

Credit system to restore national economies and underwrite the transition to ecosocially sustainable GDP, via conceptual biomimicry and fractal dynamics

At whichever early- or late-post-crisis stage we now believe ourselves to be, the events of recent years have underlined that the world's economic systems are in need of an upgrade, at the very least. In parallel we must adjust to the Earth's carrying capacity or *one planet living* as soon as possible, yet without wholesale disturbances to the econo-social paradigm, since so many lives and livelihoods depend on its continued function. To solve this conundrum we may look to nature for inspiration, extending the nature-inspired design approach of biomimicry to one of *conceptual biomimicry*, thereby harnessing 3.8 billion years of heuristic Research & Development in order to improve economic and related systems. A responsive, adjustable economy may emerge that deploys the latest technology platforms at the core level of the transaction and outwards. The semi-directed juggernaut of the global economy can thus be steered onto a cyclical course. In the process a single causal architecture of systems may be glimpsed that has implications far beyond the field of economics.

Let us examine our attitude toward peace itself. Too many of us think it is impossible. Too many of us think it is unreal. But that is dangerous, defeatist belief. It leads to the conclusion that war is inevitable—that mankind is doomed—that we are gripped by forces we cannot control. We need not accept that view. Our problems are manmade—therefore, they can be solved by man.

The last of these observations made by President Kennedy during his June 1963 speech calling on the Soviet Union to join negotiations for a nuclear test ban could just as well be applied to economics as to weapons proliferation. It is also worth asking directly, What are the connections between trade and peace?

The world today is getting smaller and more interconnected. It is far easier to travel anywhere in the world and far easier to know anything in the world than ever before. The degree of interdependence between two or more individuals is higher than at any time in history. While the world is now far smaller, our weapons have become exponentially more deadly, sophisticated and ubiquitous. The potential for conflict has never been greater.

And yet if you divide the amount of actual conflict in the world today by the above provocative factors and population pressure, an interesting phenomenon appears: we are becoming more peaceful. And this is before we consider the ever closer and more numerous economic ties that form the web of transnational commerce. Or is it?

By and large, throughout history, trade has been the most normalising interaction between groups. Trade requires and breeds tolerance. It leads to the development of humanistic norms on grounds that must by their nature be common to all involved. A commercial transaction does not require politics and religion to be discussed. At the same time, trade does not necessarily make the world a better place - for example, if the trade is in narcotics, endangered species or human beings.

Trade is a tool. The tool is not flawed if it is used with negative consequences. On many occasions trade has been used, intentionally or otherwise, with the result of greater toler-

ance and understanding about the *Other*. Conversely trade has been used to make the world a more deadly and dangerous place, most egregiously when combined with force or the threat of force — the British Opium Wars in China, for example.

A key question emerges: how do you tease apart, then promote, the beneficial aspects of trade and commerce from those that are unconscionable and least sustainable (in any sense of the word)? The answer begins by asking that question, and elevating it to a position of prominence, in regard to each transaction and transaction type.

Can trade be used specifically to promote peace and more enlightened forms of human interaction?

Although the picture is a complex one, we can observe that broad foundational factors provide the basis for conflict: competition for resources, level of individuals' education, and opportunity. Therefore the same factors, when successfully addressed, may also provide a natural basis for conflict resolution and cooperation. Trade and commerce, when used right, can provide opportunities for peace and social cohesion.

Responding to the need

A cursory look at the economics section of a well-stocked bookstore today confirms that the awareness of the need for a new paradigm is high. Yet as for (other) social and environmental justice movements, being aware of the problem and having the solution are not the same thing.

Recent research reveals that a slew of societal and health problems, including mental illness and obesity, increase in rich nations as a function of wealth disparity between the rich and poor within the country - and are unrelated to average income (Wilkinson & Pickett, 2009). Although the benefits are greatest to the poor, the benefits resulting from greater equality are felt by the majority of the populace (ibid.).

What is an appropriate response to this longstanding challenge?

Many traditional reactions to the issue of wealth disparity have been polarised: ignore it or attempt wealth redistribution. Yet the true goal of those who have espoused wealth redistribution is not to take resources from those who have more, but to uplift those who have less. There may be a way of doing this without the calcification of ingroup-outgroup differences into rigid (often class) identities - which itself brings greater polarisation and social fragmentation.

Is it possible to tackle the root economic causes of social dysfunction in a robust and meaningful way that bypasses ideology and vilification¹? (And is there a problem if no-one loses?)

I want to address this broader question by exploring the following three questions, in reverse order:

- What can we do with modern digital technology and associated platforms today that we could not do before?
- How can economics be used to create greater social cohesion and harmony?

¹ That is to say, bypassing identity politics and class identity, and in ways that do not victimise, stigmatise or idealise any actor or type.

- Are there solutions in nature² that we can learn from?

Systems biomimicry

Modern design is increasingly learning, via the field of biomimicry, to take inspiration for human made objects from the natural world. For example, the bumps or tubercles on the humpback whale's flippers have been found to delay stall (Miklosovic et al. 2004), channel flow and increase aerodynamic efficiency (Fish and Battle 1995), and have now inspired a wind turbine shape with reduced drag and inefficiency (Fish et al. 2011, Wind Energy Institute of Canada 2008) (Fig. 1).

Yet nature designs systems before it designs individuals. Therefore we can also benefit from the replication of features of natural systems, in a related field that can be called *conceptual biomimicry* or *systems biomimicry*. This is biomimicry applied to human-made systems. We may also borrow from natural forms and organisms to inform these systems.



Amazon rainforest soils are notoriously thin, yet they support ecosystems that are among the most vibrant and abundant in the world. The wealth³ of these systems is not in the soil but aboveground, in the active cycling or interchange of elements and nutrients between the different 'actors' - stations or nexus locations within a single, dynamic whole. This may be termed *the principle of wealth as active cycling*. Organic and sustainable success may be achieved by using this and other conceptual biomimicry principles as design templates for our own systems.

Ecology and economy are linked by the Greek word *oikos* (οἶκος), meaning *home* or *house*. Thus *ecology* is the study of our 'home' planet, the Earth. An *economy* is the structure comprising the 'house rules' for the nation's finances. These two core concepts can be unified by a third, overarching one: *ecosociety*. More than a 'green' version of society, *ecosociety* provides a true home for human needs and aspirations, in balance with nature's carrying capacity. It is the hearth society around which life congregates and harmoniously organises. The warmth of the hearth is created through the synergy of its elements. The gift of the hearth is the intangible value of its interactions.

By definition, that which is sustainable can only be so if it is not only environmentally but also economically and ecosocially sustainable. Therefore we can, necessarily, broaden the definition of sustainability to 'whole sustainability' or *ecosocial sustainability*. Using this broader definition consistently will bring about meaningful and holistic results.

² Nature offers a library of 3.8 billion years of adaptive success achieved through iterations of trial and error.

³ Wealth is defined here as the wealth of the whole, interdependence codified into functional structures. The wealth or human significance of sustainable, or viable, economies is in the interdependent cycling, the reliable fluidity of resources between actors, who work for personal well-being and end up operating for the collective good. The predictable flow of resources is largely based on trust and collaboration. If you have massive personal assets but no-one else has anything, what value is your wealth? You cannot exchange it for things you need and desire. Wealth here can be defined as having everything that you need – and knowing that you have it. This is a sustainable, ecosystem-compatible definition of wealth.

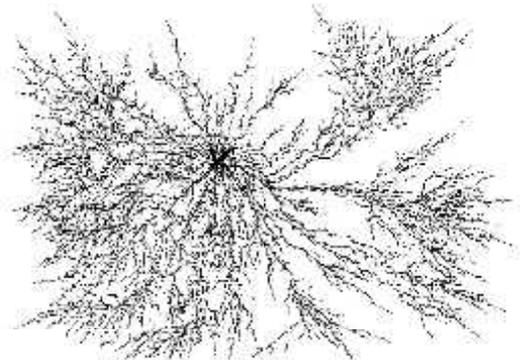
Conceptual biomimicry offers further solutions. If, as many commentators agree, we are at the end of one econo-social paradigm, and in need of a new - more just and sustainable - one, what can nature teach us to help bridge the void?

