



# laetus in praesens

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## Periodic Pattern of Human Life the Periodic Table as a metaphor of lifelong learning

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### Introduction

The following purely speculative exploration results from the recognition that very few people ever grow to be older than the number of chemical elements ordered in the well-known [Periodic Table of Dmitri Mendeleev](#). The total number of those elements confirmed is currently 111, with unconfirmed claims made with regard to elements up to 122 (see [Timeline of chemical elements discoveries](#)). The oldest person in history, whose age has been verified, is [Jeanne Calment](#) (1875-1997) -- 122 years. Consideration has been given to the [extension of the Periodic Table beyond the seventh period](#), with an eight-period table suggested by [Glenn T. Seaborg](#) in 1969 --, with elements up to 210 hypothesized. These concerns parallel those of [life extension](#) into a similar number of years, notably using [strategies for engineered negligible senescence](#).

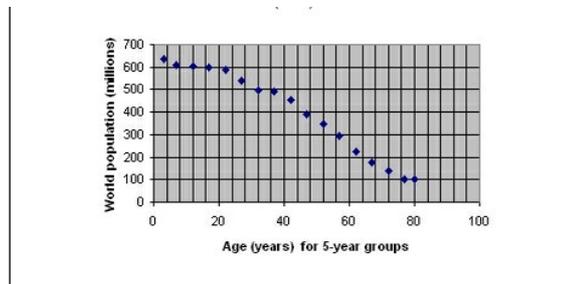
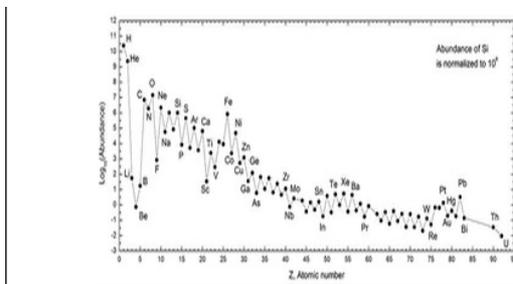
Whilst the relationship of such numbers to human lifespan may be purely coincidental, it is worth considering whether it is not and is indeed indicative of some as yet unknown fundamental constraint on the ageing process. It could for example prove instructive to compare the relative global [abundance of the chemical elements](#) (in terms of atomic number) with relative global [human life expectancy](#) (as measured in years) -- with the latter expressed in terms of the proportion of the population having a given age (the [age distribution of the world's population](#)). Such measures, typically represented as an [age structure diagram](#), are a focus of the [UN Programme on Ageing \(The Ageing of the World's Population\)](#).

Any such correspondence leads to the notion that on every birthday individuals can be mnemonically associated with the next element in the periodic table -- somewhat as [wedding anniversaries](#) are associated with particular substances (notably including chemical elements) according to the number of years so celebrated.

The average life expectancy for many, especially those in some challenged societies, may then be associated with particular elements earlier in the table. The experiences associated with the later elements are then necessarily inaccessible to most.

The question for reflection is then whether other features of the ordering of the periodic table suggest intriguing ways of thinking about the passage of years of an individual human life -- possibly a kind of *Periodic Table of Human Living* or a *Periodic Table of Human Life*. This is further discussed elsewhere in greater detail ([Periodic Pattern of Human Knowing: implication of the Periodic Table as metaphor of elementary order](#), 2009).

Indicative correspondence between world population by age and abundance of chemical elements by atomic number	
Abundance of chemical elements by Atomic Number Source <i>Wikipedia</i>	World population (male + female) by Age Source: U.S. Census Bureau, International Data Base (094). U.S. data are based on official estimates and projections



## Related explorations and precedents

**Musings:** The table of chemical elements has of course been used as a means of framing insights about life in the famed work of Italian author [Primo Levi](#) (*Il Sistema Periodico*, 1975), published in English as *The Periodic Table* (1995). In 2006, the [Royal Institution of Great Britain](#) named it the best science book ever. It is a collection of 21 stories, each with the name of a chemical element and connected to that element in some way. The stories based on people and events in the author's personal and professional life interweave to create a vision of the synthesis of the life of the author as seen through the kaleidoscope of chemistry. The book has been widely and appreciatively reviewed (Patricia Blake, *Chemistry Becomes a Muse the Periodic Table*, *Time*, 28 January 1985; [review](#)). A similar approach has been taken by Michael Swanwick (*A Periodic Table of Science Fiction*, 2005), associating 118 very short stories with each chemical element.

**Biology:** The [Human Genome Project](#) has been described in terms of identifying the "Periodic Table of Biology". Recent research in biology has pointed to the possibility of a "periodic table of life" based on 68 basic molecules -- understood as "elements". Susumu Morimoto has presented *A Periodic Table for Genetic Codes* (*Journal of Mathematical Chemistry*, 2002). J. D. Bashford and P. D. Jarvis (*The Genetic Code as a Periodic Table: algebraic aspects, Biosystems*, 57, 3, 2000, pp. 147-161) use a simple numerical labelling scheme for nucleic acid bases, to show how data can be fitted as low order polynomials of the six coordinates in the 64-dimensional codon weight space. As professor of geology, ecology and evolution at Rutgers University, George McGhee (*Convergent Evolution: a periodic table of life?* pp. 17-31) has proposed -- as a thought experiment -- the possibility that animal species might be ordered in terms of some form of periodic table. By analogy, he uses the elemental concepts of complexity and evolutionary sequence to arrange the major groups of animals in a series rows. The various columns are then used to characterize the "mobility" of the elements in those rows on the basis of locomotory type. He proposes a research program to explore the spectrum of existent, nonexistent, and impossible biological forms.

**Nutrition:** The Periodic Table has been used as a framework for nutritional requirements and toxicity (Vaughn Aubuchon, *Periodic Chart of Human Elements and the Need in Human Nutrition*, 2006; Mineral Information Institute, *The Role of Elements in Life Processes*).

