Bridging Complexity and Ecology: An Outline of Health Ecology

Vladimir Dimitrov
School of Social Ecology and Lifelong Learning,
University of Western Sydney, Hawkesbury Campus,
Locked Bag 1797, South Penrith DC, NSW 1797, Australia

Theoretical discoveries and practical insights of complexity science lead to a new understanding of health as a vital characteristic of the all-embracing web of life. The new concept of health ecology developed in this paper reveals delusions in the medical model of health currently used, and illuminates a way to health by continuously strengthening the self-healing capacity of nature and humans.

1. Introduction: Emergent dynamic ecologies

In 1982 Stephen Wolfram pointed out a new direction in human inquiry: development of a general theory of complexity in nature [1, 2]. When projected on the conceptual space of ecology, this direction reveals a new unifying framework for ecological studies: the framework of emergent dynamic ecologies. This framework includes environmental ecology, human ecology, social ecology, deep ecology, ecology of mind, ecology of learning, and is widely open to embrace new ecological discoveries.

The term "ecology" is rooted in the Greek word *oekos* meaning "house." In the same way as the house provides a shelter for people to live, the universe provides a "shelter" for the infinite manifold of inanimate and animate forms to exist and evolve together. The house—*oekus*—is a place where its inhabitants relate to one another and dynamically interact. Ecology studies different aspects of these interrelationships and interactions. In this sense, ecology is similar to complexity science, as the latter is also focused on studying dynamic interrelationships and interactions.

While ecology explores the astonishing variety of the outward manifestations of the dynamic interactions in nature and society, complexity science tries to reveal their inner secrets. What propels them? What sustains their emergence? Where does their self-organizing ability come from and how does it manifest? Into what kind of patterns do the interacting entities self-organize? How do these patterns influence each other? What are the factors that reinforce or impede the dynamic

interplay of the self-organizing patterns? What makes them evolve, transform, or dissolve?

The unified framework of emergent dynamic ecologies serves as a bridge between the two holistic branches of human inquiry: ecology and complexity, enabling ecological exploration of the existential dynamics and the study of their self-organizing power. The unified framework not only leads to mutual intellectual enrichment of ecology and complexity, it also gives birth to new exciting areas of research.

In this paper we outline the emergence of health ecology, a new holistic inquiry into human and environmental health, within the general framework of emergent dynamic ecologies which include the following.

- *Environmental ecology* deals with the dynamic interactions of all the existential forms of nature (unfortunately, the number of these forms is decreasing as a result of the ecological ignorance of those who have power in today's society).
- *Human ecology* focuses on the interrelations of humans and their natural and artificial (human-made) environments.
- *Social ecology* considers human society as a bearer of infinite dynamic relationships between individuals, groups, organizations, nations, states, cultures, machines, and so forth in their inseparable interconnectedness with nature.
- *Deep ecology* pursues the development of systemic conceptual frameworks to assist personal and social decisions that emerge from the spinning web of human interactions and affect the natural environment and life [3].
- *Ecology of mind* studies the process of human thinking as a continuous dynamic emergence of thoughts, feelings, and experiential phenomena out of the dynamic interactions of an infinity of inner and outer factors [4].
- *Ecology of learning* explores the factors and conditions that facilitate the process of learning and searches how to increase its efficiency, in the sense of opening new possibilities for realization of the self-organizing impetus of the living entities, at any level of the web of their interrelationships and interactions [5, 6].

The theoretical discoveries and practical insights of complexity science are applicable to the study of each of the above ecologies, as well as to the whole edifice of emergent dynamic ecologies.

At the focus of health ecology is the unique web of life- and health-supporting interactions at all levels of their self-organizing emergence: intrapersonal and interpersonal; between the individuals and the environment, as well as between the individuals and society; between society and nature, as well as between society and the whole evolving universe.

2. Medical model versus the model of health ecology

Existing medical practices are primarily concerned with how to fight with diseases and diseases are considered "enemies" of people. People must be prevented from being invaded by these enemies. Once invaded, people become "patients" from which the diseases must be removed so that they can be cured. "Cured" is the key term in the medical model used in our days; there is not much discussion about "health" in this model.

The medical model absorbs most of the money spent on health, its prestige is almost unchallenged, especially in developed nations, but contemporary thinkers about health are increasingly aware that this model is limited, inadequate, and often dangerous. Medical interventions are becoming ever more complex and costly, causing unwanted side effects that produce litigation, which raises the cost of the treatment and reduces its availability in a vicious circle.

Many people today look for alternative approaches based on holistic methods of healing rooted in the wisdom of the ancients. "Heal" comes from the same root as "whole" and "holistic:" restoring wholeness, restoring health, which has nothing to do with fighting with or removing disease.

In the medical model, practitioners cure patients of diseases. In the healing model, a range of agents can heal the patient, who is always a dynamic part of the process. This crucial part of the process can be understood as self-healing.

The model of health ecology is centered at one of the main conceptual roots of complexity science: self-organization. When projected on health, self-organization refers to self-healing, that is, the self-sustaining or self-restoring ability of nature, which has been passed to all living creatures.