Consider the natural design challenge associated with moving oxygen and carbon dioxide between the ambient air and the cardiovascular system of an animal. These are two vastly different but immediately adjacent paradigms. Using fractal (repeating) geometric forms, nature - or evolutionary adaptation - solves this problem with a supermassive number of tiny alveoli in the lungs, and a very thin membrane to a system of blood capillaries, creating an interface between one paradigm and the other, essentially by *breaking up the large task into a supermassive number of tiny allocations*⁴.

This adaptive systems response, found throughout the natural world - including the human body - can be termed the principle of *supermassive tiny*: a supermassive number of tiny solutions harnessed together to meet what would seem daunting design challenges. The greater the challenge, the more numerous and tiny the loci of change must be - and therefore the more compact the solution⁵.

The tiny scale at which this characteristic operation takes place allows the function to be performed in a relatively small area. This represents a third of many principles of conceptual biomimicry, seen for example in the shape of DNA - where it is called supercoiling - and in the folding of the surface of the brain: *a three dimensional biological plane, when both confined and evolutionarily driven to expand, folds in on itself in order to expand the plane of operations and its functional or processing capacity*⁶.

Can the supermassive-tiny principle be used to improve our national and global economic systems?



Self Similarity

One of the features evident in the shape of the lungs is the 'self similarity' between any part of the whole, at any scale, and any other part of the whole. This is a mathematical feature associated with fractal geometry and the natural world.

The same branching distribution-collection shape appears in a plethora of other contexts, including the blood vessels of an animal, the roots of a plant, the veins of a leaf, the shape of a watershed, the side of a mountain - and then conceptually, as maps of human information-gathering, commercial distribution or revenue-harvesting channels. Remarkably, this self similarity has been observed in mature primary growth forests, in which the distribu-

4 The network of tiny capillaries on the other side of the alveolar membrane form a 'mirror image' design of the bronchial system.

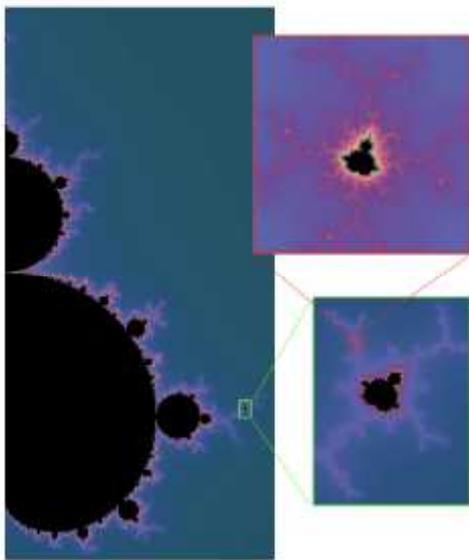
5 In the mathematical sense this dynamic, where scale is relative and no longer perceived as limited or assumed absolute, is the key architecture of all fractal forms everywhere.

6 Is this also true for the cosmos? Does this phenomenon exist for dimensions invisible to human perception and instruments?

tion pattern of small trees and large trees matches identically the distribution on a single tree of small branches to large branches⁷ (West et al. 2008).

This consistent self similarity means that the system in question is holographic in nature, and that any surviving part holds clues for the restoration of the whole. This is echoed and confirmed by an observation of the natural regeneration of ecosystems (UNFAO) - and fundamental to the field of Assisted Natural Regeneration - that *by restoring the fundamental stability of an ecosystem, species and functions native to the original system will return without agency or manipulation*. This is a fourth principle of systems biomimicry.

Self-similarity can be mapped in the physical universe (organically) and mathematically (conceptually) - the latter illustrated for example in the mapping of complex numbers known as the Mandelbrot set⁸ (Fig.



3). There is a relatively simple equation underpinning this universally repeating form. In essence these shapes self-populate towards infinity because the output of the equation is fed back into the equation as an input.

Economics and social cohesion

Where do bad outcomes come from?

Why do people make choices that, most intelligent commentators would agree, lead to 'bad' outcomes - such as criminal violence or environmental destruction? Is it, in more than a minority of cases, because of some intrinsic desire to do harm or to see a negative outcome? Or is it because the balance of incentives and disincentives that the actor experiences, associated with the different options apparently available, leading up to the moment of decision-making, points to-

wards the choice that leads to the bad outcome?

Does a holistic understanding of this complex but chartable decision-making landscape provide a significant degree of accuracy when it comes to predicting human choices and behaviours⁹? If so then this landscape can be positively influenced for improved economic and ecosocial outcomes.

Human outcomes are in large measure the expression of human motivations. Decisions and thus outcomes, in essence, represent the balance between these incentives and disincentives. When the actor determines she has enough information at her disposal, or as much as she can obtain, after appraisal one of the options is likely to seem more desirable

⁷ "Geometric and dynamic properties of trees in a forest and branches in trees scale identically, so that the entire forest can be described mathematically and behaves structurally and functionally like a scaled version of the branching networks in the largest tree." (West et al. 2008)

⁸ The hologram: any part of the whole contains the blueprint for the entire system, whether that system be conceptual-mathematical or applied-physicalised-mathematical.

⁹ Putting aside, for the sake of this discussion, the vast field of cognitive behaviour, let us consider only those examples where the decision-making process can be described as 'rational' - whatever degree of (perceived) self-interest is involved. Different people will define what is rational and what is not rational in different ways - therefore rationality is defined somewhat subjectively, with self-interest being one of the key axes of divergent subjective belief, opinion and worldview between those with strongly-held opinions on the subject.

than the others. The option she chooses is the one that seems to her to represent the highest relative degree (or sense) of desirability, according to personal goals, aversions, and other cognitive, appraisal and decision-making factors.

Incentives that lead to deleterious outcomes have been called **perverse incentives**, whereby immediate self-interest trumps long-term self-interest and/or the good of the whole. On the other hand, where an actor is faced with different incentives that are of comparable significance, but each of which is associated with a different potential choice, the result may be a confused set of outcomes, or the temporary deferment of the decision, or long-term paralysis of the decision-making process altogether. In such scenarios, the different motivating factors may be termed **non-aligned incentives**.

Aligned incentives are where short-term personal interest matches the long-term interest of both the decision-maker and others - "the collective good" - leading to recognisably ecosocial outcomes.

Personal decision-making landscapes very often contain all three kinds of incentives, even if they are not identified as such, and this terrain can change - some aspects more quickly than others. Although this landscape is often quite complex, a single decision must often be made. Internal tension arises from the difference between what the person wants to do and what she feels compelled to do by circumstance. The latter is often related to perceived survival needs, for example in the case of a farmer who cuts down the last tree on her land for firewood to cook the family meal. The lack of short-term incentives for her to leave the tree in place, and the presence of incentives to cut it down, represent a failure on the part of the human systems interfacing the individual on one hand and the environment, the collective good, and the future, on the other.

This scenario is repeated a billion times a day around the world, across all cultures. Yet the very same expediency dynamic may be turned to the positive, when the balance weighted by perverse and non-aligned incentives is shifted by the significantly increased presence of positive and aligned ones.

It is the above dynamics that represent the core axis of decision-making¹⁰, *not* flaws in the character of the decision-maker. This is a key consideration. Many traditionally relied upon responses to the challenge of compromised incentive sets do not display significant degrees of intelligence, empiricism or compassion. Attempts to ignore the challenge or to castigate, shame, vilify or browbeat the actors in question into acceptance of their wicked and immoral nature have unsurprisingly proven ineffective on all but the briefest of time horizons. These reactions seem to be subject to, and expressions of, classic human in-group-outgroup identification and behaviour patterns (Sherif et al 1954/1961), with all of the predictable accompanying cultural reinforcement, resulting in their limiting not facilitative effect on the needed systemic, positive change.

Instead we might ask if it is possible to adjust these incentive sets individually and collectively by introducing into the decision-making landscape a proliferation of artificially engineered short-term incentives that, by weight of balance and not coercion, bring about greater alignment with longer-term outcomes and states that are in the interests of everyone.

