ProgBlog 9

2013

Regularity and predictability:
piecing together the "unseen unknown" of the future

By Michael Lee

"If nature were not beautiful, it would not be worth knowing,
and if nature were not worth knowing, life would not be worth living."

Henri Poincaré, *The Foundations of Science* (1913)

How much of what happens in nature, so admired by scientists from Galileo to Poincaré, conforms to its known rules? And, for futurists, how much of the future is written into nature's rulebook?

When types of behaviour in nature and society obey scientific laws or established principles, it opens the way for potentially robust predictions of their future states and outcomes. In particular, the more regular behaviour is, the more predictable it should prove to be. The Latin word *praedicere* means to "make known beforehand" and predictions make statements about what is going to happen, often as a consequence of certain causes, both direct and indirect. But when behaviour is apparently, or actually, random, the degree of difficulty for predictions rises accordingly. Underlying regularities, which enable causal influences and universal behaviour to be unveiled, provide a theoretical framework for what South Africa's leading scenario strategist, Clem Sunter, has called the science and art of making predictions.

A good analogy for studying the future is constructing a jigsaw without having any picture on the top of the puzzle box as a reference point. At first, the futurist has hundreds of isolated pieces – facts, data, information, ideas, intuitions – scattered in all directions on the table. He has little or no idea of the picture he'll end up constructing.

Slowly, pieces which match are joined, completing certain areas of the puzzle. This work requires detailed comparative analysis of what each piece represents and how it might fit together with other pieces. As he assembles pieces in several areas, the futurist starts to think about what kind of picture the completed sections will make as a whole. When an unfolding pattern falls into place, the futurist forms a concept of the puzzle's subject matter. His aim is to form a detailed vision of some developing future.

The puzzle-maker progresses from a study of individual pieces and how they connect to constructing sections which themselves link into an inter-connected pattern. He creates order from chaos by spotting regularities in the apparently random scattered pieces. There are patterns within patterns which form part of one broad picture.

By comparing study of the future to the assembly of a jigsaw which has no picture on top of the box, we realize how painstaking and methodical the work of the scientifically minded futurist has to be.

Specifically, a type of systematic thinking called induction is used by which he sifts through, studies and compares pieces in order to join them. *The Concise Routledge Encyclopedia of Philosophy* defines induction as: "an inference from a premise of the form 'All observed A are B' to a conclusion of the form 'All A are B.'"[1] The only difference between the two statements in the definition ('All observed A are B' and 'All A are B') is that the word "observed" has been dropped from the second statement. The implication is that the observations of A and B provide reasonable grounds for concluding that a pattern has been discovered for all As and Bs. Induction helps scientists to make universal statements about nature without needing to observe the *whole* of nature to prove them. The statement 'All *observed* A are B' is elevated to the more universal status of 'All A are B'.

The key to this sort of inductive thinking is systematic observation leading to the identification of patterns or the discovery of persistent regularities. That's why this approach may also be defined as: "the inference of a general law from particular instances."[2] In the case of the puzzle-maker, his reasoning would be expressed something like this: "These pieces have similar colours and shapes so I will put them into one pile where I'll test if they actually fit into one another as it seems likely they will. If they do fit, it'll prove they belong together in a permanent relationship in the picture I am forming."

The logical movement in induction is always from particular to general. It's also a matter of progressing from the known and seen (jigsaw pieces) to the unseen unknown (how the pieces fit together).

[1] *Concise Routledge Encyclopedia of Philosophy*. 2000. London: Routledge. 392.
[2] Pearsall, J, ed. 1998. The New Oxford Dictionary of English. Oxford: Oxford University Press. 932.

Knowledge of the future is based primarily on this kind of induction. The futurist moves from the observed known, in the present and past, to the unseen unknown of the future. He does this by identifying regular behaviours which are considered persistent or generally applicable. The explanations as to why the behaviour is regular in the first place will indicate how strong the relationships between the factors involved really are.

Since he starts with so few knowns and so many unknowns, the puzzle-maker without a puzzle picture needs to employ systematic logic to complete his task. From his inauspicious starting position, he must derive definite conclusions about the future. He uses the powerful tool of induction to do this. After all, it's the most powerful method for producing knowledge ever invented.