We can either strengthen and realize our natural self-healing potential, or weaken and destroy it, depending on our culture. Death in the health ecology model is an inevitable manifestation of transitoriness of the physical bodies of the living forms. The occurrence of the moment of death in humans is often accelerated by various traumas, including diseases that emerge as a result of living consciously or unconsciously under conditions that are destructive to health and impede the ways of realizing our self-healing potential.

These conditions are deeply rooted in the culture of our society, which involves also the predominant attitudes and dispositions of people. Unfortunately, many of the dominant cultural patterns in the world today value competition and the accumulation of profit and power. Such "cultural" behaviors increase the chance of severe ecological disasters in nature. This intensifies stress at the individual and social scales, in-

ducing feelings of hostility and worthlessness in life, and therefore act against our health.

The start of the new millennium (with horrible acts of terrorism and war in response to those acts) is marked by a contemporary culture that strongly opposes harmony in nature and thus endangers both human and environmental health, as they are two sides of one and the same coin.

3. Human and environmental health: The approach of health ecology

Complexity theory contains a repertoire of models which can be used to explore different aspects of the turbulent space of human existence in which health and "unhealth" interact with each other, and with other aspects of human experience and the natural world.

3.1 Integrated ecological space

In order to capture a sense of the interrelatedness of life the concept of integrated ecological space (IES) [7] has been proposed. It is a space of complexly interwoven relationships between living beings and their environment. In terms of this concept, every living entity represents a network of mutually connected agents, or interdependent constituents, which constantly interact with one another and with the environment to ensure that entities survive and evolve. The networks of living entities are not separated, but build an all-embracing dynamic web of relationships that covers the whole existential space.

The drive to restore and maintain conditions of wholeness and integrity in IES can be seen as a fundamental emergent property of the whole dynamic web, a property that underlies the holistic concept of health ecology in the complexity-based unifying framework of emergent dynamic ecologies.

Through the prism of complexity science, the potential for self-healing is seen as an inherent self-organizing urge of each living entity towards states of integrity and harmony, both at an internal level (related to the functioning of the constituents of this entity) and at external levels (related to the functioning of the whole dynamic web in IES).

In the model of health ecology, disease is not a self-contained, isolated pathological event with a set of causes acting in a linear way. A predisposition to disease occurs when integrity breaks, either at the level of an entity or at the level of the whole web of relationships in IES. The broken integrity may create obstacles that impede the self-healing ability of living entities. In human beings, these obstacles can be rooted in different aspects of culture: physiological, ecological, social, and psychological (mental, emotions-based, or/and spiritual).

3.2 Sustaining the self-healing potential

Solé and Goodwin, biologists from the Santa Fe Institute of Complexity, use the concept of "dynamic attractor" to understand the surprising and paradoxical phenomenon of self-healing [8]: "health is the typical or natural condition of an organism; it is the dynamic attractor to which the self-healing organism tends to return spontaneously."

The integrity of the whole web of interrelationships is responsible for sustaining the dynamic attractor of health. At the same time, the self-healing dynamics supported by this attractor play a crucial role in sustaining the integrity of the whole dynamic web of interrelationships in IES.

Because of this vital interdependence, anything in IES that destroys the web of relationships, anything that divides, separates, or excludes, appears as an obstacle for realization of the self-healing potential of the living entities.

3.3 Vortices of health

The realization of the self-healing potential of each living entity depends on the interplay of many factors in IES. Some of these factors emerge out of the dynamic web of relationships between the entities, the rest of them appear as a result of the interaction between the entities and their environment. In order to capture the wholeness of the dynamic interplay of interrelationships under conditions of high energy, it is illuminating to model it as characteristically taking a vortical form, similar to that of a whirlpool or tornado, able to produce powerful self-organizing forces.

Our hypothesis is that these vortical forms of interactions between the multitude of factors in IES may be responsible both for sustaining the self-healing potential of each entity and for activating it into a powerful urge towards integrity and harmonious dynamic relations with the environment, and therefore towards better health. We refer to these vortical forms as *vortices of health*.

While living at the vortex of health, an entity feels empowered to realize its self-healing potential. Living outside the vortex, its self-healing ability may diminish and disappear; various diseases may emerge or take a more severe form, and death comes closer. Conceivably, human beings can learn how to energize the vortices of health and thus facilitate and support the self-healing forces which emerge out of them. These forces keep the dynamics in IES at the attractor of health, a metaphor for the "healthy area" in IES. The key role for health ecology is to explain how people can "fire" the vortices of health and thus sustain their lives and the life of nature at the attractor of health.

3.4 Bifurcations in integrated ecological space

In chaos theory the occurrence of bifurcations marks transition from order to chaos in the dynamic model of the population growth in biology. In the model of health ecology, "bifurcations" can be used to describe the transition from health to unhealth occurring within IES at individual, social, or/and environmental levels.

One can consider the emergence of the ozone hole, the green house effect, disappearance of certain kinds of species, soil degradation, and so forth as manifestations of bifurcations occurring in the dynamics of nature. The collapsing health of a drug (or alcohol, or nicotine) addict reveals the emergence of bifurcations in the form of qualitative changes in individual dynamics that may be irreversible. An irreversible change is signaled by a chronic disorder that is likely to be accompanied by a decrease in the self-healing potential of the individual.

