



# laetus in praesens

Alternative view of segmented documents via Kairos

21 October 2012 | Draft

## Eightfold Configuration of Nested Cycles of Cognitive Transformations

### Meta-pattern of connectivity through a hypersphere?

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Produced on the occasion of the joint meeting of the [Scientific and Medical Network](#) and the [Society for Scientific Exploration](#) on *Mapping Time, Mind and Space* (Brú na Bóinne, Ireland, 2012).

## Introduction

In a preceding exercise the focus was on identifying the nature and range of cognitive transformations, of which people are commonly aware, in quest of an approach to configuring them together in a meaningful pattern (*In Quest of a Dynamic Pattern of Transformations: sensing the strange attractor of an emerging Rosetta Stone*, 2012). That initiative indicated various possibilities for further exploration. The challenge is that these possibilities are disparate in nature and it is quite unclear how they might be fruitfully interrelated, whether this is feasible, or whether any outcome would be comprehensible -- or even desirable. An initial purpose is therefore merely to identify the pieces of a puzzle -- of unknown design -- which could include in no particular order:

- the experience of cognitive transformations -- as argued extensively in the above-mentioned paper
- the cybernetics of human knowing, as providing one disciplined approach to cognition in terms of a well-recognized, mathematically-informed language (cf. (cf. *Cybernetics and Human Knowing: a Journal of Second Order Cybernetics, Autopoiesis and Cyber-Semiotics*; European Society for the Study of Cognitive Systems).
- various efforts to recognize cybernetics of a "higher order", notably with a specific focus on [self-reflexivity](#) and [recursiveness](#), as separately reviewed (*Consciously Self-reflexive Global Initiatives: Renaissance zones, complex adaptive systems, and third order organizations*, 2007)
- the variety of electronic components essential to the design of functional circuits -- understood as widely-recognized tangible forms embodying cybernetic control functions on which a computer-enabled, knowledge-based society is dependent. Given the precedent of [biomimicry](#), the recognition through "technomimicry" that such components might effectively constitute accessible metaphors of cognitive transformation processes (resisting, inducing, "encapacitating", etc....)
- the periodic table of elements as illustrative of a widely accepted pattern of relatively complex organization -- adaptable to the issues of cognition, as separately argued (*Periodic Pattern of Human Knowing: implication of the Periodic Table as metaphor of elementary order*, 2009; *Periodic Pattern of Human Life: the Periodic Table as a metaphor of lifelong learning*, 2009; *Functional Classification in an Integrative Matrix of Human Preoccupations*, 1982)

- probable requirement for senses other than vision through which pattern recognition may be found to be meaningful, as notably suggested by sensitivity to harmony in music (cf. *Tuning a Periodic Table of Religions, Epistemologies and Spirituality -- including the sciences and other belief systems*, 2007; *Cyclopean Vision vs Poly-sensual Engagement*, 2006; *Strategic Challenge of Polysensorial Knowledge: bringing the "elephant" into "focus"*, 2008)
- the possibility of radical design innovations, notably inspired by geometry and topology (and their implications for astrophysics), as potentially vital to enabling forms of paradoxical comprehension appropriate to the challenge of turbulent times
- the fundamental role of key symbols in implying a widely-held "unconscious" insight into integrative order, as exemplified by the **Tao symbol** of the East or variants of the cross in the West (such as the **Lauburu**) -- and the value of exploring the possibility of such contrasting symbols (*Middle East Peace Potential through Dynamics in Spherical Geometry: engendering connectivity from incommensurable 5-fold and 6-fold conceptual frameworks*, 2012; *Enhancing the Quality of Knowing through Integration of East-West metaphors*, 2000)
- the understanding of the variety of personality types, as variously articulated (**Myers-Briggs Type Indicator**, the **mindscapes** of Magoroh Maruyama, etc), possibly essential to enabling effective teams and viable communities (cf. Maurice Yolles and Gerhard Fink, *Personality, Pathology and Sagiv-Schwartz Mindscapes*, *Social Science Research Network*, 2012)
- the degree of articulation, as a **pattern language**, offered by the classical Chinese encodings of change-related insights into decision-making (*Transformation Metaphors: derived experimentally from the Chinese Book of Changes (I Ching) -- for sustainable dialogue, vision, conferencing, policy, network, community and lifestyle*, 1997)
- constrained human cognitive capacity and the quest for ultimate simplicity -- irrespective of unconstrained, conventional explanatory capacity, unencumbered by the complexity of a multiplicity of dimensions (cf. *Dynamics of Symmetry Group Theorizing: comprehension of psycho-social implication*, 2008). Potentially related constraints are suggested by **Dunbar's Number**, the **Hayflick Limit**, and **apoptosis**.
- the unrealistically questionable nature of conventional aspirations to definitive cognitive closure, as separately argued (*Paradoxes of Engaging with the Ultimate in any Guise: living life penultimately*, 2012; *Living as an Imaginal Bridge between Worlds Global: implications of "betwixt and between" and liminality*, 2011).

The following exploration is an effort to weave together these different "threads" using the periodic table as a valuable template -- whilst offering a specific critique of the role of the table metaphor in current psychosocial organization. The weaving metaphor itself follows from a previous argument (*Interweaving Thematic Threads and Learning Pathways*, 2010).

## Use of electrical metaphors for comprehension of transformative cognitive processes

This theme was extensively discussed in the preceding paper, notably in a section on *Modulating cognitive transformations: electrical metaphors and semiconduction* (2012). Noted in particular was the work of **Dedre Gentner** (*Flowing Waters or Teeming Crowds: mental models of electricity*, 1983) and Marlene Johansson Falck (*Electrifying Performances and Brains that Fuse: metaphor and the cognitive function of electricity*, 2005). The latter indicated:

As is evident from my material, which consists of a large number of metaphorical expressions from the OED, CIDE and 20th CW1, there is remarkable consistency among the instances with respect to the kinds of experiences that may be structured by means of our experiences of electricity. Almost all the mappings exemplify the use of electricity to conceptualise people's actions or emotions. (pp. 52-53)

As indicated by the reference above to "flowing waters", widespread use is also made of the so-called **hydraulic analogy**, treating electrical circuits as water flows:

- **Electric potential**, corresponding to **hydraulic head**
- **Electric charge**, corresponding to the quantity of water.
- **Current**, corresponding to quantity of flowing water over time.
- **Voltage**, or potential difference, corresponding to a difference in pressure between two points: the higher the water, the higher the voltage. Negative voltage could then correspond to having water levels lower than some arbitrary zero level.
- **Resistance**, corresponding to the degree of constriction in the water conduit
- **Inductance**, corresponding to a second loop of water that must be sped up or slowed down by the circuit and that resists the change in current.
- **Capacitance**, corresponding to a dam preventing water from crossing and allows a buildup of different water heights on either side.