Following the groundwork of sorting through hundreds of puzzle pieces to complete some sections of the puzzle, the puzzle-maker begins to connect the sections themselves. Now he needs more hypothetical, speculative reasoning. Say, for example, he speculates that the puzzle is going to represent the picture of a country road leading to a farmhouse. He has noticed shapes showing similarities to photographs, paintings or personal recollections he can call to mind of farmhouse scenes. By using holistic intuition in support of the inductive process, the futurist acquires a general concept of the puzzle's subject-matter, its emerging picture.

Given that futurists build big pictures of the "unseen unknown", they will depend heavily upon inductive analysis of details supported by holistic intuition in a kind of self-reinforcing cycle of reasoning.

This detective-like futurological work hinges on the identification of regularities. They are patterns which persist in different conditions due to underlying persistent relationships between key variables. It's been suggested that patterns coming through in the puzzle while it's being assembled reflect regularities in form and structure. If behaviour in the systems of nature and society is highly irregular, the futurist will be unable to form patterns, the building blocks of his pictures of the future.

It'll be useful at this point to examine the concept of regularity in more detail. Regularity is defined by the New Oxford Dictionary of English as "arranged in, or constituting, a constant or definite pattern…recurring at short uniform intervals….arranged in, or constituting, a symmetrical or harmonious pattern…conforming to…an accepted standard of procedure or convention."[3] Synonyms for regularity derived from this definition would be words like: pattern, arrangement, symmetry and even template; that is, something which has a definite form, like a stencil, which can be replicated. The pattern has to be persistent, due to fixed relationships.

[3] Pearsall, J, ed. 1998. The New Oxford Dictionary of English. Oxford: Oxford University Press. 1563.

Regularities, like patterns, can be observed in the real spatial world as will shortly be illustrated. Yet something can only be recurrent within time, not outside of time. By definition, a regularity needs to be periodic, that is, occurring at generally predictable intervals. Futurists look for time patterns, cycles of measurable duration. We should study regularity spatially and temporally.

Regularities allow us to work out models of behaviour as cycles repeat themselves in measurable periods of time, from seasons and tides to economic waves, from natures' water cycle to historical movements and production lifecycles. These cycles in nature and society are complete time patterns.

A cycle is like a circle in that it indicates a completed movement back to the starting point. The usual implication of this word is that this circular movement can be repeated (just as one can keep going round and round a circle indefinitely). In addition, a circle is normally seen as a highly regular, perfect shape. The three main ideas of a cycle, then, are: (i) a circular, completed movement, (ii) a highly regular shape and (iii) a recurrent process. The domains of nature and society, which are profoundly interconnected, are filled with cycles as will soon be shown.

What we call a lifecycle traces the path of how unique things begin, change, grow, peak, decline and die through time, following a typical sequence of universal phases. Perhaps *lifespan* is a better word for these unique passages of time of entities, including organisms, than *lifecycle*. Cycles, by contrast, are periodic, they recur within predictable time-frames.

I cannot think of a single entity in nature or society which is not subject to some lifecycle, some temporal framework in which it operates. Nor is anything isolated from cycles which are happening all over nature. These cycles, or repeatable time patterns, enable some measure of prediction about future states as entities move through, and change with, time in universal ways. Since *everything* exists in the space-time continuum, everything must be deeply influenced by its spatial and temporal dimensions. The laws of nature are universal and often describe how systems behave in space-time.

Science has always focused on understanding regularities. It's customary to formulate laws, principles, theories and models which explain the processes and mechanisms of recurrent phenomena. Once these regularities have been proven by evidence beyond a reasonable doubt, they become universal characteristics of the world we know and understand. Such knowledge can then be used throughout the world, by people of different cultures and beliefs, to solve common problems through science.

Let's go on a quick guided tour of nature and society to observe regularities and time patterns at work.

To start with, there's a highly regular motion throughout the stable solar system which is our cosmic neighbourhood. Think of the near perfect sphere shape of planets and stars. Orbits in the solar system are close to perfect circles.[4] Planets have very regular orbits "within a few percent of circles".[5] Thankfully, the moon and earth are synchronized: "The moon turns once as it orbits Earth: both its spin and its orbit follow cycles that repeat themselves regularly."[6] As is well-known, our planet completes one rotation on its axis every 24 hours to make each day. At the same time, it revolves around the sun in about 365.25 days to produce each year. Pretty regular stuff, I must say. When one tosses a stone into a dam the ripples are neatly circular, not haphazard. Patterns are evident everywhere if you look for them.