**Psychology:** The psychologist [John Curtis Gowan](#) (*The Development of the Creative Individual*, 1972) discussed the periodic aspects of the theory of developmental stages and notably an "Open-Ended Periodic Table of Development and its Implications" (see extract *Development of the Creative Individual*, *GenerativeScience*, 2007). He noted at that time how surprisingly few researchers or theorists had considered periodicity as a function of human development. He describes periodicity as when the same pattern of events is seen to run through a higher development as previously reflected in a corresponding pattern from a lower sequence. He related his exploration to the psychological work of [Erik Erikson](#) and [Jean Piaget](#). [Edward B. Titchener](#) had previously attempted to classify the structures of the mind: psychology's periodic table. By 1896 he had identified more than 44,000 separate, distinctive sensory experiences. G. J. Schramm (*A periodic table of emotional phases*, *Journal of Abnormal and Social Psychology*, 1936) explored the possibility of a natural classification of emotional behaviour based on the understanding that such behaviour is a phase function.

**Investment:** As noted by Michael M. Pompian (*Behavioral Finance and Wealth Management: how to build optimal portfolios that account for investor biases*, 2006, p. 218), some investors do not pay heed to the cyclical nature of asset class returns, making those that have recently performed spectacularly to appear unduly attractive. To counteract the effects of this bias, many practitioners make use of what has become known as the "periodic table of investment returns", an adaptation of the periodic table of chemical elements (see *The Callan Periodic Table of Investment Returns*, 1988-2007; Index Funds Advisors, *The IFA Periodic Table of Investment Returns*, 1989-2008).

**Consciousness:** The work of [Ken Wilber](#) in elaborating *AQAL: "All Quadrants All Levels"* may be understood as a form of periodic table of consciousness. The effort of Allan Combs (*The Radiance of Being: Complexity, Chaos and the Evolution of Consciousness*, 1995-2002) to develop the AQAL system with Ken Wilber into the 'Wilber-Combs Matrix' has indeed been described by Combs as a 'periodic table of consciousness... representing a large but finite array of potential states' melding traditional Vedanta categories (physical, pranic, mental, subtle, causal) together with the five structures of consciousness of [Jean Gebser](#) (*The Ever-Present Origin*, 1985-1991) and the 'value memes' of *Spiral Dynamics*, to represent how different 'states' of consciousness are experienced and interpreted according to the developmental structure or 'stage' through which they are perceived. Combs endeavours to map out the psychic lattices of patterns, states, structures, and basins through which consciousness engages with reality.

In describing the background to his own *Eightfold Model of Human Consciousness* and related proposals, [Robert Anton Wilson](#) notes the earlier initiative of [Timothy Leary](#) to formulate a tabular system of *Eight Circuits of the Nervous System* (also known as eight brains, intelligences, functions), later organized into a 24-stage *Periodic Table of Evolution* (1973) and associated with an *8-Circuit Model of Consciousness*.

**Learning:** The periodic table has inspired the development of a "Periodic Table of Learning Elements", based on an understanding of

"learning molecules" (trademarked) by David Shoemaker (*Learning Molecules: an approach to problem-based online learning*, 2006). These elements represent different presentational formats: ways in which learners engage and interact with course content at eCornell -- in partnership with Cornell University for development of online leadership training.

**Knowledge:** Edward Haskell (*Full Circle: The Moral Force of Unified Science*, 1972) proposed a generalization of the original Mendeleev periodic table in an attempt at the unification of human knowledge, assembling the sciences (physical, biological, and psychosocial) within a single periodic system. This was one inspiration for the development of a *Functional Classification in an Integrative Matrix of Human Preoccupations* (1982) and for consideration of the possibility of *Tuning a Periodic Table of Religions, Epistemologies and Spirituality -- including the sciences and other belief systems* (2007). The latter indicates other precedents in the exploration of periodicity in the psychosocial realms.

## Focus on living and learning

**The focus in what follows is however on ways of understanding which people might themselves derive from the structure of the table as a whole** -- irrespective of these various approaches, whatever the insights that might be drawn from them. The periodic table is seen here as a structure of rich, but comprehensible, complexity that may offer valuable mnemonic hooks (for some) on which to order experience -- at least tentatively, as a thought experiment regarding personal learning. It follows from an earlier uncompleted exercise (*Towards a Periodic Table of Questions: strategic opportunities from ordering WH-questions*, 2006).

The concern here is not to explore the possibilities of this metaphorical framework in any detail but rather to point to themes that may merit further reflection. This would of course be encouraged by some degree of familiarity with the periodic table and its structure -- readily obtained from summaries in encyclopedias like *Wikipedia*.

As to the "evidence" advanced for any more fundamental relationship between the atomic number of stable chemical elements and human age, appropriate precautionary comments have been supplied by Thomas L. Griffiths and Joshua B. Tenenbaum (*Randomness and Coincidences: reconciling intuition and probability theory*, 2001).

Following the musings of Primo Levi, the suggestion is that there is more that can be fruitfully mused about.

## Overall periodic structure

The electron configurations of the chemical elements present a periodic variation with increasing atomic number (or atomic weight). As such they display periodic variations of the physical and chemical behavior. Within the [Periodic Table](#), as conventionally represented, a [period](#) is a horizontal row of the table, whereas a group, or family, is a vertical column of that table. Commentary typically focuses on the 18 [periodic groups](#). The modern explanation of the pattern of the table is that the elements in each such group have similar configurations of the outermost [electron shells](#) of their atoms. Most chemical properties are primarily determined by the orbital location of the outermost electron.