¹⁰ Thereafter our choices to a large extent determine the outcomes, even if the relationship between choices and outcomes is at times complex, with eventual outcomes resulting from the interactions of many different people, species and systems.

Most people, I contend, want to do the right thing and will over time respond overwhelmingly positively to opportunities to do so that are aligned with both their need to survive and their desire to thrive¹¹. The solution I propose is neither as simple nor as unsatisfying as trying to *change the person*, but instead is to superimpose a *responsive, manageable economic system* on top of the existing one, in order first to stimulate it and then transform it.

How can modern economic systems be adapted to meet the needs of today and tomorrow?

Some have espoused changing everything, turning back the clock, and throwing away the current economic way of life altogether. This is not realistic. Too many lives are tied to today's economic operating system to discard it wholesale. Change undoubtedly does need to occur, but is better achieved according to the principle of supermassive tiny — transaction by transaction. The more that this principle is applied the better, utilising one or more systems that do not replace but accompany the existing one, providing an interface to the future and guiding the current system rather painlessly onto a better course.

When we remember that today's economic system will be in place for many tomorrows, we begin to think in terms of sustainability, on all levels: economic, social, environmental.

At this point the question posed earlier becomes relevant:

What do modern technologies and platforms allow us to do now that we could not do before?

Before answering this question directly by delving into the necessary features of the solution, it will be helpful to place ourselves in the relevant historical context.

A great deal of human activity currently revolves around the scramble for money. Money has become something we all seek. So ubiquitous and prevalent is this quest that we have forgotten that it is not in fact money that we seek.

No-one truly wants money¹². Money is just a token. It is what money can obtain or secure - and more specifically, our perceptions of this capacity - that truly motivate us¹³.

This distinction is important. Intergenerational personal and societal suffering, and ecological destruction, are still being wrought because of this fundamental confusion. Our language reflects the assumed truth that it is possession of and access to money that determines a human being's 'net worth'.

In extreme forms, in both history and the present, this across-culture tendency has led to gross dehumanisation of human beings by other human beings, and a form of insanity whereby one treats another as an object, a possession, something that can be used up, tossed aside, its suffering ignored, its life disposable. It is critical that we address this. All socio-political movements that have led to atrocities being committed against other human beings have begun with dehumanisation of *them* (Stanton/Genocide Watch). Even though self-interest plays an important part in our motivation, we are also morally obliged to address less extreme expressions of dehumanisation - because all major imbalances begin with minor imbalances, and because it is our inevitable evolution so to do.

11 First comes an alignment of motivations within the actor, then alignment between the actors. Next, the positive outcomes – instead of the problems – recombine with each other, to yield beyond sum gains. Survival needs and survival fears can thus be eased.

12 If every human being on the planet knew that they would have an infinite supply of money for the rest of their lives, human behaviour would change. There would be no more 'hunger' for money.

13 The *pursuit* of happiness and happiness are not the same.

What are the root causes of such psychological and collective fragmentation and indifference? How did we get here?

We find ourselves today in an era of hyper-specialisation. This process began with the advent of settled agriculture approximately 12,000 years ago. For the first time in history, significant portions of the population did not have to spend their working lives engaged in a subsistence lifestyle. Agricultural surpluses and the taxation system built upon them rapidly led to development of technology, crafts, guilds, art, culture, social classes, bureaucracy and fixed government. People could be born to families who did not work the land, and live and die far away from it. The seeds of our modern urban dwelling were born.

This shift would also start to change human identity and self-reference. Before agriculture, the much higher degree of common experience among our ancestors placed a strong cultural-psychological check on social stratification. Since agriculture, we have been ever embarking upon an explosive polymorphic exploration of identity in what has become a process of socio-psychological speciation.

Relative to their significance for our identity and future, little thought has been given to these trends. With them comes another. The trend towards specialisation, at least in its default unmanaged setting, brings with it the concentration of wealth and thus also power in the hands of an ever smaller number of individuals. And the more money and opportunities a person has, the easier it is to generate even more money and opportunities, for reasons economic and social. The inverse is also true, as Mohamed Bouazizi¹⁴ and many others in history have discovered.

These specialisation and wealth concentration trends and tendencies were vastly exaggerated by first the Industrial Revolution and then the Digital Revolution. In a sense the Industrial Revolution is the grandchild of the agricultural revolution, and the Digital Revolution is the grandchild of the Industrial Revolution. Along the way our exchange systems have evolved from exchange to tokens and now to the age of digital money. We are on the threshold between the old and the new but have not yet grasped the possibilities for win-win outcomes, nor understood what can be left behind easily, at no net loss.

The more stable that our economic systems have become, the easier it has become to hold onto wealth across time, space and system types. The homogenisation of systems, a feature of the current hyper-globalisation, so far greatly to the detriment of national sovereignty, accelerates this funnelling effect yet further. Government has become relatively weaker and democracy more notional in proportion to the hyper concentrations of financial capacity and associated socio-economic-political influence.

The above dynamics explain how it is that the richest 85 people in the world now own the same as the bottom half of the world's population (Credit Suisse 2013, Forbes). This is far from the pre-agricultural pattern of wealth distribution!

On the psychological and social level, with this hyper-specialisation, it becomes more important than ever to ask, What unites us - as humanity? What do we now have in common? (And do we risk becoming alien to ourselves if we do not address this issue¹⁵?)

¹⁴ Mohamed Bouazizi was a 26 year-old fruit seller from Sidi Bouzid, Tunisia, who set himself on fire in response to egregious ongoing corruption and insult against his person, an event that precipitated the events known as the Arab Spring of 2011.

¹⁵ Is this the definition of self-generated alienation - that our adaptive success has spun us on a path whose destination we little consider, because we are too caught up in the extrapolated trajectory of our ancestors' unexpected success in the Mesolithic period to wonder where we are going?

One response is: needs and values. We all have needs, and almost everyone has values - even though some of the needs and many of the values vary from person to person and from group to group. Something else that we share, in an attempt to meet our needs and live out our values, is the system of interconnectedness, a system of systems, known as *the global economy*.

And so the question is a fitting one: How well does the current economic system serve our needs and values - both the shared and the individual ones? Is it fit for purpose? Can it be improved?

It is beyond the scope of this paper to analyse in detail the merits and shortcomings of the current economic system. Suffice to say that of the myriad possible ways in which human economies could be organised, there is no logical reason to suppose that the current model is the best one. New technology-delivered systems are available to us. These systems are currently used but in a non-integrated way, and not from the atomic level outwards: the core personality of the transaction is in need of an upgrade.

Changing GDP

Currently the economic health of a nation and the world is measured in GDP. We are all affected by changes in GDP. But what is it GDP? Is it a measure of money - of some form of countable units?

GDP is not a measure of anything visible or tangible. It quantifies the *flow rate* at which money moves or cycles through the economy, over a given period of time. Money is a token. The value of tokens, physical or digital, is only activated when they are transacted. Until then the economic energy remains in potential form. Tokens, or credits, are not 'owned' by anyone, because they are only representative - representative of an agreement based on trust. The more trust, the greater the value.

Tokens are held then used, held then used. The more that a token moves, the more value it provides, and the more that the trust involved is rewarded. The more that a token moves, the higher that GDP becomes. GDP is not a possession that can be acquired, any more than you can hold miles per hour in your hand: it is considered to be a measure of the beneficial fluidity of the economy, and an indicator of economic health.

Important questions as to the usefulness of the current metric of GDP and how it can be transformed are addressed below, embedded within the following discursive format that logically builds the architectural blueprint of a new, facilitative system. For now, from a 'strictly economic' perspective (a misnomer because economics affects nearly everything and nearly everything affects economics) let us ask, how can GDP be increased?

Simply put, this is achieved by increasing the rate at which money cycles through the economy.

How is that to be effected?

System features

The reason that we or any other economic actors spend or don't spend money, that we invest it or don't invest it, is because of the incentives set associated with each option available to us at the time of the decision - in fact, the multidimensional ecosystem of incentives

and disincentives is organised around the poles of the different perceived available options.