It's natural for humans to see beauty in such symmetry and regularity. Perhaps this predilection explains the appeal of mathematics with its abstract beauty and even perfection. In 1751, mathematical genius Leonhard Euler (1707-1783) proved that for 3-D polyhedra, their vertices (V), edges (E) and faces (F) *always* have the relationship expressed in his formula :V- E +F = 2. [7] This is a highly regarded and elegant theorem which expresses an abstract order and perfection in 3D shapes. Euler also proved there can only ever be five regular solids given the truth of his formula and the limits it imposes on permutations for polyhedra. Regular polyhedra do occur in nature, too (for example in some crystals). Euler's theorem expresses a universal relationship. It symbolizes mathematical order. It embodies a perfect regularity.

Mathematical regularities may seem more abstract than regularities observed in nature but we often design useful and ornamental products based on the inspirational order and knowledge of mathematics. The popular golf ball, for example, is typically designed with 220 hexagons and 12 pentagons for its perfectly calibrated balance.

Coming down to life at the micro scale, Kepler identified the hexagonal symmetry of snowflakes early in the 17th century and contemporary scientist and mathematician Stephen Wolfram believes their formation follows a few simple rules resulting in subtle variations on a six-pointed shape. He also states that spiral patterns in plants converge to within a degree or less of 137.5°. That's a pretty exact pattern, a widespread regularity. Wolfram has noted that the complex variety of shapes of trees and leaves is driven by a simple underlying branching pattern. Likewise, Leonardo da Vinci recognized regular patterns in how leaves are arranged on a plant stem (phyllotaxis). Mathematicians and artists seem attuned to these invisible patterns of life.

[4] Wolfram (2002):1187.
[5] Wolfram (2002):973.
[6] Strogtaz (2003):184.
[7] Richeson, D. 2008. Euler's Gem – the polyhedron formula and the birth of topology. Princeton: Princeton University Press.2.

There are elegant regularities in the physics of the solar system and on earth. Tides can be accurately timetabled because they occur periodically as a result of the consistent gravity exerted by the moon on our oceans as these two planets rotate in a choreographed dance of their orbits. In 12 hours, earth rotates 180 degrees, while the moon turns 6 degrees around the earth in the same period time. As a consequence, high tide will occur approximately every 12 hours and 25 minutes. This is the clockwork cosmos Newton observed so admiringly. I'm more than happy we live in a balanced, stable – and *predictable* - solar system.

Consider for a moment the lovely mystery of how the humble dung beetle navigates its direction by the stars and moon as it works with animal muck. Recent field experiments on a South African game reserve demonstrated that these cosmically sensitive insects can roll their dung balls along straight paths under starlit skies, but not when it's overcast.[8] The researchers say their findings represent the first proven use of the Milky Way for orientation in the animal kingdom. They sum up their findings in these stirring words: "African ball-rolling dung beetles exploit the sun, the moon, and the celestial polarization pattern to move along straight paths, away from the intense competition at the dung pile. Even on clear moonless nights, many beetles still manage to orientate along straight paths. This led us to hypothesize that dung beetles exploit the starry sky for orientation, a feat that has, to our knowledge, never been demonstrated in an insect. Here, we show that dung beetles transport their dung balls along straight paths under a starlit sky but lose this ability under overcast conditions. In a planetarium, the beetles orientate equally well when rolling under a full starlit sky as when only the Milky Way is present." [9]

In short, the dung beetle at work moves in straight lines by aligning itself to patterns in the sky. This strategy enables it to maximize the efficiency of its work and increase its security. It seems extraordinary that the dung beetle detects regularities in the heavens and lives by them. It's certainly one creature who isn't buying the conclusions of the Black Swan theory.

The new science of synchronization, explained in my previous blog, "Our Automated Future", has identified millions of oscillators throughout nature, from the human heart and brain to pulsars in outer space, which all pulse at regular intervals. These oscillators have the capacity to synchronize and harmonize with others in their vicinity.