The Periodic Table suggests insights into:

- different "periods" of life or living (childhood, adolescence, young adult, mature adult, etc)
- distinctions between people at different "stages", on the assumption that within any period people may be more closely identified with a characteristic "group". Each such stage may be characterized by certain behaviours that distinguish one group from another and their attitudes to relationships between groups at different stages.
- the set of 18 periodic groups offers a way of mapping such recognitions as the 18 characteristics of a "fully endowed human body", according to Buddhist tradition, made up of 8 "freedoms" and 10 "endowments", or the 18 "kinds of knowledge" (*Examples of Integrated, Multi-set Concept Schemes*, 1984).

Various schools of psychology have endeavoured to distinguish periods and stages in life. Of particular interest in the Periodic Table is the manner in which it is more complex than a simple table. Later periods provide for inclusion of additional blocks corresponding to atomic numbers that are completed before returning to the periodicity of the earlier periods.

The various precedents cited above all point to ways of thinking about the relevance of a periodic pattern to an understanding of life and learning.

As noted below, there is much discussion of alternative forms for the Periodic Table more appropriate to its overall complexity. Potentially of even greater potential interest is the seemingly controversial proposal of Jean-Claude Perez (*Mendeleev Periodic Table Prediction Equation*, 1997-2008). He had the idea to seek a single mathematical equation which would organize the information of the most heterogeneous table of science -- generating and predicting its structure. Perez integrated this with explorations of a possible numerical structure of DNA, genes and genomes, the golden ratio and Fibonacci numbers laws, and subsequently proposed an *Equation of Life* (2008), as summarized in book form (*Codex Biogenesis: les 13 codes de l'ADN*, 2009).

## Pattern completion

The succession of elements in the Periodic Table corresponds to the progressive completion of external electron shells (or [atomic orbitals](#)) within each period -- or to the completion of inner orbitals prior to continuing with completion of the outer ones. With respect to learning, the contrast between these two forms of completion has been discussed separately (*Fundamental learning distinction: Understanding vs Comprehending?* 2007), notably:

The lesson here is that the superficial regularity -- congenial to comprehension by the mind -- may obscure more fundamental processes of completion. The ability of scandium to "remember" that it has unfinished business thus offers a contrast between

superficial metaphysical **comprehension** of any whole and development at a more fundamental level -- perhaps the essence of the experience of **understanding**. Comprehension may indeed see a pattern, but runs the risk of premature closure -- perhaps reinforced by groupthink. Understanding, however, embodies that pattern in application. This is a form of "maturity" that recognizes a more fundamental form of balance that needs to be kept.

Any such **understanding** may even be usefully considered as an accumulation of unconscious learning -- in contrast to the primary modes of interaction with the world characterized by the learnings of the outermost orbital shells.

The pattern of the Periodic Table reinforces the implication that learning throughout life involves a succession of "completions". When learning at a particular stage is completed, it is possible to "move on" -- whether or not an analogous learning situation occurs at a later period, at a higher turn of the spiral. Of course a form of "completion" through the formation of molecular bonds is fundamental to chemical processes sustaining life. Such completion is also achieved through partnerships between people or cognitive modes that "complement" each other.

Given the popularity of the phrase "moving on", preceded by "drawing a line", the emphasis here is rather on "completing a cycle". The implications of such geometric metaphors have been explored elsewhere (*Engaging with Globality -- through cognitive lines, circlets, crowns or holes*, 2009; *Metaphorical Geometry in Quest of Globality: in response to global governance challenges*, 2009). These stress the significance to comprehension of circles and spheres which relate more closely to the understanding of an orbital. Of course the cycle characteristic of circles is appreciated in the most widespread of spiritual mnemonic aids (*Designing Cultural Rosaries and Meaning Malas to Sustain Associations within the Pattern that Connects*, 2000).

Sustainable new learning is then to be understood in terms of orbital completion. The process might be compared to the pattern completion game of *Tetris* (see [applet version](#) by Melinda Green). This involves a random sequence of **tetrominoes** (sometimes called "tetrads" in older versions) -- shapes composed of four square blocks each -- which fall down the screen representation of "playing field" (a rectangular vertical shaft, called the "well" or "matrix"). The object of the game is to manipulate these tetrominoes as they fall, by moving each one sideways and rotating it by 90 degree units, with the aim of creating a horizontal line of blocks without gaps. When such a line is created -- completion of the row it disappears. Many variants exist, including a **3D** version.

Completion of learning orbitals within a circular framework also recalls meditative interaction with a **mandala** and any progressive increase in insight regarding the segments in its concentric domains. Indeed a mandala could be understood as a form of circular periodic table.

## Characteristic and emergent properties: new "phases"

The orbitals in elements, especially in the case of completed shells, are appropriately considered in terms of the dynamics of wave functions (rather than as the orbital movement of ball-like electrons). The completion of shells through learning then suggests the value of associating the sense of individual identity with a degree of dynamic cyclicity as previously discussed (*Emergence of Cyclical Psycho-social Identity: sustainability as "psychically" defined*, 2007). Each such integrative completion giving a more robust sense of such identity.

It is of course the case that many groups and methods of psychological and spiritual development envisage a succession of stages of integration associated with the emergence of new or "deeper" insight, as reviewed elsewhere (*Varieties of Rebirth: distinguishing ways of being "born again"*, 2004). These may be ritually associated with **initiations** as rites of passage -- effectively to a new period of the table. The possibility of any such succession of characteristic initiations may be associated with age -- such as every 7-8 years -- when a new period starts. The possible initiations may even correspond in number to the number of periods of the Periodic Table of naturally occurring elements, namely seven (eg Michael Mirdad, *The Seven Initiations of the Spiritual Path*, 2004)

Other characteristics that may change within any period include analogues to:

- characteristic state, metaphorically described in terms of solid, liquid or gas -- as with someone who is "solid" as opposed to very "fluid"
- conditions of transition, metaphorically described by the "boiling point" of an individual, or the tendency to "crystallization"
- typical reactivity with others, notably in relation to being more or less "positive" or "negative"
- progressive increase of atomic weight, as recognized as characteristic of the more mature and those elders who evoke respect for their "weighty" advice

Such characteristics suggest new ways of thinking about the sympathies or antipathies between groups of like-minded people, namely what evokes hostility and where tolerance is easy. This points to possible ways of reframing understandings of relationships and their relative stability -- or more generally to the challenge of engaging with difference and otherness.