It is possible to positively affect this ecosystem by stocking it with short-term aligned incentives, so that actors are more incentivised to spend and invest resources in ways that are truly sustainably - for outcomes that are better in economic, social and environmental terms.

What is it that incentivises us to spend money that we wouldn't otherwise spend? Apart from advertising, influence and coercion, there is only one rational answer, and that is *saving money*¹⁶. It is the sales principle: we go to the sales because we can get the same item for less money than we would have otherwise spent. Therefore the incentive for the proposed solution must be that by using it you will save money in some way.

The next question is, When it isn't sales time, why would you purchase a product or service that you wouldn't otherwise have purchased?

Is there a way of incentivising product merchants or service providers (*merchant-providers*) to reduce the ticket price of items in such a way that they in turn will end up more wealthy, in net terms?

What would that incentive be? What can the merchant-provider receive in exchange for cost reductions that they make in order to incentivise purchases by their customers? It must be something that these merchant-providers find as or more useful than the amount of money by which they have reduced the ticket price. It could be something they use in a similar way to the original purchaser - to buy products and services for less money than they would otherwise have to spend - from other merchant-providers, who in turn do the same.

A system of transferable credits starts to take shape.

But if you simply introduce credits into the system to replace a portion of the national currency, with participants both receiving less money and spending less money, surely what occurs at the national level is lower GDP?

Quite possibly, yes.

Consider that we live in an age where most of what is called money is a digital commodity¹⁷. It is therefore possible to do something with a new credit system - because only swipe cards and user accounts are involved - that we could not do with physically minted currency. That is to engineer a quantum leap into each transaction¹⁸.

How will this work?

The merchant-provider will receive more credits than the purchaser spent.

¹⁶ Some would argue that saving money is not a rational argument to spend it. In this regard let us confine the discussion to instances where spending money can and does save money, in alignment with sound business or self-management acumen.

¹⁷ Most 'money in circulation' today has no physical form whatsoever. 97% of it is created in the form of credit or liabilities by the different private banks of the world (Source: Positive Money), which act in effect without oversight or coordination for the holistic common good.

¹⁸ The term *quantum leap* derives from the instantaneous displacement of an electron in orbit around the nucleus of an atom. Before the leap the electron orbits at one distance, after the leap it orbits at a different distance from the centre.

For example, suppose you are a participating merchant-provider. You sell me a chair. Before this system was in place, it would have cost me £10, and now it costs me 1 credit + £9. In the moment of transaction that is what I spend. But what if your account is credited with 2 credits, not 1?

An instant, automatic accumulation of value will have occurred, not just for you but for the system as a whole.

The automatic accumulation of value in the system reflects a fifth observable principle of systems biomimicry: *the more ample or extensive an ecosystem, the greater the stabilising presence it exerts on its component participants, sectors, elements, actors and sub-systems - and on surrounding ecosystems.*

From that moment on, each imbalance and stressor occupies a slightly smaller proportion of the resources and resilience capacity of the whole. The fact that this system increment occurs as a result of the success of the system, facilitates organic, responsive growth and thus re-embeds the successful output as an input into the equation - a feature of the Mandelbrot set. (We may logically expect the resultant system to reflect the success of nature and the cosmos of which it is a self-similar expression - see *Appendix 1*)

I call this system **Fluidity** because it facilitates the fluid circulation of money in the economy.

At this stage, it will be useful to explore the fundamental factors that provide the dynamic basis for the Fluidity ecosystem.

Ecosystem of variables

There are several important variables in play around each transaction, and these can be adjusted, discretely in many cases, to positively affect the incentive sets of the many different actors and actor groups involved.

The primary goal of the credit system is to move more of the national currency faster (but sustainably). Therefore credits are geared to the national currency. The rate at which they are geared is thus called the **gearing ratio**. If a product costs the buyer 1 credit + £9, we can say the gearing ratio is 1:9.

The second variable describes the amount by which credits accumulate at the moment of transaction, via the quantum leap, to the benefit of the merchant-provider. For example, if you spend 1 credit and the merchant-provider receives 2 credits, we can say that is an **accumulation ratio** of 1:1.

There is a close and dynamic relationship between the gearing ratio and the accumulation ratio.

If gearing ratios are too low (i.e., not enough credits to national currency) then buyers will not be incentivised to use the system; merchant-providers will have to set gearing ratios above such thresholds. If gearing ratios are too high, especially towards the start, uptake would also be depressed. Therefore the balance, as in most things, lies somewhere in the middle. It is for the ecosystem of actors and not a centralised authority¹⁹ to determine this viable range between the bounding equations. If both ratios are centrally determined there

would be little room for entrepreneurial innovation – but the whole purpose of the system is to find and promote that economic ingenuity. Yet if the accumulation ratio but not the gearing ratio is set by the facilitating agency, there is plenty of room for actors to achieve success through a process of trial and error.

There will be many ways for actors to experiment and innovate. For example, the higher the gearing ratio, the more valuable that credits will become, because this will allow greater cash savings to be made in the purchase. On the other hand, anyone accepting part payment in credits will also be using credits in part payment for purchases of their own, so it could be argued that these two factors would cancel each other out - at least, if the two gearing ratios were the same. But merchant-providers will be setting their own gearing ratios - although not their own accumulation ratio²⁰ - so there will be leeway for innovative actors to leverage the difference between the gearing ratios at which they purchase products and services, on the one hand, and the gearing ratios at which they spend their credits, on the other.

All participants will be in learning mode and will acquire the skills and insight to improve their strategies and economic returns. The system as a whole will rapidly improve. Merchant-providers will quickly gain a sense of the maximum gearing ratios they can offer and under what circumstances—for example, via promotions or bulk buys. Some merchant-providers will be more successful than others at leveraging the Fluidity tool for economic success. This is a critical consideration for the national economy (see *Fig. 4. Threading the Needle*).

A third variable should be introduced, to make the engine more powerful and provide greater room for innovation and problem-solving. It is not desirable that participants hoard credits. The purpose of the system is to facilitate increased flow of economic energy. Therefore, over longer periods of time, credits will disappear from user accounts, according to a precise **evaporation curve** that is derived through calculation, heuristics, and desired goal states. On the other hand, rapid turnarounds of credits will attract bonus allocations. These factors will keep credits and national currency cycling, and GDP on a robust trajectory.

The variable rate at which credits disappear may be called the *evaporation rate*. This dynamic, like others, will be specifically adjustable according to the specific sectoral and regional needs of the economy at the time. The presence of *evaporation* reflects the truth that the value of the system, as its name suggests, is in its fluidity.

The determination of viable ranges for the variables in question will in large measure be an exercise in crowdsourcing, using *the power of many harnessed intelligences to develop solutions through trial and error* - a crucial, sixth, principle of conceptual biomimicry. The key is in creating an ecosystem of possibilities for all actors involved and then facilitating their development of the most successful strategies, for personal and collective benefit. (The two outcome types need not be at variance.)

Now armed with this understanding of variables, let us continue the exploration of the dynamics of Fluidity system development.

Achieving sustainably elevated GDP

²⁰ One of the keys to the success of this system is to provide the right number of variables that actors can control themselves, so they have room and incentive to innovate, but not more than necessary, which would cause confusion, reduce the clarity and thus value of data, and compromise uptake rates.

What will merchant-providers do with the extra accumulated credits?

The answer is, the same thing as their customers - spend them on things they need and desire, from merchant-providers who will do the same in turn, driving further uptake and deeper participation in the system. A cascade effect takes place.

But is it enough to flood the system with credits in this way? Will GDP rise back to where it was?

If the above is all that happens, perhaps not. That is where the data come in.

Every transaction will be registered by a powerful system computer. Together all the information points will create a living map of economic activity, of great complexity and beauty, that can be updated by the minute. Taken together, the transactions within the system will reveal key trends and dynamics that have simply not been available before. The living ecosystem of interactions can be analysed to reveal market dynamics and economic behaviour on national, sectoral and regional bases.