At minor scales, breaks and restorations in IES occur continuously. Their interplay leads to "the edge of chaos," a concept used in complexity science to explain dynamic behavior at the intermediate level between order and chaos. When applied to health ecology, the edge of chaos refers to a region in IES where the living entities need to balance themselves so as not to drift into too much disorder on the one hand, and too much order on the other hand. Such balancing requires a high level of self-organizing ability of the living entities, that is, ability for co-adaptation and co-evolution [9].

As far as the self-organizing ability of the species, which reaches its highest level at the edge-of-chaos regions in IES, manifests through their self-healing potential, and the latter is maximized when the species dwell at the vortex of health, we can conclude that the vortices of health exist at the edge of chaos. Both the orderly and disorderly patterns of individual dynamics are equally dangerous for health; the former leads to repetitive behavioral patterns, stereotypes, and addiction; the latter leads to disharmony and break one's connectedness with the environment. It is the edge of chaos that facilitates the emergence and sustenance of the vortices of health.

3.5 Double harmonious resonance

The medical model is linear: X causes or contributes to disease D, Y alleviates or cures it. The experience of being or becoming well or ill often shows a more complex pattern of causality, requiring other ways of representation. One of these that comes from theories of complexity is the idea of harmonious resonance [10]. If being healthy means to be in a state of integrity and harmony, a living entity may be in such a state if it functions in harmonious resonance within its own (internal) network of agents and with the larger (external) whole of the environment. And

it is within the areas at the edge of chaos in the IES where this two-fold harmony manifests through the vortices of health.

If the agents (organs, cells, and systems) of a living organism resonate harmoniously with each other as an inseparable whole and with their environment, the organism is more likely to be healthy. When harmony and integrity are destroyed and agents within the organism "speak" separately to each other and to the environment, then a kind of disease or illness is under way.

If the influences between the internal agents of the individual organism, and those between the latter and its environment are reciprocal, as is assumed in holistic models of health, then resonance needs to be understood accordingly as a kind of double harmonious resonance, that is, a resonance that is both internal and external.

Is this kind of resonance possible? Yes, it is, as it occurs in IES, where the species and their environment are considered inseparably connected. So, harmony in functions of the internal organs of a living entity reflect the harmony of its relationship with the environment, and *vice versa*: the harmonious relationship of the living entity with its environment is an outward projection of its inner harmony. In the case of human beings, the notion of inner harmony has a much richer meaning than simply a harmonious functioning of the organs and systems of the body.

When an entity functions under conditions of double harmonious resonance, it dwells at the vortex of health.

3.6 The great delusion

The vortex of health of an individual can be imagined as an energy pattern emerging out of the individual's dynamics; it cannot be borrowed from other individuals or implanted from outside of one's inner nature. No doctor in the world, no matter how competent, can make it whirl; the individual alone is responsible for the functioning of their vortex of health. In order to understand this functioning and to support it wisely, we need the help of our consciousness, of our experience, and of our inner impetus to live and know.

Through studying how to concentrate and relax the mind and the body, through practicing techniques that help us acquire inner peace and harmony, the flow of energy coming from the natural environment can be consciously directed inward and used to activate the vortices of health. Otherwise, our self-healing capacity remains in a dormant state and we need to rely upon help from outside when feeling sick. By doing this, we substitute the holistic effect of the realization of our self-healing potential with short-term partial effects produced by the use of various chemical medicines.

Many people in the world die as victims of the great delusion of our days that help for our health comes from outside! The society continues

to amplify this delusion because strong economic forces are behind it. The global pharmaceutical corporations make unbelievable amounts of money on this delusion. A great number of medical practitioners keep this delusion powerful.

The efficiency of our self-healing capacity goes down, and we look for the use of medicines to help us while the following also happens.

- The air is full of carbon dioxides produced by our cars and the industrial complexes spread all over the world.
- Dangerous chemical wastes, including nuclear, continue to be released in monstrous amounts.
- The soil and the water are irreversibly contaminated.
- The process of deforestation and extinguishing natural species goes on with an ever-increasing tempo.
- The ozone holes make sunshine spread cancer in our bodies instead of healing them.
- The rains are acid and the fruits and vegetables eaten are full of chemicals (or "genetically engineered") to look commercially attractive, but are detrimental for our health.

So we are entrained in a kind of health-damaging vicious circle: we continue to pollute nature with one kind of chemical and at the same time fight the effects of this pollution on us by using another kind of chemical. The more we pollute nature with the first (technological) kind of chemicals and thus gradually convert it into a source of new emergent illnesses, the more we use the second (medical) kind of chemicals to fight the illnesses and thus become gradually addicted. In both cases, the result is one and the same: serious destruction of our health.

Is there any way to get out of this vicious circle? Health ecology can reveal such a way: Only if we take care about the natural environment and help it restore its own self-healing capacity. This will facilitate the increase of our self-healing potential (as we are "children" of nature and our health totally relies upon its support) and help ourselves reduce our dependence on medicines.

3.7 Holistic nature of self-healing

One essential aspect of the multifaceted mission of health ecology is to show the danger of only relying on the help of medicines, while neglecting the vital factor for our health, that is, our potential for self-healing. Nature has endowed us with this potential at the moment when we emerged from the womb, and it is a grievous failure not to develop and use it to the full. Nature is the main supporter of the self-healing potential. It is a generous and free supply of energy, the sun and air,

water and soil, flora and fauna, harmony and beauty all help the vortices of human health move and generate their healing forces.