Especially intriguing is the sense in which the shells might be associated with different modes of thinking. Potentially the shell associated with the 2 elements of the very first period (hydrogen and helium) might be associated with binary modes of thinking (A and not-A) governing the sense of "us and them" and the consequent responses. Given the dramatic implications of binary logic in sustaining (and undermining) cognitive life, the complex dynamics of "hydrogen" and "helium" in the "Sun" might then also offer some insight [see [proton-proton chain reaction](#); [CNO cycle](#)].

The 8 groups of the next periods, "transcending" this binary logic, might indeed then be associated with the modes of thinking that are so characteristic of the Chinese **Ba Gua** modes. Using this framework, an experiment has been initiated by **Jiajun Wang** (a researcher from China based in the USA) to make interactive use of the cells of the periodic table to order and present information over the web on aspects of his personality and thinking that he considers to be an essential part of his mind set (*About me -- shown in Period Table*,

2009).

This invites reflection on any mapping of the insights of the 64 hexagrams derived from them onto the Period Table as a whole, excluding "inner blocks" (cf *Transformation Metaphors: derived experimentally from the Chinese Book of Changes (I Ching) for sustainable dialogue, vision, conferencing, policy, network, community and lifestyle*, 1997). The *I Ching* can of course be considered as an 8-period periodic table in its own right, whether represented in tabular or circular form, as noted by various authors (Jan C. A. Boeyen, *Number Patterns in Nature, Crystal Engineering*, 2003; Paul S. Prueitt, *Generalized Framework Theory*, 2002). For example, Andreas Schöter (*The Yijing as a Symbolic Language for Abstraction*, 2005) shows how a formal description of linked chains of substructures within the Boolean lattice can be used to develop a theory of individual perspectives. This theory shows how local perspectives exist in the global context of totality and further, how the focus of the individual determines the scope of their perspective.

## Unexplored potential

Of major interest of course is any analogue to radioactivity and the associated question of [isotopes](#). The Periodic Table in its conventional form typically obscures the range of isotopic forms of any one chemical element. Isotopes (or nuclides) of an element have nuclei with the same number of protons (the same atomic number) but different numbers of neutrons. About 339 nuclides occur naturally, of which 256 (about 75%) and have never been observed to decay. More than 3100 nuclides are currently known, including those that are radioactive or have only been created artificially (see *Table of Nuclides*; *Exploring the Table of Isotopes*)

It is tempting to consider radioactivity as in some way suitable as a metaphor for creativity -- with the twist that many of the most renowned geniuses are often perceived as "unstable" (as with the uncertainty characteristic of those in terminal "decay" beyond a certain age). It raises the possibility of a future Periodic Table of Insight. Some spiritual disciplines might already see this as implicit in their worldview, teachings and sacred literature -- especially when it has some overall organization -- as with the *Kabbalah* in its various forms, or the Buddhist text entitled the *Brahmajala Sutta* (*The Discourse on the All-Embracing Net of Views*).

What forms might a Periodic Table of Wisdom take in the light of the many sets of aphorisms? Could sets of aphorisms be usefully mapped onto some periodic structure -- as is to some degree implied by the particular learnings purportedly communicated during ritual initiations? With a view to communication with extraterrestrials, as psychologist at the [SETI Institute](#), Douglas A. Vakoch (*Celestial Waves: framing spiritual principles for interstellar communication, Science and Spirit*, 2007) asks whether it might be possible to discover a "Periodic Table of Spiritual Principles" analogous to that for chemical elements. He describes his methodology in exploring whether it is possible to uncover the recurrent, underlying spiritual themes that are manifest in more specific spiritual principles. Specifically he explores:

Is there a way to arrange the disparate individual spiritual principles so that their interconnections become obvious, and in the process create a framework to convey our ideas about spirituality to extraterrestrials?

One of the most intriguing properties of any periodic table is that it makes provision for elements not yet known or discovered. This applies as much to the progressive acquisition of extant knowledge by an individual through learning as to the discovery of new knowledge. How to envisage what is not yet known and may only be discovered in years or centuries to come?

## Ageing and death

As noted above, the atomic numbers of the range of chemical elements would seem to be closely related to currently possible human life expectancy as measured in years. If this relationship is not purely coincidental, what understanding of the wave functions of atomic orbitals might relate to what understanding of cycles of learning during a human life -- given the increasing instability of both beyond what appears to occur naturally? Whether or not such a correspondence holds to any degree, to what extent might it suggest fruitful insight? (cf *Theories of Correspondences -- and potential equivalences between them in correlative thinking*, 2007).

The future may well discover correspondences between seemingly disparate domains of knowledge -- as has been the case in the past. The magnum opus of [Christopher Alexander](#) (*The Nature of Order: The Phenomenon of Life*, 2002) highlights a degree of interactivity between objective and subjective understandings of order. Given that the order of the Periodic Table highlights one of the most fundamental patterns discovered in the objective world, it would not be surprising if that pattern was evident in some way in human learning.

In [actuarial science](#), central to [life insurance](#), a [life table](#) (also called a mortality table or actuarial table) shows, for a person at each age, what the probability is that they die before their next birthday -- or, in this context, reach the next position in the Periodic Table. From this starting point, the following are derived:

- the probability of surviving any particular year of age
- remaining [life expectancy](#) for people at different ages
- the proportion of the original birth cohort still alive
- estimates of a cohort's [longevity](#) characteristics.

