

Like Life Itself,

Sustainable Development is Fractal

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A new understanding of the world is revolutionizing how scientists and other professionals of all disciplines are solving important problems today, and this understanding also has the potential to significantly impact how we think about and work to achieve a sustainable world.



The term “fractal” was coined by Benoit Mandelbrot in 1975 and popularized in a scientific paper by him two years later.

In just the last couple decades, we have learned that fractal geometry – and its related field of chaos theory – forms the very basis of science. “Chaos,” as its name implies, is the study of processes that appear so random that they do not seem to be governed by any known laws or principles, but which actually have an underlying order. We now know that the physical, biological, social and even the economic universe is not random, and we’re beginning to determine just what that underlying “code” is.

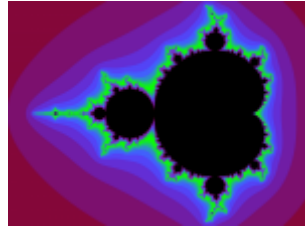
Scientists are learning that everything natural is created by the immutable laws of fractal geometry. This includes static elements as well as energy flows, living things, and their behavior patterns. They are all built on self-similar patterns that replicate each other on increasing and decreasing scales, sort of like Russian nesting dolls. The various levels of scale are not all exactly alike, but they are all self-similar and build one on top of the other based upon a fundamental “code” that reproduces itself on different scales. In both the metaphysical and practical sense, the entire universe is built by fractal geometry.

While it’s a relatively simple concept to understand and the general idea isn’t new, we have barely begun to realize the full importance and usefulness of fractal geometry. We are now beginning to learn how to dissect these “codes” and fractal geometry is now being used in many different ways. It is being used to better understand and impact economic trends, computerized image/data compression, human behavior, natural systems, molecular biology, cosmology, and much, much more.

Brief History

Throughout history, scientists have formed scientific principles in one discipline based on those from another. In ancient China, irrigation science formed the basis for the healer’s model of Chi, the life-force energy that flows through meridians like aqueducts. In psychology, Freud’s conceptualization of emotion used a scientific model of a hydraulic steam engine. More recently, laser technology and holography have prompted the

neurological investigation and understanding of memory. The interrelationships go on and on, and now our recent understanding of fractal geometry goes to the heart of it all.



Mandelbrot created what is now called the Mandelbrot Set to visually illustrate the properties of fractal geometry.

Benoit Mandelbrot, a financial analyst who worked at IBM, discovered the computer's ability to visually display what had previously been abstract mathematical equations, such as the mathematics of recursive loops. He coined the term "fractal geometry" to describe his efforts to portray the complexity of nonlinear systems in visual form, admitting his fascination for the beauty of many fractal forms. In such an equation, the formula is typically simple, consisting of a single equation, the output of which is fed back into the equation as its next input, forming an infinite loop. Although the idea of recursive loop equations have been around a long time, it is only with the advent of computers that enough iterations to approximate infinity – in both inward (high number of decimal places) and outward (high number of digits) directions – can be produced.

The Fractal Nature of Life Itself



The human cell possesses all the functioning of the entire human body.

Fractal geometry has dramatically expanded our scientific understanding in the field of biology. If you understand how a cell works, you understand how a human works biologically. A human is nothing more than a collection of about 50 trillion cells, each with the same structure and basic functionality, replicated and then adapted to work together to achieve the success of the community – the human being. All the functions of the human body are already present in every living cell that comprises it. Each cell has its own intelligence and all the functions of the whole human being. They know how to grow, reproduce, digest food, respire, defecate, communicate, etc. Everything humans can do, each cell in our body already does individually. After all, humans were programmed by and patterned after the cells themselves.

Similarly, humanity is comprised of a population of self-similar humans, each made up of trillions of cells. As cells evolve, as people evolve, so does humanity. Biologically speaking, the entire population of the world is akin to a cell. It has the same functions and needs. It's a self-similar pattern of increasing scale. The old axiom, "As it is above, so it is below," becomes the geometry of life and the laws of humanity. The similarities of function and need are scientifically inescapable.

As is true with all things that are fractal, understanding the inner-workings of one level of the structure offers insight into all other levels of the structure. Humans tend to think of ourselves as a singularity, but by scientific definition each human is a community of cells, all working together harmoniously toward one end, the sustainability of the whole. If you understand the

dynamics of how 50 trillion cells can live in the smallest environment in harmony, all the rules are there for a few billion people to live on the planet – in harmony. But this knowledge must be applied, as it is in the human body.