At this stage there are two observations to highlight. The first is that these data have tremendous economic value for all merchant-providers - whether they are participating in the system or not. But the data will not be for sale (there is a better use for them).

The second observation is that when you give everyone the same tool, some will make better use of it than others. Some of the merchant-providers will have greater success using the tool of Fluidity to increase their profitability, on a (national currency) revenue-per-credit basis, than others.

There is a relationship between these two observations.

Let us say that you are a merchant-provider participating in the system²¹. When merchant-providers start using Fluidity, apart from the credits they acquire, they will experience a temporary drop in both costs (outgoing) and revenue (income), but no net loss, because they will retain control of how many credits they accept as part-payment, and will limit the amount of credits they accept to an amount that is less than or equal to the combined number that they can spend and wish to retain²².

From among the many thousands of participating merchant-providers, it will be possible to see who is better at achieving profitability increases via use of Fluidity. The strategies these actors deploy will have national significance. Each of these merchant-providers will be closer than average to the moment when, after the initial dip in costs and revenue, their national-currency income is as high or higher than before they began using the system - in addition to the credits they earn and accumulate.

This moment can be called *revenue +1* or *rev+1*. It is a critical achievement for two reasons. Firstly, another kind of exchange can take place. These innovators will be asked to share their best practices with other merchant-providers, in exchange for i) publicity, ii) further credits, and iii) access to the highly valuable data and analytics that the system provides. All of these will help these merchant-providers become even more successful, sur-

²¹ Merchant-providers will be using Fluidity credits to make more money, wherever they can.

²² Noting that now merchant-providers will also have credits they never had before, and will be incentivised to spend them to realise cash benefit from their participation.

pass rev+1, and thus have a more and more beneficial effect on the national economy. By the same token, other merchant-providers will learn how to improve their practices and will themselves approach rev+1. Everyone gets better together.

The second, related, reason that rev+1 is so important is that each instance of rev +1 is a pixel in the bigger picture that is **GDP+1**. As more and more enterprises and organisations reach, and are assisted in reaching, rev +1, islands of best practice become continents of best practice; the good become very good and the best become even better. At the national level what starts to occur is higher GDP than would have occurred in the absence of the system. Thus the primary goal - restoration of economic vitality - is secured.

- “Wealth” here is defined as the ability to obtain the products and services you need and desire.
- Fluidity partially decouples wealth from income, providing more resources to participating actors, sometimes with no net change in income.
- Some of these actors will leverage the increased wealth to better effect, increasing their national-currency income towards rev+1.
- The best practices of these merchant-providers will be shared with others (**solid vertical line**).
- As a result, as more and more actors achieve rev+1, GDP rises above the baseline.
- Ecosocial allocations and adjustments facilitate qualitative shift of GDP.
- Wealth and the new GDP converge as it is finally transformed into ecosocial GDP.

One of the features of the Mandelbrot set is that the sum of the equation is reinvested as an input into successive iterations of the equation. Fluidity mimics this feature, also seen in Earth ecosystems, appearing as a seventh principle of systems biomimicry: *some of the fruit of efforts for adaptive success on the part of one or more organisms - or byproducts thereof - becomes available to other actors as a resource, or is reinvested into the system as a whole, in ways that directly and/or indirectly improve the system’s scope, resilience and function.*

Growth versus expansion

Fluidity allows the economy to be made leaner and more competitive, and thereafter provides the facilitation of better social and environmental outcomes - because it isn’t enough to increase GDP: we have to give ourselves a sustainable basis to thrive long into the future, and that involves the transition to sustainable GDP. (Once needs are being met, it is easier to honour values²³.)

As many recognise, GDP is a highly confused metric. It currently places the same value on destructive and constructive activities and consequences - whether it is nature, society or the individual being affected. What we currently call growth is not true growth. It is expansion. True growth is sustainable and intelligent. It allows further sound growth to be built upon it. Expansion billows outwards and deflates when sanity returns, within a predictably unpredictable boom-bust cycle.

Does Fluidity allow us to move from a paradigm of seeking expansion to one of achieving growth?

²³ Empty stomach has no ears ~ Haitian expression.

The bigger the system, the smaller the relative effect upon it of the same action. As rev+1 is achieved over and over again, the upswing in GDP allows more and more free credit allocations and other adjustments to be made in favour of those enterprises, individuals and organisations that are having, or seek to have, a positive effect on society, the environment and the individual. A community volunteer who has given years of service to others can be rewarded. A struggling not-for-profit organisation on the brink of making a massive social contribution can keep its doors open. A renewable energy technology requiring higher uptake for the unit cost to come down permanently can be supported by favourable allocation parameters.

Each transaction within the system represents a rope that can be tied around the prow of an economic ship that has been heading on a course - unfettered use of resources within a finite biosphere - whose destination is both predictable and unknown. We can change the direction of this vessel and put it on a circular course of one planet living.

The Fluidity engine

$$F = T \quad S$$

The core mathematical engine for the Fluidity software to employ to manage a vast number of interactions and variables, on a self-improving basis, is already in existence. It is a formula for intelligence developed by computer scientists Alex Wissner-Gross and Cameron Freer (Wissner-Gross and Freer 2013) that is now being successfully applied to systems and Artificial Intelligence applications.

Software based on this model is able to solve gaming challenges in unique problem-solving environments that it has not been exposed to before *without instruction on what the challenge is* (Wissner-Gross and Freer 2013: Supplemental Material).

In this model intelligence is defined as a physical force that maximises future freedom of action, by keeping options as open as possible (Wissner-Gross and Freer 2013). This can only be done by predicting the future, which requires engaging with the world, firstly by observation of parameters and data, then by active response using trial and error (heuristics) to learn what works and what doesn't. Software built on this model learns fast, honing its responses until it arrives at a solution²⁴, in the same way that the human brain acquires new skills and abilities via the firing of neural pathways until the particular pathway is found that allows the goal state to be attained - after which that pathway will fire more rapidly and more automatically.

²⁴ The original meaning of a *computer* is a *person who computes*. There is a remarkable similarity between the way that the Wissner-Gross/Freer equation works to solve problems, meet challenges and achieve goals, on the one hand, and the way that all the individuals involved in a Fluidity system will be working together - as if forming one self-collaborating organism - such that it appears that there would be a partnership between what look like twin communicating natural intelligent systems. Perhaps we will be achieving *self-biomimicry*, a deeper embedding of the intelligence that is all around and within us, deeper into our lives and systems? This could otherwise be expressed as symmetry and synchronicity between human, natural and 'artificial' intelligence systems - both of them speaking some common core intelligence language - and therefore a priori the distinction between organic and non-organic. This begs the question, What is life? That is a very important question for humanity's near and distant future...and perhaps also our past.

The Wissner-Gross/Freer model provides the computational basis for Fluidity, but the engine needs to be directed as to what kind of outcomes to operationalise. The primary economic goal is understood, but to simply increase GDP is insufficient and would not bring us any closer to a future that is both assured and sustainably abundant.

Codifying Ecosociety

As the primary economic goal of increased GDP is attained, it becomes time to address ecosocial goals. An algorithm can be built around the Gross-Wissner/Freer model, directed by the principles of a **Fluidity Charter**, which will be a synergy of the highest social and environmental rights, ideals and principles. In addition to fundamental guiding principles of protecting the disadvantaged, giving voice to the voiceless, uplifting women and children (especially girls), the Charter will draw inspiration and body from:

- 1) The United Nations Millennium Development Goals (*Appendix 2*)
- 2) Rights and determination of indigenous people to autonomy, to their ancestral lands and natural resources, to their traditional way of life, to their right to exist and develop according to their own definition and trajectory.
- 3) The Rights of Nature and respect for all living beings, based on the Hippocratic Principle, and taking initial guidance from Articles 71-74 of the 2008 Ecuador Constitution, including the rights of Nature i) to be respected, ii) to be restored, iii) for endangered species to be protected and destructive measures prevented, and iv) for all persons to be able to enjoy and benefit from nature (Global Alliance for the Rights of Nature). (*Appendix 3*)
- 4) The Second Bill of Rights - The Economic Bill of Rights - that Franklin Delano Roosevelt wanted to ensure for every US citizen, namely:
 - I. The right to a useful and remunerative job in the industries or shops or farms or mines of the nation;
 - II. The right to earn enough to provide adequate food and clothing and recreation;
 - III. The right of every farmer to raise and sell his products at a return which will give him and his family a decent living;
 - IV. The right of every businessman, large and small, to trade in an atmosphere of freedom from unfair competition and domination by monopolies at home or abroad;
 - V. The right of every family to a decent home;
 - VI. The right to adequate medical care and the opportunity to achieve and enjoy good health;
 - VII. The right to adequate protection from the economic fears of old age, sickness, accident, and unemployment;
 - VIII. The right to a good education.