Aside from the above references, it may be considered unclear to what extent these terms are considered credible in relation to cognitive processes. It is however appropriate to note that a range of such electromagnetic phenomena are currently the focus of extensive study in relation to the the performance of neurons in the brain. This suggests that they play roles, as yet only partially understood, with respect to consciousness and cognitive transformations (cf. James Beichler, *The Neurophysical Basis of Mind and Consciousness*,

American Physical Society, 2012).

The credibility of the relation may be explored otherwise through exercises such as the following. Using the Google search facility, this provides an indication through a count of the search results when the terms in the columns and rows of the table below are paired -- both with quotes (indicated by w:) and without quotes (indicated by w/o:). When paired with quotes, this gives the results for the phrase (eg "cognitive resistance"). Google does not use **wild cards** to ensure incorporation of word variants. However when used without quotes, the results include such word variants through a process it defines as **stemming**.

The table is of course merely an indication, without taking account of other possibly relevant word orders when quotes are used. Nor does the exercise take account of synonyms. The results in the phrase search may also be falsified by intervening punctuation. The exercise does not take account of other uses of a term which may render meaningless the particular indication (eg "charge" as in cost, "current" as in time). The results without quotes are suggestive of the existence of texts which include otherwise distinct preoccupations.

Electrical metaphors for comprehension of transformative cognitive processes						
	cognitive	psychological	mental	psychosocial	social	meditation
<b>resistance</b>	w: 2,930 w/o: 14.8 mill.	w: 87,300 w/o: 26.3 mill	w: 71,300 w/o: 92.5 mill	w: 1,780 w/o: 2.4 mill	w: 75,400 w/o: 203 mill	w: 3,010 w/o: 10.7 mill
<b>inductance</b>	w: 2 w/o: 1.3 mill	w: 2 w/o: 1.75 mill	w: 150 w/o: 1.27 mill	w: 0 w/o: 138.000	w: 64 w/o: 2.79 mill	w: 1 w/o: 24,700
<b>impedance</b>	w: 407 w/o: 1.06 mill	w: 705 w/o: 0.58 mill	w: 1,920 w/o: 1.13 mill	w: 0 w/o: 1.24 mill	w: 537 w/o: 3.3 mill	w: 3 w/o: 1.84 mill
<b>capacitance</b>	w: 80 w/o: 0.26 mill	w: 63 w/o: 3.28 mill	w: 632 w/o: 5.02 mill	w: 1 w/o: 0.69 mill	w: 89 w/o: 0.96 mill	w: 0 w/o: 0.62 mill
<b>charge</b>	w: 1,210 w/o: 15.3 mill	w: 8,320 w/o: 38.3 mill	w: 6,440 w/o: 164 mill	w: 210 w/o: 2.2 mill	w: 60,700 w/o: 751 mill	w: 1,680 w/o: 17.6 mill
<b>current</b>	w: 16,700 w/o: 55.2 mill	w: 9,500 w/o: 121 mill	w: 27,600 w/o: 373 mill	w: 2,070 w/o: 11.5 mill	w: 598,000 w/o: 3,600 mill	w: 6,690 w/o: 40.5 mill
<b>voltage</b>	w: 242 w/o: 4.1 mill	w: 467 w/o: 2.7 mill	w: 3,780 w/o: 20.4 mill	w: 3 w/o: 2.7 mill	w: 1,850 w/o: 46.2 mill	w: 43 w/o: 19.3 mill
<b>potential</b>	w: 45,900 w/o: 45.7 mill	w: 35,600 w/o: 72.1 mill	w: 62,600 w/o: 229 mill	w: 2,250 w/o: 8.9 mill	w: 129,000 w/o: 1,080 mill	w: 10,700 w/o: 23.3 mill
<b>conductance</b>	w: 92 w/o: 0.47 mill	w: 5 w/o: 0.3 mill	w: 159 w/o: 0.62 mill	w: 0 w/o: 0.96 mill	w: 202 w/o: 0.8 mill	w: 1 w/o: 0.39 mill
<b>connectivity</b>	w: 1,590 w/o: 6.7 mill	w: 6,090 w/o: 3.9 mill	w: 1,650 w/o: 14.7 mill	w: 49 w/o: 2.7 mill	w: 171,000 w/o: 83.4 mill	w: 194 w/o: 1 mill
<b>circuit</b>	w: 1,730 w/o: 6.7 mill	w: 933 w/o: 10.4 mill	w: 16,600 w/o: 63.1	w: 76 w/o: 4.4 mill	w: 90,300 w/o: 205 mill.	w: 1,570 w/o: 6 mill.
<b>capacity</b>	w: 264,000 w/o: 27.1 mill.	w: 40,300 w/o: 36.1 mill.	w: 3.7 mill. w/o: 8 mill.	w: 3,210 w/o: 4.6 mill.	w: 101,000 w/o: 590 mill.	w: 1,040 w/o: 13.4 mill.