The following video introduces the laws of fractal geometry to our understanding of biology.



The Environment

One of the largest fractal relationships in real-life is the self-similarity of objects in nature.

Clouds, trees, ferns, snowflakes, crystals, mountain ranges, lightning, river networks, coastlines, and much, much more can be produced remarkably accurately within a computer using relatively simple fractal geometric equations. It is the way nature produces itself.

The Human Body



The brain, nervous system, respiratory system, circulatory system, and everything else in the human body, is a product of fractal geometry at work. Significant advances in medicine are currently being developed using fractal geometry that are directly attributable to our new understanding of the body.

Psychology

Scientists are learning that not only is human physiology fractal, but so is human behavior. In fact, fractal geometry has immense consequences on our mental and physical quality of life. Individual behavior, while often seemingly random, actually follows predictable patterns based on the “code” of instructions that are built into an individual’s psyche. Behavior, over time, reflects self-similarity and predictability. In fact, psychologists are beginning to define individual identity based on the patterns of self-similarity embodied in behavior. With the human psyche, just as with fractals, the closer you look, the more there is to see.

Psychologists can start with any detail about a person, no matter how trivial it may seem, and the more it is explored, the more richness and complexity is revealed, but it also can be traced back to the “code” of instructions that are embedded within the psyche of that individual person. In true fractal-like fashion, any part of behavior one examines reflects and is intimately connected to the whole. Through the exploration and understanding of this code, psychologists can begin to heal mentally sick patients.

Psychologists are learning that human creativity takes on fractal characteristics. Human creativity has an underlying process that selectively amplifies small fluctuations of mental stimulus and molds them into coherent mental states experienced as thought.



Fractal patterns of mental activity in sleep and wakefulness have been evaluated from EEG recordings. This has important implications for the proposal that dreams result from the brain's attempt to bring meaning to the images evoked by a stimulation of the brain's visual and motor centers during rapid eye movement sleep.

Other researchers are beginning to suggest that fractal geometry and chaos theory might help bring some order to the potpourri of provocative findings in parapsychology. For over a century, parapsychologists have investigated such purported phenomena as extrasensory perception and psychokinesis using old linear models from natural science. There is now some optimism that fractal models may begin to provide some breakthroughs.



George Washington lays the cornerstone for sustainable development. Click on the image to read more.

Our understanding of fractal geometry has enabled scientists to make breakthroughs in social psychology and welfare. We're learning that our ethical perspectives and the functioning of community are based on fractal geometric relationships. The forms of these community fractal relationships extend to national and even global physiology. For example, to this day George Washington is considered to be the "Father of Our Country" by setting the example for American democracy which now is playing out internationally, albeit with some unintended consequences due to some alterations in his original philosophy.

Economics

Fractal geometry has significant ramifications in economics and finance. Countless economic and financial "behaviors" are fractal in nature. In a nutshell, understanding fractal geometry enables organizations to improve their profitability and opens up entire new economic opportunities that simply did not exist previously.

In the 1930s, Ralph Elliott proposed that market prices unfold in specific patterns, which we now call fractal patterns.

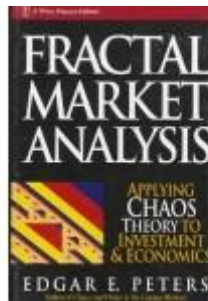


Ralph Elliott, a professional accountant, developed a concept now called the Elliott Wave Principle in the 1930s.

The Elliott Wave Principle says that just as naturally-occurring fractals often expand and grow more complex over time, so does collective human psychology. This is manifested in buying and selling decisions reflected in market prices. The principle has become popularized by Robert Prechter, a noted stock market analyst who realized through reading many of Elliott's lost works that mass psychology is what the markets are all about, and mass psychology is governed by fractal geometry. Elliott Wave practitioner John Casti said in *New Scientist* in 2002,

It's as though we are somehow programmed by mathematics. Seashell, galaxy, snowflake or human: we're all bound by the same order.

In the 1970's, Mandelbrot found other economic variables that followed similar patterns. His research suggested that markets of many different kinds exhibited a complex behavior that could be broken into smaller and smaller self-same bits. Price fluctuations could be described by fractal functions. He eventually wrote a book on the subject, *The (Mis)behavior of Markets*.