[Survival analysis](#) attempts to answer questions such as: what is the fraction of a population which will survive past a certain time? Of those that survive, at what rate will they die or fail? Can multiple causes of death or failure be taken into account? How do particular circumstances or characteristics increase or decrease the odds of survival? As mentioned above, it could for example prove instructive to compare the relative global [abundance of the chemical elements](#) (in terms of atomic number) with relative global [human life expectancy](#) (as measured in years) -- with the latter expressed in terms of the proportion of the population having a given age (the [age distribution of the world's population](#)). Such measures, typically represented as an [age structure diagram](#), are a focus of the [UN Programme on Ageing](#)

(*The Ageing of the World's Population*). Of major concern are the differences between these structures in developed as compared to developing countries, and to their rapid evolution over recent decades.

Of related interest, on a resource-challenged world, is the methodology of **life cycle assessment** (LCA) -- or life cycle analysis, and cradle-to-grave analysis. This is the investigation and valuation of the environmental impacts of a given product or service causes or necessitates by its existence. The "product" in this case being a human being. Hence the related concern with **ecological footprint**. Of particular interest in relation to population is the manner in which ecological footprints are calculated, and their presentation as tools for personal **footprint assessment on the web**. The factors taken into consideration might be said to be well-crafted to avoid exposing people to the embarrassment of more pointed questions, as discussed elsewhere (*Recognizing the herd of elephants in the living room of climate change discourse*, 2008).

Discussion of the challenging issues of ageing and longevity might be usefully reframed in the light of insights into what makes for the "stability" of chemical elements of higher atomic number. Extensive research has recently indicated 155 as alimit (Albert Khazan, *Upper Limit in Mendeleev's Periodic Table: Element No.155*. Svenska Fysikarkivet, 2009).

The increasingly "instability" of atoms, even if they can be created, suggests a way of thinking about why people tend to end up with a preference for death, often claiming "tiredness". Of interest in this respect is current understanding of the **Hayflick Limit** (the maximum potential lifespan of humans at 120, the time at which too many cells can no longer split and divide to keep things going) as reported by Byron J. Richards (*Hayflick Comments on Aging*, *Wellness Resources*, 29 June 2009):

Aging occurs because the complex biological molecules of which we are all composed become dysfunctional over time as the energy necessary to keep them structurally sound diminishes. Thus, our molecules must be repaired or replaced frequently by our own extensive repair systems.

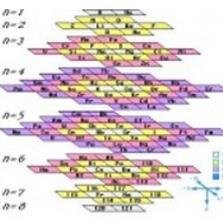
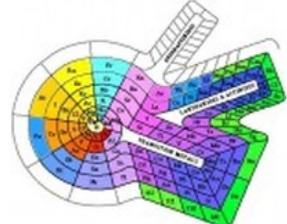
These repair systems, which are also composed of complex molecules, eventually suffer the same molecular dysfunction. The time when the balance shifts in favor of the accumulation of dysfunctional molecules is determined by natural selection -- and leads to the manifestation of age changes that we recognize are characteristic of an old person or animal. It must occur after both reach reproductive maturity, otherwise the species would vanish. These fundamental molecular dysfunctional events lead to an increase in vulnerability to age-associated disease..

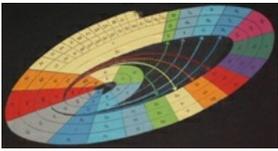
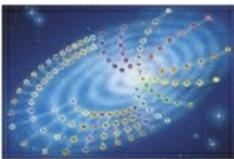
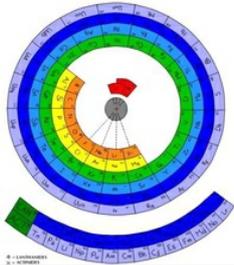
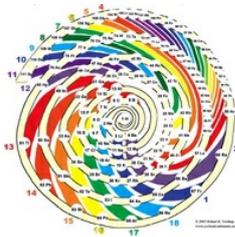
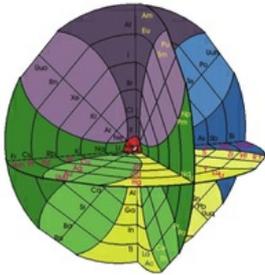
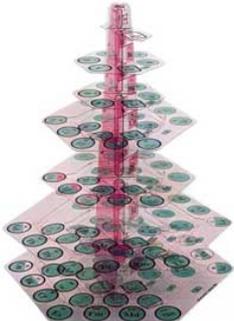
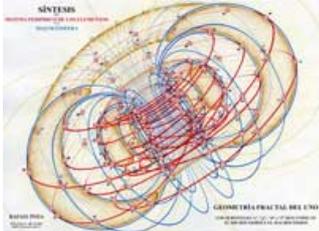
There would appear to be a collective cultural equivalent, as explored by **Jared Diamond** (*Collapse: How Societies Choose to Fail or Succeed*, 2005). Perhaps this is also to be understood in terms of how cultural resources are used up. Whether group or individual, the creative sustaining dynamic of an earlier "golden age" is lost. There is no capacity to transit to a more sustainable mode -- perhaps to be understood in terms of the resilience of the **adaptive cycle**, as explored by **Thomas Homer-Dixon** (*The Upside of Down: catastrophe, creativity, and the renewal of civilization*, 2006).

To the extent that any **Periodic Pattern of Human Life** will be discovered to have a fundamental memetic dimension, any such form of collapse may then be explored in terms of a memetic singularity, as previously discussed (*Emerging Memetic Singularity in the Global Knowledge Society*, 2009). Whereas Homer-Dixon's analysis focuses on energy, this would then imply some kind of memetic analogue.

In the learning context explored here, this suggests a disinclination for further learning and experience -- held to be one of the challenges for extending human lifespan (given the prospect of eternal boredom). But in the case of the chemical elements, there is the intriguing possibility of "islands of stability". Nuclear physics envisaged the possibility of elements with particularly stable "magic numbers" of protons and neutrons. This would allow certain isotopes of some transuranic elements to be far more stable than others; that is, decay much more slowly.