Irrespective of the high proportion of such results which may be irrelevant, it is clear that some hold insights that merit exploration. Surprisingly there is even a technical literature on "*cognitive radio*", for example. With respect to meditation, one blog indicates:

If the purpose of meditation is to eliminate distracting thoughts, then perhaps meditation is an exercise in increasing one's *mental inductance*

Of particular interest, as an unexpected insight of relevance to a current global preoccupation, is the example of an exploration of *inductance*. This has been a focus of Ronald K. Mitchell (*A Transaction Cognition Theory of Global Entrepreneurship*, 2003):

Transaction cognition theory decomposes a transaction into its three basic elements: an individual, other persons, and the work. According to this theory, variability in human performance can be attributed to variability in cognitions related to these elements of a transaction. (p. 183)

This follows a direction suggested by [Kenneth Arrow](#) (1969) regarding the parallels between physical systems and economic systems, whereby the "transactions costs" are the economic equivalent of friction in physical systems. Citing Oliver E. Williamson (*The Mechanisms of Governance*, 1996), Mitchell notes that one of the reasons for appealing to other disciplines for assistance in the development of entrepreneurship theory is that more mature disciplines may well have encountered and solved problems common to newer fields. Mitchell argues for the value of drawing on electrical engineering as follows:

A problem that has been studied extensively in electrical engineering, and that is analogous to similar problems in entrepreneurship, is the problem of inductance. Inductancy, or reactivity, occurs in electromechanical situations such as electric motor acceleration or deceleration, where either sparks ... or shocks .. are created. In electrical engineering, the level of this reactivity is termed inductance... Transaction cognition theory suggests new inductance relationships -- the propensity of a transaction to fail ("sparks" or "shocks" in economic transacting) -- might be thought of as a function... of the level of planning, promise, and competitions (the reactivity constant), multiplied by the rate of change in transaction flow. When conceptualized in this manner, new relationships in global entrepreneurship are suggested, especially in the area of value conservation.... one of the key implications... is that the level of cognitive inertia in entrepreneurship... is susceptible to change... (p. 206)

In a later study (Ronald K. Mitchell, Kenneth Keng and Wei Chen, *Institutional Entrepreneurship and "Inductance" in the Public Sector: a China case*, Texas Tech University) the authors note:

In this paper we use an extensive analysis of China's economy to explore an under-considered phenomenon in public-sector entrepreneurship: social inductance (reactivity/resistance to development). Herein we demonstrate, in this still-planned economy, how the decisions of policy-makers and institutional entrepreneurs can impact long-term growth in low, medium, and high-inductance scenarios

A different example is offered in the modelling exercise presented by Luiz Bevilacqua and colleagues (*Knowledge Diffusion Paths in a Research Chain*, *Mecánica Computacional*, 2010):

The mathematical model incorporates a diffusion coefficient, a generation, and a knowledge inductance, or impedance, coefficient as the parameters that guide the diffusion of knowledge in the research chain.

It is worth considering whether many of the most vexatious current issues of human communication could be fruitfully reframed in terms of "impedance matching" -- for which the Smith Chart is valued, as discussed below (cf. Jeffery C. Allen and Dennis M. Healy, Jr, *Hyperbolic Geometry, Nehari's Theorem, Electric Circuits, and Analog Signal Processing*, *Modern Signal Processing* MSRI Publications, 46, 2003)

## From "periodic table" to "periodic container"

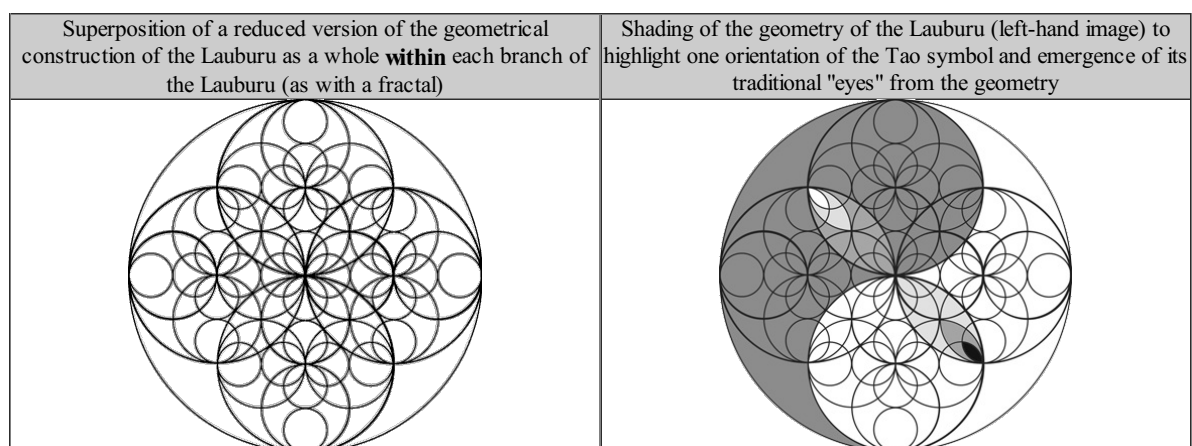
Given the above argument with respect to metaphors derived from the electricity and electronics on which the current knowledge-based global society is dependent, it is appropriate to recognize that electrons have been understood as "organized" by that society into a variety of "elements". Each element is a complex configuration of electrons represented simplistically as orbiting a nucleus -- with such orbits better understood as forming "electron shells" whose spherical nature is a challenge to the conventional imagination. The elements have of course been conceived as organized into a periodic table.

In a world focused on tangibles, none has seen an electron, however their nature and existence is inferred. Few can be said to have seen many elements in their pure state. As noted above, the periodic table is an inspiration in the quest for a meaningful ordering of transformations -- perhaps to be recognized as being as intangible as electrons. It is especially significant in that it is considered to be one of the most comprehensive generalizations of science. In more general terms, however the focus here is on a suitable "pattern container" -- of which a table is but one possibility (and potentially problematic for reasons noted below).

Also of interest is the quality of representational coherence commonly associated with readily remembered symbols. It was for this reason that the geometric combination of the Lauburu and Tao symbols was explored in a section of the preceding paper (*Modulating cognitive transformations: electrical metaphors and semiconduction*, 2012). This gave rise to the following images illustrating their integration.