[8] "Dung beetles navigate by the stars" guardian.co.uk, Friday 25 January 2013.
http://www.guardian.co.uk/science/2013/jan/25/dung-beetles-navigate-stars
[9] Current Biology. Volume 23, Issue 4, 18 February 2013, Pages 298–300
"Dung Beetles Use the Milky Way for Orientation", by Marie Dacke, Emily Baird, Marcus Byrne, Clarke H. Scholtz, Eric J. Warrant.

Biophysicist Arthur T.Winfree, a leading expert in circadian rhythms, urges us to think of earth as a giant clock with living organisms marking time in cycles of 24 hours of alternating light and darkness, with human consciousness, too, ebbing and flowing in this daily cycle.[10] According to Winfree, this regularized marking of time according to the basic pattern of the earth clock is absolutely built in to living things.[11]

Scientist and mathematician Stephan Wolfram has discovered that simple programs, comparable to computer code, underlie all of nature's processes. Again: pretty regular stuff.

A picture of cosmic harmony and symmetry on a grand scale is emerging. And it's underpinned by a super-abundance of regularities and time patterns. But earth is not alone in being regular.

Since the survival of cultures and civilisations has always depended on mastering cycles of nature, with systems in both domains being intricately interdependent, it's not surprising there are historical regularities in the on-going evolution of human society.

And these historical regularities may be used to compose a puzzle-picture of the future, as contemporary historian, Ian Morris, suggests when he states that laws of history "give us a pretty good sense of what is likely to happen next."[12]

There's considerable evidence from theoreticians in sociology, economics and history of recurring cycles and underlying patterns observed over very long periods of human time. Since the birth of modern science, various philosophers and social scientists have looked for social evolutionary laws comparable to natural laws of development. For example, Condorcet (Jean-Antoine-Nicolas de Caritat, 1743-1794), who predicted the rise of women's rights almost a century before it happened, believed that humanity progresses according to laws of social development: "The only foundation of faith in the natural sciences is the principle, that the general laws…which regulate the phenomenon of the universe, are regular and constant; and why should this principle, applicable to the other operations of nature, be less true when applied to the development of the intellectual and moral faculties of man?"[13]

A mathematician, philosopher and political scientist, he argued that the spread of education would result in greater social equality and wealth distribution. This increase in freedom and wealth, in turn, would reinforce the spread of knowledge. Social development, then, advances through the mutual reinforcement of liberty and knowledge. In Condorcet's mind, this was a law of progress.

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[10] Winfree, A.1987. *The Timing of Biological Clocks.* New York: Scientific American Books, Inc. 12, 42, 145.
[11] Winfree (1987): 160.
[12] Morris *Why the West Rules –For Now- the Patterns of History and What They Reveal about the Future* (2011) 36.
[13] De Caritat (de Condorcet) *Outlines of an historical view of the progress of the human mind* (1795) 316.

Herbert Spencer was one of the earliest social thinkers to draw parallels between nature and society. His 1881 essay, *Progress: Its Law and Cause, with other disquisitions*, defines a law of progress (which differs from Condorcet's). Spencer posited that social development follows the same basic pattern driving organic growth: "this same evolution of the simple into the complex, through successive differentiations…we shall find that the transformation of the homogeneous into the heterogeneous is that in which progress essentially consists."[14]

For Spencer, society was a living social organism developing in a scientifically observable process: "Every active force produces more than one change – every cause produces more than one effect…Starting with the ultimate fact that every cause produces more than one effect, we may readily see that throughout creation there must have gone on, and must still go on, a never-ceasing transformation of the homogeneous into the heterogeneous."[15]

Within specific social sciences historic regularities have been observed. Like the puzzle-maker without a puzzle picture, Russian economist Nikolai D. Kondratieff tried to understand the cycles of the capitalist system by using inductive inferences from detailed historical data he gathered. His data revealed time patterns or recurring cycles which formed the basis of his theory of long economic waves.

Kondratieff's minor masterpiece *The Long Waves in Economic Life* (1935) identified cyclical, wave-like patterns of economic life in capitalist systems which averaged 50 years.[16] In addition, he identified short waves of 18 months to 3 years' duration, as well intermediate waves of 7 to 11 years. His economic waves occurred in definite time intervals.