Today, economics and finance remains one of the hottest topics in the application of fractal geometry. Fractal geometry is being used to accurately model financial market risk. This understanding has led to the evolution of a new economic discipline called, “econophysics” where the study of fractals is chief among the many topics of study. Another aspect of the real world tackled by fractal finance is that markets keep the “memory” of past moves, particularly of volatile days, and act according to such memory. Volatility breeds volatility; it comes in clusters and lumps according to the laws of fractal geometry.

Sustainable Development and Fractal Geometry

We know that human health and behavior (people) are driven by the laws of fractal geometry. We also know that our natural environment (planet) functions according to the laws of fractal geometry. And we know that the world of finance and economics (profit) follows the laws of fractal geometry. So if the individual people, planet and profit components of triple-bottom-line sustainability are bound by the laws of fractal geometry, it follows that their combination will be self-similar as well. A closer examination reveals that to be the case.



Pass It Forward - To use the SLDI Sustainable Development fractal model, click and save it. The use of the model does not express or imply endorsement by SLDI.

By following a set of instructions, or “code,” designed to define our sustainable condition on earth, all human endeavors, regardless of their size, scope and scale, can produce sustainable results by following a set of instructions, or “code.” It is this universal code which we must model in order to produce replicable and scalable results. Whether we’re interested in land development, food production, or healthy living, the same basic set of instructions apply if sustainable results are desired.

Functioning like life itself, the SLDI Code™ is the world’s first and only model that graphically and conceptually identifies the instructions to achieve sustainable results, regardless of application.

It is represented as a three-sided fractal geometric figure called Sierpinski’s (equilateral) Triangle. It begins with the whole and penetrates deeper and deeper into project decision-making, replicating itself throughout all of the various areas, aspects and phases of the project development process from planning through finance, design, construction, maintenance and back to planning again.

It was not developed as a prescriptive checklist to specify a narrowly defined set of products or practices to achieve an outcome. Such systems almost always prove inappropriate on some level because of the unlimited variability of specific project types and circumstances at any point in time. The SLDI Code provides the basic instructions upon which any sustainable project may be achieved.

Any useful system requires the ability to adapt decisions to specific circumstances. As such, the SLDI Code is equally applicable regardless of project type, scale, terrain, climatic zone, etc. It allows for the consideration of all the unique characteristics and constraints of any project, all of which ultimately produce completely unique outcomes. In other words, rather than prescribing how to design a project, the SLDI Code provides the “code” or programming that provides the user with the tools to enhance the quality of their work by combining and balancing virtually unlimited possibilities into a sustainable end result.

In fact, the SLDI Code, like many computer programs, is applicable on projects of any type, regardless of industry. The principles embedded in its top few orders of magnitude are so universal that they apply to all applications of its use, much like a word processing, spreadsheet or graphic design program may be applied broadly across industries and disciplinary endeavors.



Pass It Forward - To use the SLDI Code fractal symbol, click and save it. The use of the SLDI Code does not express or imply endorsement by SLDI.

The code enhances the quality of outcomes, however diverse they may be, toward greater sustainability from a holistic people, planet and profit perspective. Using the constructs of fractal geometry, the SLDI Code uses the practical methods of how our world, and in fact the universe itself, has been constructed, to perpetuate life in the universe in the most effective manner possible.

In the pass-it-forward spirit, SLDI is now offering this fractal geometric model, including the instructions, to all those willing to collaborate for the collective benefit of people, planet and profit – today and in the future. It's high time for us to apply the scientific laws of nature to our hope for sustainable civilization.

For More Information:

- 1) [Chaos Theory and Humanistic Psychology](#)
- 2) [Chaos Theory in Psychology and the Life Sciences](#); by Robin Robertson and Allan Combs;
- 3) [Clark, Arthur C.; Fractals – The Color of Infinity](#);
- 4) [Connecting the Fractal Coast](#); Nikos Salingaros;
- 5) [Elliott, Ralph; The Elliott Wave Principle](#);
- 6) [Fractal and Chaotic Dynamics in the Brain](#)
- 7) [Fractal Dynamics of the Psyche](#); Terry Marks-Tarlow;
- 8) [Fractal Properties in Economics](#)
- 9) Fortune Magazine, July 11, 2005; [How the Finance Gurus Get Risk All Wrong](#)
- 10) [Hunting the Hidden Dimension](#)
- 11) [Lipton, Bruce, Ph.D, Cellular Biologist](#);
- 12) [Mandelbrot, Benoit, Ph.D, Mathematician](#);

Comments



January 08, 2011 at 14:02 pm UTC | [Jules Ruis](#) writes:

For more information about fractals, see: <http://www.fractal.org>

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