The approach there was related to mappings onto a hyperbolic sphere, whether represented in 2D (as the [Smith Chart](#)) or the [generalized 3D variant](#) (cf. Madhu S. Gupta, *Escher's Art, Smith Chart, and Hyperbolic Geometry*, *IEEE Microwave Magazine*, October 2006). The 2D version is one of the most widely used charts in electrical and electronic engineering. The chart is most frequently used at or within the [unity radius](#) region. The remainder is however mathematically relevant, as recognized in [oscillator](#) design and [stability](#) analysis, for example. It can be used to represent many parameters including impedances, admittances, reflection coefficients, scattering parameters, noise figure circles, constant gain contours and regions for unconditional stability, including mechanical vibrations analysis. The chart is plotted in 2D on the complex [reflection coefficient](#) plane and is scaled in normalised [impedance](#), normalised [admittance](#) or both, using different colours to distinguish between them.

The complexification here of the image (as explored in relation to electrical engineering) is a consequence of mapping a smaller version of the larger image into the branches of the larger image -- recursively engendering a fractal form. Two such recursive mappings are illustrated in the following



As the shaded image on the right illustrates, where a figure of eight pattern can be recognized, the Tao symbol can be recognized --

although at different scales.

The speculative exploration here derives from the assumption that a pattern of eight cognitive transformations can be recognized -- at different "scales" -- as a form of "eightfold way". The focus is on the suggestion that, through the cognitive implications of metaphor, the basic electrical functions above constitute such a pattern. This is informed by the further assumption that these are more tangible expressions of cybernetic functions of greater abstraction -- as required by the [Viable System Model](#). The assumption derives from the question: *how many kinds of component are required for a viable electric circuit?*

Such a question relates to that with respect to team building, as with the [Belbin Team Inventory](#) developed by [Meredith Belbin](#). The team roles so identified are not equivalent to [personality types](#), and unlike the [Myers-Briggs Type Indicator](#) (which is a psychometric instrument used to sort people into one of 16 personality types), the Belbin Inventory scores people on how strongly they express behavioural traits from 9 different team roles. A person may and often does exhibit strong tendencies towards multiple roles.

To the extent that these assumptions are credible, the question is then how the above image might serve to "hold" this eightfold pattern -- and how it might indicate how any articulation of these cognitive functions might also be held together with(in) them. As a "container", the issue is how these more specific functions might be "packed" within the geometry, namely how the geometry might be filled. In this connection, as stressed in the preceding paper, the concern is with cognitive transformational **dynamics** (as experienced) -- rather than classification of the functions as categories or styles (as **descriptions**).

In the following discussion, the patterning constraints of the standard periodic table -- conventionally conceived as blocks of variously completed [orbital electron shells](#) -- are used to guide eightfold "cognitive" attributions in the mapping process. It is appropriate to note that an eightfold pattern has long been recognized as fundamental to the organization of the periodic table.

## Periodic table of elements as problematic sociopolitical metaphor

The widespread simplistic use of the "table" form as a means of organizing and presenting knowledge is potentially problematic in a "global" society for which a more complex geometry might be assumed to be appropriate. Before considering the valuable patterning insights currently held by the periodic table, it is therefore appropriate to highlight the questionable nature of the table as a pattern of representation.

It might be asked why such a presentation has been considered for so long to be a satisfactory mental model. The case has also been separately argued more generally ([Geometry of Thinking for Sustainable Global Governance](#), 2009; [Engaging with Globality -- through cognitive lines, circlets, crowns or holes](#), 2009). Hence the merit of exploring a mode of knowledge presentation based on the hyperbolic sphere -- as with the image above. The preceding paper argued for a new form of "multiplication table" appropriate to ordering the complex experience of the variety of cognitive transformations.

**Social classes:** The pattern of organization of the standard model of the periodic table can be used **provocatively** to illustrate the above point -- as an indication of a questionable understanding of political organization, potentially inappropriate to the complexities of a global society (even dangerously so). The table below indicates the percentage of any group of cells as a percentage of the total in the set (assumed here to be 118). The degree of comparability with conventional statistics regarding such sociopolitical categories is relatively remarkable -- especially with respect to the so-called "1%" vs. "99%", which has been a focus of worldwide criticism by the Occupy Movement.

To clarify this criticism, the standard representation of the periodic table could be "misrepresented" by "reframing" it -- embedding it in the following frame.

Standard Model of the Periodic Table of Elements (presented speculatively as a "reframing" of an image from <i>Wikipedia</i> )																					
	"Upper" class	"Middle" class	"Lower" classes (and values)										"Middle" classes (and values)					"Upper" class			
% of all categories	11.8%	30.5%	33.9%										(30.5%)					(11.8%)			
1.7%	1 H													2 He		Ideal binary world ("them & us")	Simplicity ↑				
7%	3 Li	4 Be											5 B	6 C	7 N	8 O		9 F	10 Ne	Orderly world (neat explanations & models)	
7%	11 Na	12 Mg											13 Al	14 Si	15 P	16 S		17 Cl	18 Ar		
15.3%	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se		35 Br	36 Kr	"Real world" of experience	
15.3%	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te		53 I	54 Xe	(legal arrangements, adjustments & compromises: "things not working according to plan")	
15.3%	55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po		85 At	86 Rn		
15.3%	87 Fr	88 Ra		104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv		117 Uus	118 Uuo		
"Untouchable" classes (and values)	26.6%		15.3%		57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er		69 Tm	70 Yb	71 Lu	"Underworld" of paradox, absurdity, uncertainty, illegality & crime
"invisible" classes	?		15.3%		89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm		101 Md	102 No	103 Lr	"Invisible world" (as experienced)
			(superactinides -- excluded from the standard representation of the Periodic Table)																		

Irrespective of the provocative "reframing", the coloured core is an 18-column periodic table layout, which has come to be referred to as the **common or standard form**, on account of its popularity. It is also sometimes referred to as the *long form*, in comparison to the *short form* or [Mendeleev-style](#),

which omits groups 3-12. The *wide periodic table* incorporates the *lanthanides* and the *actinides*, rather than separating them from the main body of the table. The *extended periodic table* adds the 8th and 9th periods, including the *superactinides* (as shown below -- and indicated in the reframing as the empty row at the bottom)

**Income brackets:** The rows down the table could be fruitfully compared with decreasing income levels (and tax brackets). "Upper" may imply leadership roles in the case of low income brackets, with the column on the far left suggesting (exploitative) action potential and that on the far right suggesting indifference, neutrality or passivity. The second (income bracket) row might be read as "upper middle class", in the case of the "middle class" group, with the implication that at lower (income brackets) it could imply upward aspirations to such values. In this sense the upper rows are indicative of the highly visible privileged classes and the lowest rows indicative of the seriously deprived, neglected and invisible classes.