Kondratieff plotted a time series for changes to wholesale price levels, interest rates, wages, foreign trade and production and consumption indicators. In each series, he noticed a succession of three waves, with each wave having an upswing lasting about 25 years, followed by a decline of slightly longer, or shorter, duration: "The movements of the series which we have examined running from the end of the eighteenth century to the present time show long cycles…these waves have been shown with about the same timing in all the more important of the series examined."[17] These recurrent patterns pointed to a definite cyclic process of economic development, the shaping forces of which are "inherent in the essence of the capitalist economy."[18]

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[14] Spencer "Progress: Its Law and Cause, with other disquisitions" 1881 *Humboldt Library of Popular Science Literature* 1 (17): 535 536

[15] Spencer "Progress: Its Law and Cause, with other disquisitions" 1881 *Humboldt Library of Popular Science Literature* 1 (17): 535 541.

[16] Kondratieff collected economic data from the US, UK and France from 1780 to the 1920s, a time span of around 140 years.

[17] Kondratieff *The Long Waves in Economic Life* (1935) 30.

[18] Kondratieff *The Long Waves in Economic Life* (1935) 42.

Kondratieff's first long wave, from 1789-1849, showed a 25 year period of upswing to 1814 followed by economic decline and depression for 35 years, making a cycle of 60 years. The second wave, from 1849-1896, demonstrated a "boom" of 24 years followed by a "bust' of 23 years, yielding a shorter cycle of 47 years. The next upswing lasted 24 years until the 1920s which lead, as everyone knows, to the Great Depression. In each wave, there is a turning-point in economic growth, when the upswing ends and depression sets in. Eighty years later, the global economy underwent a huge "bust" called the Great Recession which started in 2008. I suspect these economic waves first demonstrated by Kondratieff in the 1930s are still with us.

Joseph Schumpeter (1883-1950), well-known for his theory of creative destruction in capitalist systems, built on Kondratieff's work in his two volume tome *Business Cycles*, published in 1939 following thirty years work on the concept of the business cycle.[19] Cycles, he explained, are a process "within which all elements of the economic system interact in certain characteristic ways".[20] He reasoned that the key factor underlying economic cycles was innovation, describing it as "the outstanding fact in the economic history of capitalist society…the basis of our model of the process of economic change".[21] He defined innovation as 'the setting up of a new production function…a new commodity…[or] a new form of organization, such as a merger…[or] the opening up of new markets…"[22] The railroads were a massive innovation, as were motorized vehicles in the previous century. They were disruptive, game-changing technologies.

Schumpeter described how new companies and new industries arise as a result of innovation and threaten the existence of older competitors and their products, prices and production systems. Companies have life-spans just like organisms. Eastman Kodak, once a global corporate giant, filed for bankruptcy in January 2012, after 131 years of success.

Associated with technological innovations is the role of credit and capital investment in them. New technologies, and the industries they spawn, attract significant credit and investment as they expand. Schumpeter believed monetary cycles of credit and debt accumulation influenced the peaks and troughs, booms and recessions, of the long economic waves first identified by Kondratieff.

[19] Schumpeter *Business Cycles Vol 1* (1939) 163.
[20] Schumpeter *Business Cycles Vol 1* (1939) 449.
[21] Schumpeter *Business Cycles Vol 1* (1939) 86-7.
[22] Schumpeter *Business Cycles Vol 1* (1939) 87.

Schumpeter blamed such a dysfunctional monetary situation as a cause of the Great Depression: "Given the way in which both firms and households had run into debt during the twenties, it is clear that the accumulated load – in many cases, though not in all, very sensitive to a fall in price level – was instrumental in precipitating the depression."[23] High debt levels also precipitated the Great Recession of 2008-2012. This reveals significant economic cyclical behavior. Without doubt, there are time patterns in economic history.

Societies as a whole definitely undergo recurrent cycles of development. Highly regarded American sociologist, Pitirim Sorokin, studied social evolution throughout the span of civilization, spotting recurrent historical patterns. His doctrine of social change drew on a principle of the internal dynamic drivers of systems. Systems, including social systems, have their own built-in dynamics, including a finite number of forms and ceilings of development to contend against: "Hidden behind the empirically different, seemingly unrelated fragments of the cultural complex lies an identity of meaning, which brings them together into consistent styles, typical forms and significant patterns."[24] Each social system, trapped inside its own box of dynamic variables, is a molder of its own future within limits imposed by nature.[25]

This theory of the internal dynamism of systems resonates with Wolfram's findings that automatic simple programs, comparable to compute code, drive the evolution of all entities throughout nature.