(Sunstein and Barnett, 2005)

- 5) The Universal Declaration of Human Rights (*Appendix 4*)

All of the determined rights, goals and principles shall be applied to and on behalf of every participating and non-participating individual, whether or not part of any one or more nation, organisation, body, group, family or ethnic group; thus representing a truly universal human franchise.

These rights are to be enshrined in the Charter of an independent **Fluidity Institute** that while necessarily working with the governments of the world, maintains independence from them and strict adherence to its Charter, in both word and spirit.

Reflexive allocations and the self-improving economy

The spending of one unit of national currency within the formal economy not only has value to the individual but provides a series of inter-related values to the economy as a whole:

- (1) A 1:1 effect on GDP
- (2) A stimulating effect on GDP, e.g. via increased investment resources
- (3) Increases the tax base by a factor of (1+2)
- (4) Positively affects consumer confidence
- (5) Positively affects lender confidence, and
- (6) Factors 1 to 5 provide further synergistic interaction

For the first time, it will be possible to quantify these multipliers, how they interact, and how they change²⁵.

These metrics will allow participating national economies to be calibrated quite accurately²⁶, according to the dynamic ecosystem of these economic relationships, and on an ongoing basis; this will remove what has been a limiting factor to economic growth embedded in every human economy to date.

These values can be taken together to form one variable, which represents the net effect of one unit of currency spent on the economy as a whole. This **national currency net multiplier** (NCNM) will vary according to time, sector, region and macroeconomic factors.

Fluidity, combined with the delivery platforms used, provides the data points to understand the entire economic ecosystem that is making use of these credits. With this information comes the ability to chart these variables and how they fluctuate. Now these effects can be quantified, discretely and in unison, and a complex picture built of trigger points, and thus also economic strategies, that will be relevant to economic activities whether or not associated with the Fluidity system. Multi-dimensional visual mapping of behaviour patterns and economic consequences will follow. Our comprehension of *the economy* - what it is and how it works - will itself undergo a quantum leap.

In parallel, similar values to the above but for Fluidity credits can be quantified, and amalgamated to reveal a **credit net multiplier** (CNM). It will be possible to quantify how much the composite values vary as a function of different factors, such as the length of time

²⁵ The factors identified have always existed, to various degrees, in different economic systems. Before now it has not been possible to quantify and map these inter-communicating variables. Unable to adjust to these dynamics, markets and the human actors that create them have been caught in overconfidence-underconfidence cycles that mimic the forces responsible for seismic events: tension builds between the temporary state and the fundamental state to such a point that a landscape readjustment is inevitable.

²⁶ Apart from the value of these data to government, participating private sector and income-generating NFPs/NGOs may also be able to access them if their activities bring significant benefit to the whole.

between when a credit is acquired and when it is re-spent²⁷. These data can be used in an important way to further increase the strength of and benefit from Fluidity: accounts can be automatically topped up by a number of credits determined by multiplying the CNM by the amount of credits the account holder has spent in the period immediately previous - e.g., one day or one week. This rewards users for using the system, in proportion to the benefit they bring to the whole community, and further incentives uptake²⁸.

This mechanism, called **passive credit accumulation** (PCA), provides zero risk economic growth via intelligent feedback.

(Will large-scale PCA allocations affect the multipliers described? Will PCA make the multipliers go up or down - or both? If it sometimes make them go down, then a “breathing” effect will take place, due to the feedback effect; or, if desired, these passive credit allocations can be kept lower than the threshold at which multipliers would be decreased. But if such allocations do not affect the multipliers, or indeed increase them consistently, then such credit allocations can be automated, with *the passive result that both credit and national currency cycling through accounts will increase*, promoting system uptake and GDP increases, thereby providing more leeway to underwrite the transition to sustainable GDP.)

It is important to restate that new ‘growth’ is only meaningful if accompanied by the transition of GDP to ecosocially sustainable GDP, along an optimised trajectory.

PCA is one four Fluidity architectural features which underpin the responsive, organic growth of the system:

- Accumulation ratio
- Wissner-Gross/Freer equation
- Threading the Needle
- Passive Credit Accumulation

Like Threading the Needle, PCA provides both reflexivity and a qualitative effect not just on economic cycling but on the nature, and thus value, of credits - thereby helping effect a paradigm shift in the broader economy. ***These qualitative changes in the nature of credits elicit qualitative change in the nature of GDP.***

Economy like ecosystem

Based on observation of the other principles of conceptual biomimicry, an overarching principle - a principle of principles - is suggested: *the more that a system or organisation embeds and enshrines principles of conceptual biomimicry, the greater the organic success it will achieve.*

By weaving conceptual biomimicry over and again into the fabric of the meta-system comprising Fluidity and the traditional economy²⁹, the whole takes on the characteristics of a living ecosystem or organism. The brain and central nervous system of the organism are

27 Faster turnaround makes actors’ participation more valuable to the whole.

28 It remains important not to create more credits than the system can reasonably absorb at any stage.

represented by the hardware and software that Fluidity uses. The Wissner-Gross formula represents its reasoning ability. The Charter represents its moral code, its principles and its sense of decency - its *enneagram*. This whole begins to take on the appearance of a fairly advanced form of Artificial Intelligence, one organised around the central theme of humane economics.

With so many features and dynamics of ecosystems inculcated into the Fluidity system, it will achieve self similarity with an earth ecosystem. When placed in the heart of our economies and interrelating systems, conceptual biomimicry can bring them not *back* to life but *to* life - for the first time (see *Appendix 1*). We can funnel the power of pure mathematics and computational symmetry into every aspect of life that comes into contact with this system.

And thus we arrive at a succinct definition for eco-society: the ecosystem society.

Fluidity Temporary Currency

Evolution is a process of trial and error, followed by investing resources in what works best. To favour long-term adoption of Fluidity, participants need time to get used to it. It is logical to begin with a deployment of credits on the basis of a *temporary currency* that shares the features outlined above, but lasts for approximately six months from the day of activation.

The temporary nature of credits means they will disappear if not used within six months. Primary credit recipients will not want to lose this value, and thus be motivated to spend them within the timeframe. Purchasers of credits will not want to be in possession of credits on the expiration date. Increasingly rapid cycling will occur as holders seek to divest themselves of credits. There will be an ever-faster exchange of credits, and the average transaction size will increase. This activity will act as a liquidity pump.

Some entrepreneurial actors will take bigger risks, leading to larger credit+sterling flows as the expiration date approaches. The increase in volume upon sale will incentivise the participation of merchants and service providers. This too will motivate all participants to generate faster cycling of credits, in a virtuous cycle: the more times that money circulates, the richer everyone will be. This factor also offsets risk for those concerned about holding credits when they expire. (The accumulation ratio will be determined in consideration of this perceived risk, which is offset by the fact that the number of credits will increase with each transaction.)

If desired, the beneficial dynamics of a six-month temporary credit can later be replicated within the permanent credit currency by use of the evaporation curve, which can be made as steep or as shallow as desired.

The limited timeframe associated with a temporary credit:

- Allows actors to familiarise themselves with this new system
- Offers reassurance to those wary of being permanently committed to a credit system³⁰

29 The greater the interface between Fluidity and the national economy, the more powerful the engagement and therefore the easier it is to move that economy in the desired direction.