It is tempting to label the table in terms of the traditionally provocative categories of people in the dystopian novel by [Aldous Huxley](#) (*Brave New World*, 1932), namely alpha, beta, gamma, delta, and epsilon -- given the manner in which this is reminiscent of the subshell labelling. There is also the sense that the "*Nomenklatura*" -- are characteristic of the upper rows, in contrast with the "nobodies" below.

**Urban skyline: from penthouses to slums:** The form of the table is also provocatively reminiscent of any modern urban skyline with its skyscrapers (and their penthouses) and the invisible accommodation of the lowest classes -- whether in slums, or even in subterranean tunnels (as in Manhattan). It is of course from those "lower" and "underworld" realms that "radical" and unexpected perspectives tend to emerge in defiance of conventional law and order. It is in this sense that the transition from binary simplicity through to ever greater complexity can be recognized.

**Academic organization:** This pattern is echoed in the conceptual frameworks promoted within academic "ivory towers" and variously capable of taking account of complexity within sociopolitical, philosophical and religious models. The "ivory tower" metaphor is neatly echoed by the "skyscraper" feature in the above image, namely the worldview of the "1%" of the first two columns. These distinguish helpfully between the neutral indifference of the completed worldview of the second column and the active complicity of the first in many forms of change. Ironically the natural sciences most closely associated with the standard presentation of the periodic table are those most complicit as "handmaidens" of the military-industrial complex most active in the problematic change inspired by a binary worldview. In this sense it is understandable that there is little interest in alternative representations (of "law and order") more consistent with the dynamic complexity of the experiential global organization of world.

It could well be said that representation of the elements of the natural world by a "table" is an insult to the degree of "periodic" complexity with which the natural sciences engage. The many efforts to adapt any tabular framework to sociopolitical organization merit recognition as being equally insulting.

**Institutional concerns:** Preference for a "table" is also to be seen as curiously echoed by use of that metaphor in legislative and legal settings -- whether the traditional tables of rights and laws (originally on "tablets"), the current [tabling of motions in parliament](#), or the tabular presentation of conference programmes and organization charts (notably in the form of [matrix organization](#)). Considerable importance is attached to the "negotiating table" to which stakeholders need to be brought -- with selected issues to be placed "on the table".

The functions of government, and their articulation through government agencies, do indeed lend themselves (misleadingly) to tabular presentation. This was developed, on the basis of the periodic table, in the organization of topics for the online *Yearbook of International Organizations* and the *Encyclopedia of World Problems and Human Potential* (cf. *Functional Classification in an Integrative Matrix of Human Preoccupations*, 1982).

Institutional adaptations to exceptional circumstances are however better echoed by the complexities of the bottom of the periodic table. There is also the sense in which governance is essentially incapable of taking account of exceptions "at the bottom" -- preferring not to know of them and certainly not to care about the reality they constitute for many (cf. *Global Strategic Implications of the "Unsaid": from myth-making towards a "wisdom society"*, 2003).

Potentially striking as a metaphor is the manner in which a conventional conference can be understood as a form of periodic "table" -- echoing references to the traditional academic "[high table](#)". The singular keynote speaker, perhaps introduced by a neutral chairperson or moderator, is at the highest focal point. Closely associated may be a limited set of authorities -- either as a panel or in the "front row" -- behind is to be found the reserved seating for those to whom formal recognition is variously due, however seemingly irrelevant they may be to the topic. There is then space for ordinary participants with others behind them, possibly including those "off the street". The latter may be a particular focus of security services (as representatives of "law and order"), who may exclude them as "uninvited" to a "closed event". Such gatherings could be seen as ritual enactments of the tabular pattern.

**Timetables and tablets:** There is widespread acceptance of the manner in which social processes are managed through timetables. Ironically, the metaphor is even more strongly reinforced by [tablet interfaces](#) with the world wide web (and via which some will view this paper). The table metaphor is omnipresent -- as best exemplified by timetable -- at a time when there is increasing recognition of the limitations of the linear thinking embodied in the table and in the spreadsheets through which transactions are "organized". The complexity recognized by physics as underlying the relationship between the elements in the periodic table suggests the merit of exploring cyclic and other more dynamic forms of organization -- even as a basis for accounting (cf. *Spherical Accounting: using geometry to embody developmental integrity*, 2004). Might "global" financial crises be avoided by reducing emphasis on tabular spreadsheets -- possibly better to manage cyclic events?

**League table rankings:** It is perhaps to be expected that, following the pattern in many sports, many social initiatives and issues are ranked in a [league table](#). This is a chart or list which compares sports teams, institutions, nations or companies by ranking them in order of ability or achievement. The approach extends to comparison of countries in terms of growth, education, human rights, perceived corruption, drug use, and the like.

The questionable nature of the approach is evident when it is applied to animal species -- comparing them by size, for example. This completely obscures the role of animals of different sizes in an ecosystem. In the human case it reinforces simplistic assumptions regarding "biggest is best" and "size does matter". It notably features in questionable decisions to construct the tallest skyscraper or purchase the fastest car. It is with respect to such rankings that the preoccupation with being "number one" is associated.

**Strategic inadequacy:** Unquestionably deployed, thinking through tables is currently engendering and sustaining high levels of unemployment and public indebtedness -- with little relief in sight (cf. *12 Mindsets Ensuring Disappearance of Employment Opportunities*, 2012).