Self-healing is a holistic phenomenon, an expression of the self-organizing ability of the individual as a whole, and there is only one way to stimulate it: through holistic means. Such are the means of nature! Thousands of years ago this was fully understood by the creators of Ayurveda, the ancient Indian system of health ("ayur" means life and "veda" means knowledge in Sanskrit), according to which no single agent by itself can bring health [11].

The earlier in life we understand the wisdom of the ancients about the vital role of nature in the conscious developing and strengthening of our self-healing capacity (which is in abundance when the organism is young and full of vigor), the more efficient the realization of this capacity.

So, another aspect of the mission of health ecology relates to the health education of young people. This kind of education is a key factor in promoting health.

4. The vital role of nature

Nature embraces the whirling complexity of dynamics (forces, energies, substances, forms, and processes) that create, sustain, change, or destroy all animate and inanimate forms. These dynamics support the self-organizing potential of nature.

"Everything in nature tends towards fulfillment of its potential" wrote Aristotle, who called this property of nature "entelechy" (from Greek *en telecheia*, meaning "be in fulfillment" or "completion"). Examples of entelechy are the capacity of a seed to unfold its potential to grow when appropriate conditions arise, and the capacity of an organism to heal itself. These processes are inexplicable in terms of mechanistic causality, but it is evident that they happen all the time in biological life, including human existence.

Through its urge to move and self-realize, nature represents an all-embracing wholeness where no thing and no being exists in itself or for itself but only in dynamic relationship with other things and beings. This is a basic premise of the science of complexity (and hence of any emergent dynamic ecology), which directly relates to the integrity of existence considered as a complex of dynamics, whose creative, sustaining, or destructive powers are constantly demonstrated in nature. It is through these dynamics that everything that exists, emerges, moves, changes, and transforms from an elementary particle to a gigantic galaxy, becomes connected in an inseparable web of mutually dependent, intricately interwoven and co-evolving relationships. It is at the same time something that can only be grasped and thought about with an appropriate kind of fuzziness: fuzziology, the study of fuzziness embedded in human knowing, reveals the secrets of understanding the meaning of complex

holistic concepts like health, harmony, rhythm, self-organization, and nature [12, 13].

4.1 Rhythm and self-organization in nature

The rhythm of nature beats through us. The closer our connection with the natural environment and the more aware we are about its forces and life-supporting energies, the clearer is our perception of its rhythm.

From the digesting activity of our intestines to the firing of the neurons in the brain, every single function of the organs and cells in our bodies reflects the beat which mirrors the rhythm of nature. The state of our health: physical, emotional, and mental is entirely dependent on this rhythm. When the rhythm stops beating through the vital trinity of each individual's nature: body, mind, and soul, the individual dies.

The health of the natural environment, with all its variety of animate and inanimate entities is entirely rhythm-dependent. The rhythm of nature maps into its fractal geometry, discovered by Benoit Mandelbrot [14] and its self-organized criticality, first described by Per Bak in [15]; both fractals and criticality can be characterized by power law distributions. In this sense, the power laws describe mathematically the rhythm of "how nature works."

The rhythm of the natural environment mirrors the rhythm of Gaya, our living planet [16]; the rhythm of Gaya mirrors the rhythm of the galaxy, and the rhythm of the galaxy mirrors the rhythm of the whole universe, because Gaya and the galaxy and the universe are only different scales, or fractal levels, of one and the same dynamic existential wholeness.

Rhythm is an inherent characteristic of the self-organizing dynamics of nature. The way nature self-organizes, unfolds, and evolves is through rhythmic patterns. The vortices of health discussed in section 3 reflect these rhythmic patterns.

The self-organizing capacity of nature's dynamics is sustained through the constant interactions of the astonishing variety of the living creatures and their environment. What is crucial to be underlined is that every single entity existing in nature, be this entity animate or inanimate, is equally important for the realization of the dynamic interactions of the living creatures and their environment, and therefore for the support of the self-organizing urge of nature and its all-pervading rhythm.

Every single entity in nature is endowed with equal right to exist, interact, and evolve, and thus to contribute in its overall self-organization and rhythm. And *vice versa*, the self-organizing urge of nature and its rhythm manifest through the motion, interaction, and evolutionary potential of every existing entity, without assigning ranks of priorities among them; they all are equally open for this urge to make them move, interact, and evolve in synchrony.

4.2 Rhythm and health

Although we are able to reflect the rhythm of nature, we are also able to act against it. This happens when we do not focus our awareness on the natural rhythm, as if it does not deserve any consciously directed attention and "works" only automatically until it destroys because of a disease or death. It also happens when we are aware of the rhythm, and yet do not care about providing conditions to support its constant "work" through the body-mind-soul integrity of our human nature.

In the first case, we usually become aware of the rhythm when it is destroyed, often irreversibly. For example, a sudden heart attack can loudly announce that the rhythm has been disturbed. Usually, we hurry to "fix" it by using medical drugs. As far as the rhythm is a holistic characteristic of our natural self-organizing ability rooted in the body-mind-soul integrity, it can hardly be fixed by an artificially made chemical drug. Any drug acts in isolation and directs its effect upon a certain organ or function only; but the rhythm is essentially holistic, it cannot be restored by a partial intervention.