Sorokin painted a picture of a regularized process of social evolution: "The great symphony of social life is 'scored' for a countless number of separate processes, each proceeding in a wavelike manner and recurring in space, in time, in both space and time, periodically or non-periodically, after short or long intervals…Economic processes fluctuate endlessly between prosperity and depression….vital processes between births, deaths, marriages, divorces; all undergo their 'ups and downs' which sometimes become monotonously uniform. Crime and licentiousness, religion and irreligion, social stability and revolt, recur endlessly. Social systems…forever repeat the processes of recruiting, change, dismissal…originate, grow and dissolve. And so it goes with almost all social phenomena and process."[26] He had noticed patterned fluctuations over a twenty-five hundred year time-span. They constitute enormous time patterns.

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[23] Schumpeter *Business Cycles Vol 1* (1939) 333; 909.
[24] Sorokin *Social and Cultural Dynamics* (1957) 10.
[25] Sorokin *Social and Cultural Dynamics* (1957) 640.
[26] Sorokin *Social and Cultural Dynamics* (1957) 57.

Futurists working in specialized fields in the private or public sectors can get to know the typical time patterns and cycles of phenomena operating historically in the domains they study. They can then work out future states of systems in these fields using the method of preconstruction (see Figure 1).

Contemporary historian Ian Morris believes he has identified laws of history in the same way in which Sorokin has accumulated evidence of the existence of sociological laws. Morris explains how social development takes place across history by using three key principles from biology, sociology and geography. Geography determines what resources are made available to a people. The location of a society provides the scope for its early advancement. Regarding the sociological dimension of development, Morris argues that societies develop primarily by harnessing energy. Their survival and prosperity are dependent on extracting energy from the "Great Chain of Energy"[27]and then capturing, and using, it. This is where the third factor of human biology comes in.

Morris roots most social change in human needs: "Change is caused by lazy, greedy, frightened people looking for easier, more profitable, and safer ways to do things."[28] This statement implies that we are driven by the biological need to live securely, that is, to survive, and, once that aim has been achieved, to make life easier. Schumpeter also identified the meaning of economic activity as satisfying human wants.[29]

So societies and economies develop as humans find ways to prosper – to live easier - in their given geographies. Morris is certain that universal principles, from biology, sociology and geography, underlie the whole spread of history: "…these biological and sociological laws are constants, applying everywhere, in all times and all places."[30] The social sciences, he says, seek to explain what causes social change: "…behind all the details of what has happened in the last fifteen thousand years, two sets of laws – those of biology and sociology – determined the shape of history on a global scale, while a third set – those of geography – determined the differences between Eastern and Western development…."[31]

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[27] Morris *Why the West Rules – For Now – The patterns of history and what they reveal about the future* (2011) 84.
[28] Morris *Why the West Rules – For Now – The patterns of history and what they reveal about the future* (2011) 28.
[29] Schumpeter *The Theory of Economic Development* (1934) 10.
[30] Morris *Why the West Rules –For Now-The patterns of history and what they reveal about the future* (2011):29.
[31] Morris *Why the West Rules – For Now – The patterns of history and what they reveal about the future* (2011) 36.

There is a common principle running through the theories of Kondratieff, Schumpeter, Sorokin and Morris. They reveal the presence in history of economic, social, cultural and intellectual waves, or cycles of development, over large expanses of time. These thinkers concluded that the never-ending cyclical processes resulted from internal dynamics of social systems designed for the satisfaction of the human need to survive and develop.

As already mentioned, the futurist can exploit the regularities in the way systems behave, including social systems, through the method of pre-construction (see Figure 1).