**Truth table and multiplication tables:** Logic makes use of a [truth table](#), notably in Boolean algebra and propositional calculus, to compute the values of logical expressions. In particular, truth tables are used to tell whether a propositional expression is true for all legitimate input values, that is, logically valid. Any "[multiplication table](#)" can be understood as a highly simplified instance of a truth table. It is appropriate to ask whether the former precludes understandings of "truth" which do not take logical form but which might derive their "validity" from geometrical or topological relationships, or other "correspondences" (*Theories of Correspondences -- and potential equivalences between them in correlative thinking*, 2007).

## Engaging with distinctions

As an indication of the dysfunctional manner in which people are encouraged to think, the case may be further emphasized by the following adaptation of the above table. The successive "unfolding" or "unpacking" by stages, from left to right, highlights the following pattern of distinctions.

**First unfolding:** the immediate preference accorded to *binary distinctions* (currently exemplified by the US presidential campaign) in which issues are only too readily categorized and limited to "black or white", or "us or them" -- as discussed separately (*Us and Them: Relating to Challenging Others -- patterns in the shadow dance between "good" and "evil"*, 2009; *Transcending Simplistic Binary Contractual Relationships: what is hindering their exploration?* 2012). As with the periodic table, there is a marked aspiration to a unitary perspective (subsuming the "other"), evident in the focus on being "number one", or the "world's policeman" (cf. John Maclain, *Should the United States be the World's Policeman?* WikiSource, 2012).

A considerable proportion of daily discourse is focused on complaints regarding the problematic actions of "others" -- whether to be regretted as misguided or demonised. It is questionable whether there is then the capacity to count "beyond 2" -- as though that was assumed to be the mathematical base of the number system. The binary focus may however be framed otherwise in the light of the considerable psychosocial energy it engenders -- on which people are variously dependent and through which recognition is enabled -- appropriately recalled by the primary process of nuclear fusion in the Sun, through which the nuclei of the first element are fused into the second

**Second unfolding,** suggesting the greater elegance is evident in the articulation of the *eightfold patterns* of the second "unfolding" in the image below -- which embodies the first. This can be understood as recognition of a larger variety of cognitive processes -- a [requisite variety](#) in cybernetic terms -- to enable a viable "living system". Hence the value of exploring 8-fold systems, most notably the [Noble Eightfold Path](#) of Buddhism, the [Eightfold Way](#) of particle-physics theory, the [Eight-circuit Model](#) of consciousness, and the [Eightfold Path](#) of policy analysis.

Efforts at personality types tend to focus on patterns of this level of complexity. In practice however, recognition of eightfold organization does not ensure the harmonious psychosocial organization it might be held to imply, as is implicit in the argument of [Stephen Prothero](#) (*God Is Not One: the eight rival religions that run the world -- and why their differences matter*, 2011). Of interest in this argument is the aspiration of each of the eight to be "number one" and driving commitment to that end (often at any cost).

**Third unfolding,** highlighting the inadequacy of the simpler, neatly ordered patterns. This is evident in recognition of the complexities of the "real world" -- the "dirty" world of politics, commerce, industry and security preoccupations. This transcends the neatness of such models in practice -- typically calling upon "real world" experience. Ready use is made of *tenfold classification* systems to manage disparate variety -- avoiding consideration of systemic relationships. The challenge to simpler (tabular) understandings of "law and order" becomes even more evident through the "orthogonal" portions of the table emanating from the two blank cells in the image below, namely the lanthanides and the actinides (noted in the image above).

The need to represent them as orthogonal -- out of the plane of the table -- is suggestive of another logic which does not "fit" into the tabular presentation, implying another understanding of "law and order" (as with the "dirty tricks" of government [covert operations](#) and organized criminality). This is appropriately suggested by widespread recognition of transactions "under the table". This unconventional logic is apparent in a different way, and to a potentially heightened degree, with regard to understanding of the further development of the periodic table to include the superactinides (only noted in the image above) -- as might be the case of initiatives based on revelation. The point can be more provocatively made by the alternative logic introduced by an erection, humour, drugs, birth, death, or suicide (bombing) -- readily recognized as being "out of order" with respect to convention, as argued by [Paul Feyerabend](#) (*Against Method: outline of an anarchistic theory of knowledge*, 1975; *Conquest of Abundance: a tale of abstraction versus the richness of being*, 1999). Strategically it could be understood in terms of surprise and the so-called [black swan theory](#) developed by [Nassim Nicholas Taleb](#) (*The Black Swan: the impact of the highly improbable*, 2007).

Note that in each case the increase in complexity acknowledged in the cognitive unfolding from **left to right** is matched by increasing complexity from **top to bottom** of each column. However the complexity in the latter case is one which increasingly encounters unfamiliarity, ignorance, uncertainty and paradox (*Living with Incomprehension and Uncertainty: re-cognizing the varieties of non-*

*comprehension and misunderstanding*, 2012). Assumptions may be made to deny the relevance of this in practice. Efforts may be made to "fit" complexity into a conveniently simple pattern.

Presidential debates may be relatively incapable of transcending binary distinctions -- "me right, you wrong" -- namely the possibility of counting beyond two. This may imply forms of knowledge of which those focused "at the top" of each column are not aware -- or would prefer to ignore. That reality is only too evident in the world of criminality, gang culture and survivalism -- only too real to many in the world. Ironically such alternative logics may be of relevance to extraterrestrial cultures, as separately argued (*Self-reflective Embodiment of Transdisciplinary Integration (SETI): the universal criterion of species maturity?* 2008).

Suggestive indication of conceptual unfoldings patterned by the Periodic Table																	
Binary distinction		Eightfold distinction (2 + 6)						Eighteen-fold distinction (2 + 6 + 10)									
1st unfolding		2nd conceptual unfolding						3rd conceptual unfolding									
1 H	2 He	Orderly world (neat explanations & models)						"Real world" of experience (legal arrangements, adjustments & compromises: "things not working according to plan")									
3 Li	10 Ne	4 Be	5 B	6 C	7 N	8 O	9 F										
11 Na	18 Ar	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn
19 K	36 Kr	20 Ca	31 Ga	32 Ge	33 As	34 Se	35 Br	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd
37 Rb	54 Xe	38 Sr	49 In	50 Sn	51 Sb	52 Te	53 I		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg
55 Cs	86 Rn	56 Ba	81 Tl	82 Pb	83 Bi	84 Po	85 At										
87 Fr	118 Uuo	88 Ra	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus		104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn

One effort to indicate the progressively difficulties in handling n-fold distinctions is presented separately (*Distinguishing Levels of Declarations of Principles*, 1980).