In the second case, the physical body simply follows what the mind pushes it to do. As far as our minds are preoccupied with much more "important" thoughts than listening to the natural rhythm, such as thoughts of how to earn more money, to exercise more power, to pursue achievements and higher social status, and to indulge in all kinds of pleasures, we are usually able to notice that the rhythm goes wrong when it is too late to restore it.

4.3 Rhythm in society against nature's health

When looking back in history, we see that nations and states follow periods of development and downfalls. Both the periods of economic growth and the periods of crises are inherent in the capitalist system. These periods have little to do with the rhythm of nature. Their underlying causes remain in the fundamental contradictions on which any process of exercising political or/and economic power in human society is based. "The crises are never more than momentary, violent solutions for the existing contradictions, violent eruptions that re-establish the disturbed balance for the time being" [17].

Chaos theory or stochastic analysis might help the experts build chaotic attractors or long- and short-term economic cycles, which can mathematically map the chaotic or stochastic dynamics of a selected set of economic and social indicators, but their "rhythm" is entirely different from the rhythm of nature. For example, the frantic ups and downs of today's market economy are reflections of the pressure of the largest financial corporations and their aggressive striving to establish global economic power.

According to Hardt and Negri, the establishment of global economic power means the emergence of a global empire: "a decentered and deterritorializing apparatus of rule that progressively incorporates the entire global realm within its open, expanding frontiers" [18]. The rhythm of the social dynamics in the empire becomes nothing but a "pure exercise of command, without any proportionate or adequate reference to the world of life."

While the world of life must reflect the rhythm of nature and the universe in order to exist and reproduce, the global order in the empire recognizes only one kind of rhythm: the rhythm of the financial transactions directed to increase the wealth of the economic giants.

The distribution of power in society has become so drastically unequal and the gap between the powerful corporate minority and the majority of people existing in hard-to-bear economic conditions has become so big that the humans belonging to these two polar parts of society started to resemble two different kinds of species.

The high power differential in society impedes the self-organizing capacity of human society. The latter can manifest only if the social interactions are between individuals, each with an equally open space of opportunities for self-realization. In the global empire, this is impossible.

The rhythm of social self-organization can be sustained only in societies where the power differential tends to zero.

This proposition relates to the social dimensions of health ecology and is analogous to the proposition about the rhythm of nature: the rhythm of any process of self-organization of the all-embracing web of interrelated and dynamically interacting agents in nature and in society requires both recognition and realization of their equity. When the human species strives to dominate in nature, and the richest strive to dominate in society, the rhythm of natural and social self-organization becomes distorted. Then ecological and social disasters emerge with negative effects on human health, on the health of the society, and on the health of the whole planet.

5. Culture as a key factor in health ecology

Culture in general use refers to patterns of behavior peculiar to humans, not to bacteria, but in its deeper sense it can still refer to both. Culture is the set of attitudes and behaviors expressed in the normal functioning of a society, human or other. These patterns create the harmonious set of self-organized forms we admire in nature, where plants and animals follow their natural drives to create the intricate and functional systems of nature.

The culture we humans have developed seems to be a second nature opposed to nature itself, responsible for the continuous worsening of

the ecological conditions on the planet today. Our scientific and technological inventions create serious ecological problems impeding the process of self-organization in nature. And as far as we are a product of this process and vitally depend on it for our survival as a species, the obstacles rooted in our culture at the same time obstruct the unfolding of our lives and our potential.

5.1 Will to power

Like all other animals, we use resources of nature to sustain our physical existence, but these resources are incomparably less than the resources utilized for establishing power over nature and in society. An egocentered human mind is obsessed with the idea of exercising power everywhere. The highest realizations of the human intellect were and continue to be directed towards accumulation and realization of military, economic, and political power in society: creating advanced tools to kill each other, to exploit each other, to make those with less power follow the will of the strongest, and if they resist, to teach them lessons, seek revenge, and eventually extinguish them.

How can health, as an expression of harmony and integrity of nature, be sustained within a culture that wills to power? In the developed capitalist world, the will to power is often masked by charismatic political speeches about democracy, freedom, and equal rights for everybody. At the same time a vast propaganda machine keeps the consumption drive in society at its highest possible level and thus reinforces the establishment of a hard-to-oppose global economic order.

5.2 Fatal cultural attractors

Besides the obsession with power and its destructive social and ecological consequences, health ecology points to other serious obstacles in our culture that impede the fulfillment of human potential. The hardest obstacles to remove relate to addiction, to all kinds of unhealthy habits, prejudices and dogmas, as well as to activities centered mainly in individual selfishness (like avarice, greed, craving for luxury, self-praising, gluttony, envy, jealousy, lust, hatred, evil-doings to others, and revenge). While showing a tendency to self-propel and grow in magnitude, these obstacles absorb enormous amounts of our physical, mental, and emotional energy. Day after day our self-organizing capacity is wasted in "cultural" attractors, which have very little to do with the growth of our intelligence, with the urge to understand the secrets of our inner nature, expand our consciousness, and open our spiritual potential.