From a learning perspective, such a balance is occasionally foreseen as the successful outcome of a particular form of meditation -- namely achievement of a higher order of balance. To the extent that the associated insight of "higher order" has to some degree been formalized in wisdom literature, the case of the *I Ching* and *Tao Te Ching* are of interest, notably because of the manner in which polarity is directly addressed (*9-fold Magic Square Pattern of Tao Te Ching Insights experimentally associated with the 81 insights of the Tai Hsüan Ching*, 2006; *Hyperspace Clues to the Psychology of the Pattern that Connects*, 2003; *Commentary on Tao Te Ching Interpretation -- and the possibility of higher order patterning*, 2003).

<b>Indicative Non-tabular Periodic Patterns</b> (see <i>Database of Periodic Table Formulations</i> for wider selection and larger images; some 700 bidimensional and tridimensional representations have been produced )		
		
<a href="#">Paweł Najderek (1985-2008)</a>	<a href="#">Timothy Stowe (2003)</a>	<a href="#">Theodor Benfey (1960)</a>

		
Edgar Longman (1951) (as restored by Philip Stewart)	Chemical Galaxy (2004)	J. F. Hyde (1975) Gelest
		
Mayan periodic table	Alternative Periodic Table <i>Wikipedia</i>	Cyclical Continuum of Elemental Properties (Robert R. Northup, 2005)
		
Gyroscopic Periodic Table (Glen Atkinson)	Periodictree / ElemenTree (Fernando DuFour, 1996)	Elements and the Magnetosphere (Rafael Poza, 2008)

## Pattern of learning as a whole: life is not a "table"

Given the correspondence suggested between the possible years of [lifelong learning](#) and the stable chemical elements, most striking is of course the sense from any stage in a life of the pattern of life to that stage -- incorporating the experiences of previous stages and periods back to childhood. The most complex chemical elements of course also incorporate the structure of the earliest. Using an optical metaphor, the completed periods might each be understood as forming a cognitive lens -- so that it is through the set of such concentric lenses (as an optical system) that engagement with the world takes place.

The sense of the pattern as a whole is of course most unsatisfactorily represented by a "table" -- a term reflecting a very particular grid-like framing of life, too characteristic of how life is readily ordered and defined by bureaucracies and life insurance, in contrast to how it is lived and experienced. This is of course the challenge for any United Nations programme in presenting issues relating to "human development".

It is therefore interesting to note the many creative efforts by scientists to challenge the tabular ordering of the chemical elements -- held to be similarly inappropriate to the complexity and interrelationship of the set as a whole. One survey of such initiatives is that of J. W. van Spronsen (*The Periodic System of Chemical Elements; a history of the first hundred years*, 1969; see [Examples of past attempts to present the periodic classification of chemical elements](#)). E. G. Mazurs (*Graphical Representations of the Periodic System During One Hundred Years*, 1974) gives an indication of the struggle to make sense of the whole. Many tabular representations are accessible over the web.

There are now many intriguing examples of [alternative periodic tables](#) as accessibly represented in the [Database of Periodic Table Formulations](#) of Mark Leach. Notable alternatives to the tabular form and its variants (identified in that database) are:

- [spiral formulations](#)
- [three-dimensional formulations](#)

Many web-based forms offer interactive features (eg [Dynamic Periodic Table](#)); excellent interactive applications may be downloaded, such as that of Paul Alan Freshney ([Periodic Table Explorer](#), 2009). Again, in the light of the argument here for some form of *Periodic Pattern of Human Life*, these point to ways of interrelating lifelong learnings as a whole. This is consistent with the challenge of "seeing life whole" -- variously presented as one definition of wisdom.

However it is interesting to note that in a recent presentation with regard to the inadequacies of the conventional tabular form, Gary Katz ([Post Mendeleevian Evolution of the Periodic Table](#), 2007) deplors the relative lack of innovation with regard to the "official" table directly or indirectly under the aegis of IUPAC (whose governance of it has extended back to 1919). Typically some variants are subject to either copyright or patent or both -- perhaps a moral in its own right. The argument of Katz recalls that relating to religious scriptures:

The Periodic Table has been the icon of chemical knowledge since its inception. Learning the Periodic Table can be thought of as

synonymous with an initiation into the rites of chemistry. All of us have that in common - one cannot be a chemist without fixing the Periodic Table into the center of one's mental landscape. Of course all of the sciences share this access to the Periodic Table, but it is the chemists who most deeply feel the ownership of the text. Naturally the attitude of most chemists to the Periodic Table is very dogmatic. The Periodic Table as it was learned in high school becomes a kind of sacred text; alteration and amendment of that text might feel uncomfortable.

It is of course the case, as noted above, that a number of spiritual traditions effectively formulate their own *Periodic Pattern of Human Life*. It is unfortunate that such patterns do not serve to interrelate the insights between such traditions, as discussed elsewhere (*Tuning a Periodic Table of Religions, Epistemologies and Spirituality -- including the sciences and other belief systems*, 2007). That exploration specifically focused on the transformation of grid patterns into more complex forms as being vital to a non-linear understanding of life pattern (*Comprehension of Requisite Variety for Sustainable Psychosocial Dynamics: transforming a matrix classification onto intertwined tori*, 2006). It also addressed the intriguing relationship of the Chinese 8-fold *Ba Gua* concept to the basic set of groups (*Animation of Classical BaGua Arrangements a dynamic representation of Neti Neti*, 2008).

## Autopoiesis: Remembering the Poem to Come

The argument for a *Periodic Pattern of Human Life* is therefore fundamentally one for mnemonics of requisite complexity (*In Quest of Mnemonic Catalysts -- for comprehension of complex psychosocial dynamics*, 2007; *Conditions of Objective, Subjective and Embodied Cognition: mnemonic systems for memetic coding of complexity*, 2007). It is therefore appropriate to note, in the spirit of Primo Levi's original initiative, an online *Poetic Table of the Elements* -- in which poems are associated with each element, and readers are invited to add others.