## Using the periodic table as a patterning template for cognitive transformations

**Periodic template:** As a template, the periodic "table" is of unquestionable value as the preliminary, provisional presentation of a complex pattern, enabling issues and their relationships to be recognized, whilst embodying others implicitly. It is perhaps one of the most complex patterns with which humanity has formally engaged. As stressed above, **the concern here is to benefit from the organization of the periodic table as a template and a discipline -- for the organization of experience informed by periodicity.** (cf. *Periodic Pattern of Human Knowing: implication of the Periodic Table as metaphor of elementary order*, 2009; *Periodic Pattern of Human Life: the Periodic Table as a metaphor of lifelong learning*, 2009)

The underlying creativity brought to bear on this challenge is notably evident in explorations of the mathematics of the periodic table (cf. Denis H. Rouvray and R. Bruce King, *The Periodic Table: Into the 21st Century*, 2005; *The Mathematics of the Periodic Table*, 2005). However, their compilation seemingly makes no reference to the potential relevance of hyperbolic forms in configuring the elements more meaningfully.

It is also appropriate to note the many efforts to present the array of elements other than in tabular form -- using a variety of geometric possibilities (cf. J. W. van Spronsen, *The Periodic System of Chemical Elements: a history of the first hundred years*, 1969). Also of some relevance to this discussion is the extensive effort to generalize the periodic table to include psychosocial dimensions, as made by Edward F. Haskell (*Generalization of the structure of Mendeleev's periodic table*, 1972).

**Hyperbolic potential:** It is however intriguing to note that whilst physics is currently exploring the hyperbolic organization of the universe, and electrical engineering is making use of a hyperbolic sphere to represent the complexities of matching networks, it is not clear that exploration of the organization of the elements is benefitting from such complex insights. A possible exception is work on the role of a hyperbolic law in constraining development of the number of elements by Albert Khazan (*Upper Limit in Mendeleev's Periodic Table Element No.155*, *Svenska Fysikarkivet*, 2009; *Effect from Hyperbolic Law in Periodic Table of Elements*, *Progress in Physics*, 2007). Such a limit is reminiscent of others such as **Dunbar's Number**, the **Hayflick Limit**, and **apoptosis**.

The question to be asked is the manner in which the complexity of the mathematics currently applied is in any way constrained by the challenge to comprehension of its insights. This is particularly relevant when the periodic template is of relevance to representation of cognitive transformations commonly experienced, as is the concern here.

**Spherical geometry:** Curiously, whilst the very notion of an "electron shell" (understood as composed of "orbitals") is imbued with a sense of dynamics within spherical geometry, the conventional focus is on representation within a "table" that necessarily inhibits non-linear insights. By contrast, the mapping employed by electrical engineering in terms of a hypersphere effectively offers a "window onto hyperspace" -- encouraging speculation potentially relevant to higher orders of organization in a knowledge-based society. Whilst the pigeon-holing of elements within the table may potentially imply the spheroidal nature of the electron shells, their placement within circles offers a far stronger reminder of their inherent cyclic dynamic and the encompassing cyclic contexts.

**Unconscious competence:** There is a profound irony to the fact that every individual clearly has a considerable degree of competence (if deeply unconscious) in engaging with electron shells, the periodicity of the elements, and the complexity of their organization,

irrespective of whether they are organized in tabular form by various disciplines. Individual viability is deeply dependent on that expertise. Analogues may be suspected with respect to within the coherent organization of cognitive transformations.

**Self-reference:** Of particular interest, in relation to the experiential emphasis here, is potential recognition of a form of **self-reference** or reflexivity, as noted above, of which discussion of **second-order cybernetics** takes account (as the cybernetics of cybernetics) -- even envisioning the possibility of higher orders in response to the cognitive challenges of the **subject-object relation** (*Defining the objective ∞ Refining the subjective ?! Explaining reality ∞ Embodying realization*, 2011). This is variously associated here with the **vertical** dimension of the circular image (above), especially the vertical axis (as indicated in the table below). In this sense, as with the complex plane of mathematics, the horizontal axis is associated with the "real" whereas the vertical axis is associated with the "imaginary".

**Requisite organizational complexity:** It is most curious that mathematics, as the foundation of cybernetics, employs what amounts to a tabular organization of its own preoccupations (cf. *Mathematics Subject Classification*) without any sense that it would be more consistent, appropriate or fruitful to explore the more complex relational orderings it otherwise promotes as fundamental. The issue has been tentatively discussed separately (*Is the House of Mathematics in Order? Are there vital insights from its design*, 2000) and explored otherwise (*Towards a Periodic Table of Ways of Knowing -- in the light of metaphors of mathematics*, 2009). The issue is in principle a concern of **metamathematics**. The question is whether classification should reflect the design principle of **form following function** -- inspired by isomorphism.

Given the case currently made by astrophysicists and cosmologists for organization of the universe in terms of a "surreal" hyperbolic geometry, it might be asked why the organization of (mathematical) knowledge does not require or elicit an equivalent approach (cf. Lisa Grossman, *Hawking's 'Escher-verse' could be theory of everything*, *New Scientist*, 9 June 2012). For cosmologists this offers a way of reconciling the geometric demands of string theory, a still-hypothetical "theory of everything", with the universe as observed -- through a negatively-curved Escher-like **hyperbolic geometry** (essentially a **hyperbolic space**). Their results rely on a mathematical twist previously considered impossible.