> To open your spiritual potential means to remove the obstacles on its path. If you remove hate, love starts flowing. You are not to create love, nobody can create love. If you were to create love then it would be impossible. Love is already in you; you just

> remove the hate with the power of your heart and you will see love streaming. Remove the unconsciousness with the power of your awareness, and you will see your capacity to know arising in you. Remove the negative with the power of your mindfulness and the positive starts unfolding itself. It is almost as if a rock is blocking a tiny little stream of pure water; you remove the rock and the stream starts moving. When the rock is blocking its path, it may not ever be possible for the stream to come. We are carrying many rocks within our culture, call them blocks in your energy, and those blocks have to be dissolved and removed, if you want to let the tiny little stream of your spiritual endeavor come. Then nourish and care for it with all your love and all your knowing until it becomes a mighty river hurrying to unite with the ocean...

So speaks the spiritual master to those disciples who are thirsty to know.

5.3 Message from ancient times

The ancient wisdom provides powerful hints for dealing with enigmas and paradoxes of human existence. "There was a time when, in a small strip of the world's land surface, man achieved an almost total equilibrium with his environment and created a society as near perfect as he has so far been able even to dream about..." [19]. Great philosophers of ancient Greece like Pythagoras, Plato, Hippocrates, Thales of Milet, Galen, and Homer visited Egypt in search of wisdom.

The life and work of Pythagoras, perhaps the most famous ancient philosopher of all, who spent more than 20 years in the sanctuaries of Egypt, provides an important clue if we wish to get insight from the Egyptian wisdom. Pythagoras established a doctrine of unity, which encompassed the physical and the spiritual. He shows us a holistic philosophy which is an essentially Egyptian perspective.

The variety, complexity, and multiplicity which we see never implied separation; unity was ever present. Life in the heavens and life on earth were considered to be one, an indivisible unity. Human beings considered themselves indistinguishable from their environment, products of the same forces of nature responsible for creation of the heavens and the earth. To learn and acquire knowledge was to observe these forces at work. In the great Egyptian temples all branches of learning were housed under the same roof, regarded as aspects of the single wisdom. All diverse branches were encapsulated within this sacred wisdom. It is in it where people looked for insights to deal with enigmas and paradoxes of their lives. The essential preoccupation of the Egyptian thought was to know the origin and matter of existence.

In our fragmented world, knowledge has also become fragmented. Our society has become insulated from nature. When discussing sustainability, we speak about environment as something separated from us, something "over there" with which we need to establish a friendly

relationship. We say that the cars pollute the air outside of us, forgetting that it is the same air inside of us without which we simply cannot survive. We speak about waters somewhere there around us, totally neglecting the fact that water is an essential ingredient of our cells.

So far from us is the idea of unity, a central idea of all ancient wisdom, that even such a simple and transparent truth that the same forces which work at the universe work in us seems strange for us. Can we use this truth to make money out of it? No? Then forget it! Think about something more serious, for instance, think about sustainability: how to continue exploiting the environment, and at the same time live healthy and happily? Or how to continue current predatory processes led by us in nature and society and at the same time to preach about governmental and citizen-based mechanisms designed to ensure greater accountability of business and industry? Before organizing citizen-based mechanisms we must have those citizens. Does somebody teach us how to be a citizen? Without understanding the concept of unity and living with it, we cannot be citizens. Do we have governments which are honest stewards of the public interest related to contemporary environmental issues? One of the pathologies of our fragmented social reality is that in their efforts to hold on to power, politicians and political parties rely on crucial financial support from wealthy corporations which are not environment-friendly when making money.

We can talk a lot about precautionary principles, preventive approaches, extended producer responsibilities, clean production, corporate accountability, national public hearings, community participation, and many other issues related to sustainability, but the effect of all these talks will be insignificant unless we are able to grasp the idea of unity and work with it in our every day life. The society needs education in this regard, at schools and universities, in local communities, and global corporations. The simple message from the ancient wisdom is the message that unity can save us from self-destruction. Or at least make it not so painful.

One of the endeavors of health ecology is to spread the message of unity; there is no health out of the IES, in which the humans and nature are linked forever.

6. In search of universal principles of harmony in nature and society

In a search for justice it seems clear that existing levels of inequality are unhealthy, yet nor is it the case that equality is possible or even desirable. Something else is needed which is not as precise and definite as equality, but nonetheless meets the human craving for balance; a key concept here is *harmony* [20]. This was a key concept for the Greeks, a conjunction of three strands of meaning. Its root meaning was *aro*, join, so "harmonia" was what joined. Another meaning was proportion, the

balance of things that allowed an easy fit. The quality of joining and proportion then came to be seen in music and other arts.

The precondition for harmony for the Greeks was expressed in the phrase "nothing too much." It also had a mysterious positive quality, which became the object of inquiry for their finest minds. Thinkers such as Pythagoras sought to capture the mystery of harmony as something both inexpressible yet also illuminated by mathematics. The mathematics of harmony explored by the ancient Greeks is still an inspiring model for contemporary scientists. Crucial to it is their discovery of its quantitative expression in astonishing diversity and complexity of nature through the golden mean (golden ratio), ϕ (phi):

$$\phi = \frac{1 + \sqrt{5}}{2},$$

which is approximately equal to 1.618. It is described by Euclid in book five of his *Elements*: "A straight line is said to have been cut in extreme and mean ratio when, as the whole line is to the greater, so is the greater to the less." Any quantity Q can be divided into the golden ratio, if its greater part Q_g is chosen in such a way that it relates to the smaller part Q_s exactly in the same proportion as the whole quantity Q relates to its greater part Q_g, that is,