Unfortunately this facility reinforces the argument for moving beyond a periodic "table"-- and beyond all the dysfunctionalities associated with its administrative use. Each element is necessarily isolated from the others. Each therefore constitutes a pigeonhole into which is filed one poem -- or more (as an "isotope"). There is no accessible cognitive (memetic) relationship between the poems that are held to characterize each element. The larger pattern is that of the tabular grid as in any urban development -- readily to then be experienced as a soulless environment for living.

More intriguing -- and more realistic -- is the possibility that the form of the whole periodic pattern is effectively reformed by the cognitive perspective from any given element (rather than there being a single rigid pattern for the whole). In a sense the poem for a given element is about the experience implicit in its structure -- corresponding to the incorporated orbital shells of learning of the preceding elements in the sequence. It is these common shells that imply the connectivity that is essentially invisible in a tabular presentation. A poem, "nested" in this way to incorporate its antecedents, offers through its resonances, mnemonic leads to that connectivity and a larger sense of coherence.

A well-recognized Japanese tradition is the composition in the very last moments of the life of a poet or literate person of a *jisei*, or "death poem", often in the *haiku* form. The practice is common with Chinese, Korean, and Japanese Zen monks, and was otherwise associated with *ritual suicide* (Yoel Hoffmann, *Japanese Death Poems: written by Zen monks and haiku poets on the verge of death*, 1998). This existential engagement might be understood to be consistent with that of philosopher-poet Antonio de Nicolas in his title for a collection of poems, *Remembering the God to Come* (2000) -- an inspiration for the title of this section.

A richer metaphor is offered by the sense in which the emergence of the unique wave function associated with the orbitals of each element can be understood as engendering a form of *Chladni pattern* -- illustrated by the modes of vibration and nodal patterns of a mechanical surface (notably acoustic instruments). Each new element in the sequence -- as with each year of life and learning -- then effectively reconfigures the whole preceding pattern through a form of cognitive tone poem.

Given the role of music in the lives of many, it is appropriate to indicate that a periodic table, understood through the *I Ching* (as mentioned above), can be reframed in terms of the harmonic relationships offered by sound. This has been extensively argued by Michael Drake (*I Ching: The Tao of Drumming*, 1997, pp. 20-21) in the light of a thesis by Melinda Maxfield (*Drumming the I Ching*, 1991):

The *I Ching* is a keyboard or periodic table of rhythm archetypes. Each pattern pulsates specific qualities of energy which give inherent structure and meaning to the possibilities of being.... so the rhythm archetypes contain the potential of communication and understanding. Resonance is the key to unlocking the rhythm generating patterns of the *I Ching* code.... Sound is a carrier wave of conscious, intelligent energy. Resonance, therefore, is a sounding again of information or pure knowledge.... Through drumming, it is possible to co-create a resonant field with a rhythm archetype. Each linear image [of a hexagram]...depicts a particular drum pattern, which renders the essence of each rhythm archetype into sound.

Given the role of music in much-challenged developing societies, any such reframing of the organization of knowledge merits careful exploration (*Knowledge Gardening through Music: patterns of coherence for future African management as an alternative to Project Logic*, 2000). With the election at the time of writing of president of South Africa, appreciated by the masses for his capacity to dance, there is the need for related insight into the implications of dance in social organization (*Navigating Alternative Conceptual Realities: clues to the dynamics of enacting new paradigms through movement*, 2002).

More intriguing at any point in life is the sense of emergent pattern, partly implied by the periodicity experienced to that time. This concept of emergent order of course relates to understandings from the complexity sciences relating to the dynamics of complex systems and the process of *autopoiesis*. Its implication of "auto (self)-creation" (from the Greek: *auto* for self- and *poiesis* for creation or

production) may then be associated in this metaphor with the making of the poem (**poiesis**) characterizing the experience of the element as a perspective on life as a whole. Autopoiesis appropriately expresses a fundamental dialectic between structure and function. This framing suggests new ways of thinking about being "self-made", periodically "re-inventing oneself", or even "re-wiring one's brain".

The social implications of poetry-making, in contrast with a finished poem, have been explored separately (*Poetry-making and Policy-making Arranging a Marriage between Beauty and the Beast*, 1993; *Strategic Jousting through Poetic Wrestling: aesthetic reframing of the clash of civilizations*, 2009). Given the value attached to *haiku* "death poems", these might be said to be consistent with their implications for strategic rethinking (*Ensuring Strategic Resilience through Haiku Patterns: reframing the scope of the "martial arts" in response to strategic threats*, 2006). [NB: A widely-cited online *Periodic Table of Haiku* -- each element described through its own *haiku* -- is seemingly no longer accessible].

From such a perspective of autopoiesis, the challenge at any point in life is then one of self-creation based on intimations of the pattern to come -- an emerging understanding of the pattern -- in the light of previously experienced periodicity. It might be understood as a process of "re-membering" the poem to come.

An early experiment in fractal representation of the periodic table is that of Melinda Green (*Periodic Fractal of the Elements*, 1995), famed for her *Buddhabrot* (1993) rendering of the **Mandelbrot set**. To the extent that earlier elements are indeed "nested" within the later ones, there is a case for exploring the periodicity and fractal organization of the Mandelbrot set as a form onto which such a period pattern might be projected (*Psycho-social Significance of the Mandelbrot Set a sustainable boundary between chaos and order*, 2005). [See, for example, Jonathan J. Dickau, *The Mandelbrot Set and Cosmology*, 2006; *Biocosmology: Cosmic Symmetry-Breaking and Molecular Evolution*]. On the occasion of an International Conference on I-Ching (Yijing) Studies and Contemporary Civilization, Bent Nielsen noted contemporary Chinese scholarship on the periodic table and mathematical fractal unfoldings (*The Changes in Cultural Continuity*, 2005; see also Bent Nielsen, *A Companion to Yi Jing Numerology and Cosmology*, 2003).

