, the edge-of-chaos self-similar pattern of normal functioning, the entrainment and fragmentation of hypercoherent states over time, and organizational transformations prompted by sensitivity to salient signs, changes in attentional processes, and variations in self-other relations.

From the point of view of the sensitive organism, antagonistic, agonistic or analogic sign relations suggest probable responses. Agonistic relations may continue to feed the existing state of coherence and reinforce entrainment. Antagonistic signs or forces might provoke defensive responses, or compensations, and may entrain fragmentary organization: a complex vicious cycle. Biomedicine, being antagonistic to need states, may control symptoms but at the same time it neglects, and may worsen, health as a property of whole-system dynamics. The analogic sign-relation may be produced by self-observation, enacted or narrative self-reflection, or prescription of a resonant remedy or frequency. Low energy resonant frequencies may disrupt hypercoherence sufficiently to allow for variation in organization, but not so much as to prompt a defensive or compensatory reaction. This explanation is consistent with theories concerning the causal effects of small energy fluctuation: that small chaotic fluctuations in oscillatory harmonics in biological fields/systems prevent entrained patterns of attention and behaviour, enabling adaptation. This thesis argues that interrupting entrainment is a first step toward noticing other needs and choices and enabling adaptive transformations.

A semiotic biofield ontology invites a pragmatic solution to understanding health and healing, consistent with concepts of self-similar coherence and stabilization through variation. The inner wisdom of the organism is based on sensitive, pragmatic and self-reflexive engagements, not the actualization of an ideal outcome or the return to a homeostatic setpoint. Characteristically, healing involves transformations: the interruption of entrainment, the expansion of the problem space from a narrow, special purpose focus (and narrow sensitivity/responsiveness) to a broader space of increased possible causal variables and potential change, wherein edge-of-chaos dynamics are enabled. Transformations of need states entail the trialling of interpretations, responses and strategies, and discovering which variations are viable.

The complexity revolution in science has been underway for several decades. Despite recognition that change is needed, biomedicine is yet to embrace the implications of self-organising complexity, partly due to its reliance on an evidence-base that is dominated by a mechanistic metaphysic. It is hoped that the argument presented here clearly makes the case for continued research using an ecological approach to explicate the unique causal processes

of living systems and to guide decisions for interventions in these dynamic fields, especially those concerned with assessment of pathogenesis and intervention to promote healing.

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