$$\frac{Q_g}{Q_s} = \frac{Q}{Q_g} = \phi.$$

As later scientists have discovered, ϕ pervades both animate and inanimate forms in nature, from galactic spirals to chromosome threads. Leonardo da Vinci characterized ϕ as a "divine proportion" and used its aesthetic appeal in his consummate masterpieces. While natural forms undergo permanent changes, ϕ is preserved in their topology. For example, the unfolding of the galactic spiral preserves ϕ in its geometry, the growth of the human body preserves the golden ratio in placing the organs, the dynamics of the arrangements of leaves, seeds, and petals also follow ϕ.

6.1 Harmony and energy

The golden mean ϕ as an image of harmony can be applied as a ratio, which is itself mathematically precise, although it may not be clear what precise quantities are involved or how those quantities could be determined in practice. In this form it will express in a precise and clear form an idea of harmony which is in other respects indeterminate, to produce insights which are clarifying and enabling and can be translated into practice. We will illustrate this with reference to the theme of energy.

Our planet is like a huge collector, producer, and reservoir of energy. Partly this energy comes from outside the planet, from the sun and other

cosmic sources, and partly from sources of energy accumulated in the depths of the Earth and on its surface. The so-called "energy crisis" is bound up with the many other crises facing the planet, seemingly presenting insuperable obstacles on the path to health for individuals, nations, and the planet. It is another situation where we can look to the wisdom of ϕ as an image of harmony.

Let E denote the whole amount of energy available to our planet at an arbitrary moment t. The planet needs this energy not only for supporting the natural drift (co-evolving) of all living forms of its biosphere, but for supporting also an enormously complex physico-chemical "metabolism." Because of this gigantic metabolism, James Lovelock referred to Earth as a living entity called Gaia, the ancient Greeks' name for the goddess of Earth [16].

Part of E is used by animate and inanimate nature to maintain the processes of emergence, sustenance, evolution, and destruction of the living forms on Earth. Let us denote this energy by $E(n)$, where n stands for nature.

Being an inseparable part of nature, we, the human species, also use this energy, which is essential for our survival. It is this energy that supports the dynamic attractors and vortices of health discussed in the previous sections. Much more intensively, however, we use energy for purposes which have nothing to do with our health. On the contrary, some of those purposes are directly opposed to the sustenance of life. For example, an incredibly huge amount of energy goes to support military-industrial complexes on the planet. This includes high energy consumption in the production of more and more sophisticated weapons, rockets, planes, and bombs, more and more sophisticated military technologies to demonstrate power and exert control. Huge amounts of energy support satellite espionage activities and cosmic experiments of the industrially developed countries. Ever increasing supplies of energy go to produce ecologically disastrous chemicals, to support huge air-conditioning areas, and to satisfy continuously growing desires for luxury and comfort, to amass wealth and fame.

Let $E(h)$ denote the flow of energy used by humans for purposes like the purposes indicated above, where h stands for human, although it would be more appropriate to use ah (standing for antihuman) for this kind of monstrous energy expenditure.

As human existence strongly depends on the energy flow supporting life on the planet, $E(n)$ must be greater than $E(h)$, otherwise the biological survival and the sustenance of health of all species, including people, would not be possible. We assume that the energy flows responsible for the dynamics of Earth, as an inseparable living entity in the solar system, naturally tend to self-organize in such a way as to preserve the

golden mean in their relations to each other, which implies

$$\frac{E}{E(n)} = \frac{E(n)}{E(h)} = \phi.$$

Consequently, $E(n)$ is equal to E divided by ϕ, and $E(h)$ is equal to E divided by ϕ^2. With 1.62 as an approximate value for ϕ, the following expressions are valid:

$$E(n) = 0.62E$$
$$E(h) = 0.38E.$$

The principle of harmony in human drift (co-evolving) with nature requires that for human existence to be in harmony with nature, the energy $E(h)$ used by human society is less than 40% of the whole amount of energy E available for supporting the gigantic metabolism of our planet as an inseparable entity in the solar system.

The larger part of E, that is, more than 60%, is needed for supporting life on Earth.

Natural drift of species, including humans, is under a threat of destruction every time the energy available to nature $E(n)$ falls below the critical value of 60% of E, or equivalently, when the energy used by human society becomes greater than 40% of E.

The principle of harmony directly relates to health ecology.

6.2 The way of health

Harmony is a fuzzy concept and has mathematical and nonmathematical dimensions. There is enough evidence in life today that the harmony of people's co-existence with nature has been destroyed. Mass extinctions of species, deforestation, degradation of soil, expansion of the ozone-hole, rapidly increasing pollution of air and water on the planet, global warming, frequent occurrence of large scale natural disasters, and emergence of new severe diseases caused by environmental problems are but a few manifestations of an ever growing disharmony in nature–human co-existence.

In pursuit of technological advancements our society does not care about the energy supply of other than human living forms. Whether $E(h)$ is higher or lower than 40% of E, who cares? Everybody knows there are no "objective" ways for measuring E, and therefore no scientific method can be used to raise the alarm when $E(h)$ reaches a critical value. Moreover, many people continue to think that our planet has an unlimited supply of energy, that the use of solar energy and energy contained in the atoms' nuclei will provide people with never ending energy flow. Unfortunately, the energy capable of supporting the natural metabolism of our planet is limited.