## Conclusion

The fact that science is so strongly committed to a fundamental "table":

- that has a number of recognized problems,
- is not particularly memorable,
- is typically copyrighted (if not subject to patent), and
- is resistant to the kind of creative innovation, which otherwise purportedly characterizes the sciences,

implies a mindset shared with bureaucracy and mainstream religion. It is this mindset that fails to connect with lived experience and the challenge of lifelong learning for all in a period when governance is ill-equipped to respond to the challenges faced by people (*Abuse of Faith in Governance: mystery of the unasked question*, 2009; *Future Coping Strategies: beyond the constraints of proprietary metaphors*, 1992).

The argument above interweaves a concern with other modes of knowing, drawing in part on other senses, notably for reasons argued elsewhere (*Strategic Challenge of Polysensorial Knowledge: bringing the "elephant" into "focus"*, 2008). In the above context the "elephant" might indeed be understood as a periodic pattern. Curiously, amongst all the species, it is only onto an elephant that the periodic table has been projected (*Periodic Table of Elephants*) with its own tabular form (*The Periodic Table of the Elephants*). Such playfulness, associated with the role attributed to eliciting significance through drumming, highlights the need to engage playfully with the manner in which insight is collectively formed (*Playfully Changing the Prevailing Climate of Opinion: climate change as focal metaphor of effective global governance*, 2005).

Given the argument above relating to drumming, it is intriguing that a renowned physicist, **Richard Feynman**, was also famed for his drumming and the manner in which he sought to relate it to physics -- notably proposing use of a drumhead to demonstrate Chladni patterns (mentioned above). He was a close collaborator of physicist **Murray Gell-Mann** who named as the **Eightfold Way** a theory organizing subatomic particles (**baryons** and **mesons**) into octets leading to the development of the **quark model**.

Possible 8-fold pattern of knowing [tentative] indicative relationships between themes discussed (susceptible to representation in non-tabular <i>Ba Gua</i> mirror form)								
.	<b>Abstraction</b> (maths, logic)	<b>Pattern</b> (periodic table)	<b>Elements</b> (chemistry)	<b>Codons</b> (genetic)	<b>Existential options</b> ( <i>I Ching</i> )	<b>Design</b> (visual- ization)	<b>Embodiment</b> (musical resonance)	<b>Self- reflexivity</b> (fractal)
<b>Abstraction</b>	.	.	.	.	.	.	.	.
<b>Pattern</b> (periodicity)	number symmetry	.	.	.	.	.	.	.
<b>Elements</b> (chemistry)	wave functions	chemical elements	.	.	.	.	.	.
<b>Codons</b> (genetics)	binary coding	codons	.	.	.	.	.	.
<b>Existential options</b>	binary coding	64 (8 x 8)	.	amino acids	.	.	.	.
<b>Design</b> (visualization)	geometry topology	circular spiral	circular spiral	.	mandala	.	.	.
<b>Embodiment</b> (resonance)	wave functions	harmony	.	.	drumming music	Chladni patterns	.	.
<b>Self-reflexivity</b>	complex	emergent	fractal	.	fractal	Mandelbrot	fractal	.

The above exploration of course relies on metaphor as a key to offering cognitive connectivity. As [Kenneth Boulding](#) (*Ecodynamics; a new theory of social evolution*, 1978) teasingly puts it:

Our consciousness of the unity of self in the middle of a vast complexity of images or material structures is at least a suitable metaphor for the unity of group, organization, department, discipline or science. If personification is a metaphor, let us not despise metaphors -- we might be one ourselves.

Ways should rather be sought to develop the conceptual scaffolding and flexibility that metaphor offers for framing the future, especially to facilitate the emergence of new and more sustainable forms of social organization and problem responses.

Towards that end there would appear to be an inadequately explored nexus relating:

- people being informed of "truth" by those claiming authority and discovering "truth" for themselves -- especially given the complicity of authorities in misrepresentation (*Abuse of Faith in Governance: mystery of the unasked question*, 2009; *Snoring of The Other a politically relevant psycho-spiritual metaphor?* 2006)
- opening and closing to sources of information (cf [Orrin Klapp](#), *Opening and Closing; strategies of information adaptation in society*, 1978)
- closure on an understanding (cf Hilary Lawson, *Closure: a story of everything*, 2001) in contrast to the tentativeness implicit in *Neti Neti* (Not this, Not that).
- the interplay between subjective and objective knowledge (cf Max Deutscher, *Subjecting and Objecting: an essay in objectivity*, 1983)
- issues of self-reflexivity and embodiment (cf [George Lakoff](#) and [Mark Johnson](#), *Philosophy In The Flesh: the embodied mind and its challenge to western thought*, 1999; *Engaging with Globality through Knowing Thyself: embodying engagement with otherness*, 2009)
- some form of uncertainty principle constraining polarized perspectives and framing the unknown (cf [Garrison Sposito](#), *Does a generalized Heisenberg Principle operate in the social sciences?* 1969; *Unknown Undoing: challenge of incomprehensibility of systemic neglect*, 2008)

These suggest that the collective (or individual) resilience required to navigate the [adaptive cycle](#) through increasing social turbulence (as highlighted by [Thomas Homer-Dixon](#), *The Upside of Down: catastrophe, creativity, and the renewal of civilization*, 2006) might be better understood in terms of a "cognitive adaptive cycle" -- calling for "cognitive resilience" regarding "objectivity/subjectivity" and "certainty/uncertainty". This resilience might prove to be an essential "magic doorway" onto a pathway to survival into a viable future.

As is increasingly demonstrated by the manner in which people engage with the web and through it, particular understandings of authorized truth are of decreasing significance relative to whatever enables them to give themselves a sense of coherence in their relationships with the world.

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