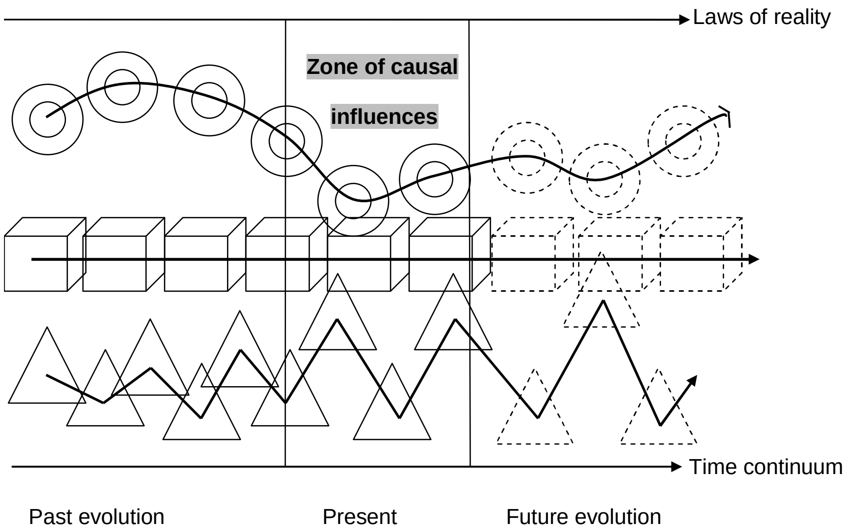

Figure 1: Preconstructing the future through pattern recognition

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The three shapes in Figure 1 represent any social entity. They each follow a different trajectory in their evolution. The futurist traces their past behaviour and then assesses causal influences, or persistent relationships, most likely to change evolutionary paths they are on. Given the degree of regularity in the cosmos, nature, history and society, there's a great deal of behaviour which is regular and therefore potentially predictable.

But what about the role of randomness, a key concept in complexity science and chaos theory, which we hear so much about these days? What is its role relative to regularity? In terms of ultimate influence over behaviour, randomness, in my view, must remain the junior partner of regularity in a complementary relationship. Wolfram defines it as behaviour which has "no significant regularities in it".[32]

[32] Wolfram (2002): 553.

Yet he sees a purpose behind randomness – to strengthen processes in the same way that diversification is a common way to minimize risk in financial and economic terms: "…randomness and complexity tend to lead to more, rather than less, robustness in overall behavior…many even seemingly simple biological processes appear to be stabilized by randomness – leading, for example, to random fluctuations in interbeat intervals for healthy hearts…some biological processes rely directly on complex or random phenomena – for example, finding good paths for foraging food, avoiding predators or mounting suitable immune responses."[33] Randomness, it appears, may be purpose-driven after all.[34] In the long-run, those purposes should be knowable. Randomness occurs within a regular and harmonious cosmos.

In the universe and on earth randomness is quiet simply dwarfed by regularity.

Both the natural and social sciences, including study of the future, can exploit knowledge of regularities to build theoretical and computer models which have predictive power. This should led to an increasing, and even escalating, use of prediction as a proactive tool for problem-solving in diverse fields such as public health, criminology, retail, finance, agriculture and energy.

Right now, predication and foreknowledge are untapped resources analogous to the hidden wealth and power of oil in the time leading up to the discovery and exploitation of the world's first commercial oil well by Edwin Drake in Pennsylvania. Once unleashed, the sheer intense power of oil generated an unprecedented transformation of industry and society.

Aren't we sitting on top of analogous reserves of immense power just locked up in our ability to predict?

Conclusion

There is complexity, chaos and randomness, but the abiding impression created by a serious observation of both nature and society is of a celestial order in the heavens and widespread spontaneous order on earth. In both domains, there is a superabundance of regularities, the study of how systems behave periodically in space-time. I'm convinced that applying knowledge of deep, underlying regularities in social evolution would be as powerful today for changing the future and the world as the discovery of oil in 1859 proved to be.

Michael Lee's book *Knowing our Future – the startling case for futurology* is available at the publisher http://www.infideas.com/pages/store/products/ec_view.asp?PID=1804 or on Amazon.com.

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33 Wolfram (2002):1002.

34 The drawing of lots is a random method of being unbiased or fair in making decisions which dates back in society to at least biblical times; today we might toss a coin or throw dice at the start of a game to decide which player or team goes first. Taking random samples is common practice in surveys. Using random numbers is important to encryption in codes to protect sensitive or valuable messages. Randomness has many useful purposes.

Acknowledgments

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