30 That fear is groundless, because if actors no longer wish to participate they simply stop participating.

- Allows contemplation of lessons learned such that advanced solutions can be embedded into the permanent credit system design - including updating and upscaling the system architecture.

For both the temporary and permanent currency, participation should be optional. Compulsory participation is poor participation.

Conclusions

Recent crises now provide a window of opportunity for positive change.

The current economic system has not been designed in a modern context, according to the needs of today and our many tomorrows. Instead a series of processes are set in motion and then reactions are made to the unpredicted if sometimes hoped for consequences. These attempted calibrations take place over long time frames that do not allow rapid readjustment. They are decided upon by a small number of people who are not endowed with supernatural abilities to see everything and know the perfect response. There is too much agency, and not enough agency.

Advantage can be taken of opportunities for crowdsourcing via use of a game-like ecosystem with maximum participants. Modern technological platforms can be utilised, and the systems built upon them, to qualitatively improve transactions.

The hybrid money system we currently own has been left to us by legacy, not yet seriously evaluated for present and future usefulness. Great potential exists by doing something differently. Done right, this positive shift in our economic evolution will have far-reaching positive implications for our evolution as a species - so omnipresent are economic exchanges and factors in our lives.

Within the context of sustainable ecology, economy and ecosociety, actors pursue enlightened self-interest in the context of a benevolent whole. Although imbalance comes and goes, sustainable systems never fall into lasting disequilibrium. Prosperity for one improves prosperity for all. Some benefits are always returned to the whole to improve its resilience and functioning.

An understanding of these healthy system types helps shape a universal definition for sustainability, as: *those structures, roles, processes, behaviours, actions and attitudes that can be maintained by any number of actors, infinitely into the future, with no net detriment to participants or to the whole; improving the quality of life and opportunities for life for all, without compromising the fundamental integrity, parameters or requirements of the whole.*

We urgently need to transform GDP into an ecosocially defensible measure.

Foundations of change

Various proposed hierarchies of needs, and our own empirical experiences of life, reveal that some tasks must naturally be completed before others. Economic viability must precede the transition to sustainable GDP because the status quo of economic development means that doing the right thing is currently more expensive than the default. It is time to fully internalise environmental and social costs into the unit price of products and services. Fluidity allows us to make this and other transitions outlined above gracefully. We should not be surprised if embedding principles of conceptual biomimicry and quantum dynamics into Fluidity system design and procedure yields great success.

The environmental movement arguably began as a shocked reaction to the potential destructive power of humanity, that we could even threaten the stability of the biosphere. For some this may have led to an increased sense of separation and anxiety, originally associated with the desire to preserve nature. The resulting sense of isolation does not lend itself to solutions integrating humanity and the natural kingdoms.

Fractal forms within and around us remind us that we are part of nature and nature is part of the cosmos. In fact the relationship is holographic, not made of parts, but displaying self-similarity beyond considerations of scale³¹. Use of established natural templates in human-made systems can provide the conduit through which the resilience, strength and beauty of nature and the cosmos enter our structures.

By providing wealth-generating opportunities to all actors, and by favouring and uplifting actions that are ecosocially aligned, Fluidity can slow natural resource loss, increase wealth and incomes, improve provision of education, raise equality, reduce conflict and enhance and upscale positive solutions wherever they are found. It can link proactive movements and organisations across national and continental borders. Held apart from the negative consequences of unmanaged trade, the beneficial tendency of trade to foster tolerance and cooperation can be enhanced, accelerated and made more sophisticated, intelligent and responsive.

The crippling and often lifelong human experience of the fight-or-flight reaction that is *survival mode* elicits anxiety, despair, poor decision-making, addiction (as escapism), fear, greed and corruption. Survival mode can be greatly eased wherever Fluidity successfully takes root. The transition from survival mode to a more abundant and peaceful lifestyle is accompanied on the neurological level by a movement from the reptilian brain to greater use of the cerebral cortex, where higher function cognition occurs.

As one and then two generations grow up with Fluidity as part of their lives, they will, compared to their forebears, experience an easing of background tension, an increase in wealth and opportunity, broader horizons, and a greater community of shared rights and aspirations. Lives will be less harsh, less shocking, more stable and less conflictual. This is good for everyone.

Each nation brings something uniquely positive to the human identity. We can learn from each other. Over generational time, as tension is eased, humanity may, if it chooses, consider what is best about itself, share these aspects with each other and replicate these best practices of culture and determination in exercise of *self biomimicry*. If this happens, more dysfunctional unconscious patterns and expressions will begin to fade, and future generations will grow up with a higher baseline expectancy of normalcy, because that will have been their experience of self and others from the start.

We who develop our best ideas will not be another generation that simply hands our problems—some inherited, some self-created—onto our descendants. Instead we will give them the world they deserve.

The solutions to manmade problems are in the hands of everyone.

31 ...and therefore also of time, since we inhabit a plane of space-time

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Appendix 1. The Master Fractal

DNA is an expression of fractal geometry in its viewable 3D form. Interestingly, it also creates fractal forms, one of which is us. We in turn contain fractal forms, but/and we also create fractal forms - not just in the physical world but also in the conceptual systems we develop.

The spiral and the watershed/capillary network are inter-related forms repeating through the physical and conceptual universe - bound by something that is holographic, because it is self-similar. This holographic nature explains for example why two electrons in different locations can move in synchronous motion, and respond to each other. We and everything we create, and everything around us, is connected within a whole that allows for 'individuality' - unique expressions and explorations - within the 'master context' of wholeness.

Physics, biology, DNA, human systems including economics, mathematics, ecology - may all be one within a holographic-quantum fractal configuration that is not affected by the disciplinary boundaries we tend to place on learning and development. These fractal forms effortlessly bridge the frontiers we assume to be solid between conceptual and physical, tangible and intangible, and together make up one master fractal of life on Earth. This unifies all things - including the non-things, including the things we have no concept of, nor cannot conceive of.

As vast as this master fractal is to contemplate, it is but a point of light on the side of a much, much larger fractal. This form cannot be limited in time in any way, since it is not limited in space in any way. In fact to our eyes it makes instantaneous leaps, without resistance, from one sphere or sector, domain of space or meaning to another. And since we exist on, in and/or as space-time, it/we can do the same thing with time.

Nature extends beyond the boundaries of the Earth and beyond the layers of our skin. Nature is in fact a single more complex 'cosmic nature' that is underpinned by physics and which expresses itself in biology, among other forums. It is a single multidimensional organisation of intelligence and mathematics that is at least partially conscious - and therefore *wholly conscious*, because it is holographic, and the fundamental characteristics of a hologram are found in any part or aspect of it.

We know that our sight is limited. We know that things exist that we cannot see. In order to discover what is 'out there' in the universe, we use faculties other than our ocular nerves and eyeballs. We use thought - mathematics, physics. We use our imagination - insight, epiphany. We use not only our minds, but also what is innate, which we then test and sometimes confirm. We have deduced that other forms permeate the plane of reality-existence that we had assumed to know so well. In time we may be able to see these expressions better - or perhaps we will continue to discern them through the lens of science and the coupling of imagination, observation and tested reasoning.

Appendix 2. The United Nations Millennium Development Goals

1. To eradicate extreme poverty and hunger
2. To achieve universal primary education
3. To promote gender equality and empowering women
4. To reduce child mortality rates
5. To improve maternal health
6. To combat HIV/AIDS, malaria, and other diseases
7. To ensure environmental sustainability
8. To develop a global partnership for development

Source:
<http://www.un.org/millenniumgoals/>
accessed on 11 May 2014

Appendix 3. The Rights of Nature in Articles 71-74 of the 2008 Ecuadorian Constitution

CHAPTER SEVEN Rights of nature

Article 71. Nature, or Pacha Mama, where life is reproduced and occurs, has the right to integral respect for its existence and for the maintenance and regeneration of its life cycles, structure, functions and evolutionary processes.

All persons, communities, peoples and nations can call upon public authorities to enforce the rights of nature. To enforce and interpret these rights, the principles set forth in the Constitution shall be observed, as appropriate.

The State shall give incentives to natural persons and legal entities and to communities to protect nature and to promote respect for all the elements comprising an ecosystem.