The human drive for technological development cannot be stopped, so $E(h)$ will permanently increase, and therefore, humanity will move further and further away from what the principle of harmony requires. If this is the case, why do we bother to speak about harmonious coexistence, divine proportions, and health ecology? Is it not better to learn how to adapt to the ever-deeper disharmony of human life?

Unfortunately, living forms cannot adapt to ecological catastrophes and disasters. If disasters occur, species die. And in our days, ecological disasters clearly demonstrate a tendency to increase in number and magnitude.

We know that we are inseparably connected with nature. We are its products. We know that when we destroy nature, we destroy ourselves, our health, and survival at the same moment. When we pollute its air and water, its plants and animals, we pollute the air, the water and the food sustaining the integrity of our physical, emotional, and mental lives. Nature is not over there, while we are staying here. It is in us as much as we are in it.

To preserve nature means to preserve all its forms of life including our human form. And *vice versa*, to preserve our human form means to preserve nature. This is the way of co-drifting with nature in accordance with the principle of harmony. This is the way of life, the way of harmony, the way of health. All other ways breathe diseases and death. We cannot divide among us and nature the air, water, sunshine, and so forth in the "divine proportion." But we can share these precious natural gifts with each other and with the other species. We all are Nature. What matters are the acts of sharing, sharing with other people not only material goods, knowledge, skill, experience, but also humanness: goodwill, warmth, respect, and love.

The wisdom of the ancient Vedas reminds us that everything that we try to hold on to, be it air or food, possession or knowledge, turns into poison not only for our physical health, but also for the health of our mind and soul, for the health of nature.

Every act of sharing with others is an acknowledgment of our interdependence and inseparability, from each other and from nature. Every act of sharing has a strong spiritual connotation. The more we share, the more united we feel with each other and with the spiritual essence of the universe. When the acts of sharing are in accordance with the principle of harmony, they have an immense transformative power. They change us from ego-centered to eco-centered, from ill to healthy, from destroyers to co-creators of the whole evolving ecological universe.

To help in the realization of this transformation is the main mission of health ecology.

Acknowledgments

The author acknowledges participation of Prof. Bob Hodge in the preparation of the present version of this paper, and particularly in the work on the second section.

References

[1] S. Wolfram, "Cellular Automata as Simple Self-Organising Systems," available at: http://www.stephenwolfram.com/publications/articles/ca/82-cellular.

[2] S. Wolfram, *A New Kind of Science* (Wolfram Media, Champaign, 2002).

[3] A. Næss and D. Rothenberg, *Ecology, Community and Lifestyle: Outline of an Ecosophy* (Cambridge University Press, 1990).

[4] G. Bateson and M. Bateson, *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology* (University of Chicago Press, Chicago, 2000).

[5] S. Hill, *et al*., "Learning Ecology and Transformative Change in Education," in *Proceedings of the Fourth International Conference on Transformative Learning*, Toronto, Canada, November 2001.

[6] V. Dimitrov, "Learning Ecology for Human and Machine Intelligence," in *Fuzzy Logic: A Framework for the New Millennium*, edited by V. Dimitrov and V. Korotkich (Physica Verlag, Heidelberg and New York, 2002).

[7] V. Dimitrov, "Complexity of Life," available at: http://www.uws.edu.au/vip/dimitrov/complexity1.htm.

[8] R. Solé and B. Goodwin, *Signs of Life* (Basic Books, 2000).

[9] S. Kauffman, *Origins of Order: Self-organization and Selection in Evolution* (Oxford University Press, New York, 1993).

[10] V. Dimitrov, "Swarm-like Dynamics and their Use in Organization and Management," *Complex Systems*, **12**(4) (2000) 413–421.

[11] F. John, *An Elementary Textbook of Ayurveda: Medicine With a Six Thousand Year Old Tradition* (Psychosocial Press, 2001).

[12] V. Dimitrov, "Introduction to Fuzziology," in *Fuzzy Logic: A Framework for the New Millennium*, edited by V. Dimitrov and V. Korotkich (Physica Verlag, Heidelberg and New York, 2002).

[13] V. Dimitrov and B. Hodge, *Social Fuzziology* (Physica Verlag, Heidelberg and New York, 2002).

[14] B. Mandelbrot, *The Fractal Geometry of Nature* (Freeman Company, San Francisco, 1982).

[15] P. Bak, *How Nature Works* (Copernicus, New York, 1996).

[16] J. Lovelock, *The Ages of Gaia: A Biography of Our Living Earth* (W. W. Norton & Company, 1995).

[17] K. Marx, *Capital*, volume 3 (Penguin, 1981).

[18] M. Hardt and A. Negri, *Empire* (Harvard University Press, Cambridge, 2000).

[19] M. Rice, *The Origins of Ancient Egypt* (Routledge, 1991).

[20] V. Dimitrov, "Principle of Harmony in Econometric Modelling," *Economic Thought*, **12** (1989) 96–105 (in Bulgarian); English version available at: http://www.uws.edu.au/vip/dimitrov/Harmony.html.