Article 72. Nature has the right to be restored. This restoration shall be apart from the obligation of the State and natural persons or legal entities to compensate individuals and communities that depend on affected natural systems.

In those cases of severe or permanent environmental impact, including those caused by the exploitation of nonrenewable natural resources, the State shall establish the most effective mechanisms to achieve the restoration and shall adopt adequate measures to eliminate or mitigate harmful environmental consequences.

Article 73. The State shall apply preventive and restrictive measures on activities that might lead to the extinction of species, the destruction of ecosystems and the permanent alteration of natural cycles.

The introduction of organisms and organic and inorganic material that might definitively alter the nation's genetic assets is forbidden.

Article 74. Persons, communities, peoples, and nations shall have the right to benefit from the environment and the natural wealth enabling them to enjoy the good way of living.

Environmental services shall not be subject to appropriation; their production, delivery, use and development shall be regulated by the State.

Source:
<http://therightsofnature.org/wp-content/uploads/pdfs/Rights-for-Nature-Articles-in-Ecuadors-Constitution.pdf>
accessed on 11 May 2014

Appendix 4. The Universal Declaration of Human Rights

PREAMBLE

Whereas recognition of the inherent dignity and of the equal and inalienable rights of all members of the human family is the foundation of freedom, justice and peace in the world,

Whereas disregard and contempt for human rights have resulted in barbarous acts which have outraged the conscience of mankind, and the advent of a world in which human beings shall enjoy freedom of speech and belief and freedom from fear and want has been proclaimed as the highest aspiration of the common people,

Whereas it is essential, if man is not to be compelled to have recourse, as a last resort, to rebellion against tyranny and oppression, that human rights should be protected by the rule of law,

Whereas it is essential to promote the development of friendly relations between nations,

Whereas the peoples of the United Nations have in the Charter reaffirmed their faith in fundamental human rights, in the dignity and worth of the human person and in the equal rights of men and women and have determined to promote social progress and better standards of life in larger freedom,

Whereas Member States have pledged themselves to achieve, in co-operation with the United Nations, the promotion of universal respect for and observance of human rights and fundamental freedoms,

Whereas a common understanding of these rights and freedoms is of the greatest importance for the full realization of this pledge,

Now, Therefore THE GENERAL ASSEMBLY proclaims THIS UNIVERSAL DECLARATION OF HUMAN RIGHTS as a common standard of achievement for all peoples and all nations, to the end that every individual and every organ of society, keeping this Declaration constantly in mind, shall strive by teaching and education to promote respect for these rights and freedoms and by progressive measures, national and international, to secure their universal and effective recognition and observance, both among the peoples of Member States themselves and among the peoples of territories under their jurisdiction.

Article 1.

All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood.

Article 2.

Everyone is entitled to all the rights and freedoms set forth in this Declaration, without distinction of any kind, such as race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status. Furthermore, no distinction shall be made on the basis of the political, jurisdictional or international status of the country or territory to which a person belongs, whether it be independent, trust, non-self-governing or under any other limitation of sovereignty.

Article 3.

Everyone has the right to life, liberty and security of person.

Article 4.

No one shall be held in slavery or servitude; slavery and the slave trade shall be prohibited in all their forms.

Article 5.

No one shall be subjected to torture or to cruel, inhuman or degrading treatment or punishment.

Article 6.

Everyone has the right to recognition everywhere as a person before the law.

Article 7.

All are equal before the law and are entitled without any discrimination to equal protection of the law. All are entitled to equal protection against any discrimination in violation of this Declaration and against any incitement to such discrimination.

Article 8.

Everyone has the right to an effective remedy by the competent national tribunals for acts violating the fundamental rights granted him by the constitution or by law.

Article 9.

No one shall be subjected to arbitrary arrest, detention or exile.

Article 10.

Everyone is entitled in full equality to a fair and public hearing by an independent and impartial tribunal, in the determination of his rights and obligations and of any criminal charge against him.

Article 11.

(1) Everyone charged with a penal offence has the right to be presumed innocent until proved guilty according to law in a public trial at which he has had all the guarantees necessary for his defence.

(2) No one shall be held guilty of any penal offence on account of any act or omission which did not constitute a penal offence, under national or international law, at the time when it was committed. Nor shall a heavier penalty be imposed than the one that was applicable at the time the penal offence was committed.

Article 12.

No one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honour and reputation. Everyone has the right to the protection of the law against such interference or attacks.

Article 13.

- (1) Everyone has the right to freedom of movement and residence within the borders of each state.
- (2) Everyone has the right to leave any country, including his own, and to return to his country.

Article 14.

- (1) Everyone has the right to seek and to enjoy in other countries asylum from persecution.
- (2) This right may not be invoked in the case of prosecutions genuinely arising from non-political crimes or from acts contrary to the purposes and principles of the United Nations.

Article 15.

- (1) Everyone has the right to a nationality.
- (2) No one shall be arbitrarily deprived of his nationality nor denied the right to change his nationality.

Article 16.

- (1) Men and women of full age, without any limitation due to race, nationality or religion, have the right to marry and to found a family. They are entitled to equal rights as to marriage, during marriage and at its dissolution.
- (2) Marriage shall be entered into only with the free and full consent of the intending spouses.
- (3) The family is the natural and fundamental group unit of society and is entitled to protection by society and the State.

Article 17.

- (1) Everyone has the right to own property alone as well as in association with others.
- (2) No one shall be arbitrarily deprived of his property.

Article 18.

Everyone has the right to freedom of thought, conscience and religion; this right includes freedom to change his religion or belief, and freedom, either alone or in community with others and in public or private, to manifest his religion or belief in teaching, practice, worship and observance.

Article 19.

Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers.

Article 20.

- (1) Everyone has the right to freedom of peaceful assembly and association.
- (2) No one may be compelled to belong to an association.

Article 21.

- (1) Everyone has the right to take part in the government of his country, directly or through freely chosen representatives.
- (2) Everyone has the right of equal access to public service in his country.
- (3) The will of the people shall be the basis of the authority of government; this will shall be expressed in periodic and genuine elections which shall be by universal and equal suffrage and shall be held by secret vote or by equivalent free voting procedures.

Article 22.

Everyone, as a member of society, has the right to social security and is entitled to realization, through national effort and international co-operation and in accordance with the organization and resources of each State, of the economic, social and cultural rights indispensable for his dignity and the free development of his personality.

Article 23.

- (1) Everyone has the right to work, to free choice of employment, to just and favourable conditions of work and to protection against unemployment.
- (2) Everyone, without any discrimination, has the right to equal pay for equal work.
- (3) Everyone who works has the right to just and favourable remuneration ensuring for himself and his family an existence worthy of human dignity, and supplemented, if necessary, by other means of social protection.
- (4) Everyone has the right to form and to join trade unions for the protection of his interests.

Article 24.

Everyone has the right to rest and leisure, including reasonable limitation of working hours and periodic holidays with pay.

Article 25.

- (1) Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.
- (2) Motherhood and childhood are entitled to special care and assistance. All children, whether born in or out of wedlock, shall enjoy the same social protection.

Article 26.

(1) Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit.

(2) Education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms. It shall promote understanding, tolerance and friendship among all nations, racial or religious groups, and shall further the activities of the United Nations for the maintenance of peace.

(3) Parents have a prior right to choose the kind of education that shall be given to their children.

Article 27.

(1) Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits.

(2) Everyone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author.

Article 28.

Everyone is entitled to a social and international order in which the rights and freedoms set forth in this Declaration can be fully realized.

Article 29.

(1) Everyone has duties to the community in which alone the free and full development of his personality is possible.

(2) In the exercise of his rights and freedoms, everyone shall be subject only to such limitations as are determined by law solely for the purpose of securing due recognition and respect for the rights and freedoms of others and of meeting the just requirements of morality, public order and the general welfare in a democratic society.

(3) These rights and freedoms may in no case be exercised contrary to the purposes and principles of the United Nations.

Source:

<http://www.un.org/en/documents/udhr/>
accessed on 11 May 2014