It is such insights which underlie the remarkably unusual images offered by the 2D Smith Chart as the basis for the above configuration of circles, as noted by Madhu S. Gupta (*Escher's Art, Smith Chart, and Hyperbolic Geometry*, *IEEE Microwave Magazine*, October 2006). The 3D variant is based on a mathematical "trick", again one notably used by Escher in his paradoxical images and by Mandelbrot in fractal rendering. As noted by *Microwaves101.com*:

The mathematical trick proposed by the 3D Smith chart... is to extend the reflection coefficient's plane with the point at infinity (thus to accept the division with 0) and work in the extended reflection coefficient's plane.... Then a one-to-one mapping between the points of the 2D Smith chart (extended to infinity) in 2D and the inverted Riemann sphere is performed. The 2D extended Smith chart is considered to be the equatorial plane of the **Riemann sphere** and then after the mapping one gets the 3D Smith chart which is on the surface of the unit sphere. (*Three Dimensional Smith Chart*, January 2012)

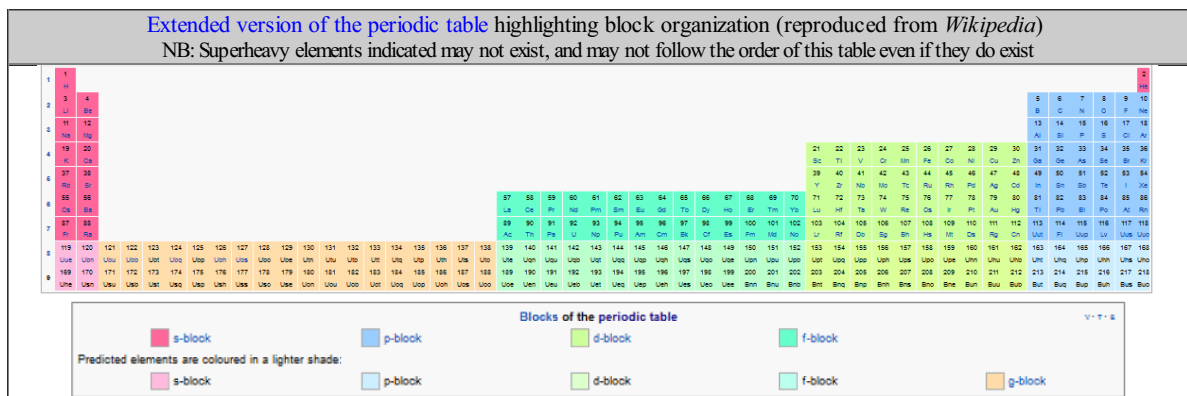
Helpful insights into the visualization implications of the 3D variant are provided by A. A. Muller and colleagues (*A 3-D Smith Chart Based on the Riemann Sphere for Active and Passive Microwave Circuits*. *U.P.B. Sci. Bull.*, Series C, 74, 2012). As noted by the useful comments of Gupta with respect to Escher's aesthetic work:

His intuitive manipulation of spatial regions, arrived at from aesthetic grounds, nevertheless represent sophisticated mathematical tools, such as conformation mapping and hyperbolic geometry, thus suggesting that these mathematical operations are not entirely arbitrary in the abstract sense but have a relationship to human perception.

The concern here is what account should be taken of "human perception" in the systematic organization of knowledge. Of relevance to a degree of paradox required by such perception in practice, Gupta also notes: *The hyperbolic distance between two points is invariant under a Möbius transformation.*

## Possible mapping of periodic correspondences into nested circles

How then might it be possible to map category "boxes" into circles? Is this a case of "circling the square"? Or is it a case of exploring the possibility of a memorable pattern of distinctions of potential significance to cognitive transformations -- especially with the cognitive subtlety implied by the Riemann sphere?





left-lower												
Size 4	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	10	10
right-lower												
Size 4	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	10	10
left-upper												
Size 4	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	10	10
right-upper												
Size 4	Ac*	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	10	10

**Primary vertical axis:** Those corresponding to the "inner transition elements" (namely the lanthanides and actinides) could be mapped in relation to the **central vertical axis** of the largest circle (Size 1). These 2 "rows" require 18 positions in the periodic pattern in each case. One group of 18\*\*\* could be mapped onto the lower portion of the axis **below the horizontal**, the other onto the portion **above the horizontal**. In each case the 2 pairs of circles (Size 4) together contribute 16 positions. The additional 2 in each case could be associated with the circle (Size 2) circumscribing both.

Attribution of "f-block" cognitive transformations to the principal vertical axis															
upper vertical															
	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	18***yy
lower vertical															
	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	18

NB: No use is made of the **horizontal items on the vertical axis**, which could be of relevance in considering mappings corresponding to the hypothetical later elements (the **superactinides**) in the g-block envisaged in the **extended periodic table**. Also no attempt has been made to make use of direction of spin, if the elements of the Tao symbol are taken as dynamic.

Attribution of "g-block" cognitive transformations to secondary horizontals on the principal vertical axis												
Groups > vertical axes	3	4	5	6	7	8	9	10	11	12	tot.	cum. tot.
left												
Size 4									Cu	Zn	10	10
right												
Size 4									Ag	Cd	10	10

## Towards a "new set of wheels" for psychosocial navigation

It is important to recall that the pattern of nested circles was suggested by the 2D projection of the hyperbolic (Riemannian) sphere discussed in the preceding paper with respect to the **Smith Chart**. As with the innovative 3D variant, commentary draws attention to the unconventional complexity of what is held by these mappings of an understanding of the **complex plane**. As noted, for immediate purposes, the horizontal axis of the pattern of circles could be compared to conventional understandings of tangible reality. The vertical axis could be compared to unconventional understandings of imaginary reality. Their relationship as axes of a complex plane is discussed separately (*Imagining the Real Challenge and Realizing the Imaginal Pathway of Sustainable Transformation*, 2007).

In relating the pattern to that of the periodic table of elements, it is appropriate that the cognitive transformations mapped onto the vertical axis are less commonly recognized -- even contested as non-existent -- irrespective of their occurrence in the reality of many, however difficult they may be to replicate. As with the corresponding elements, many experiences tend to be "unstable" (namely with short half-lives) and therefore "radioactive" -- and thus metaphorically appropriate to the "imaginary" nature of the axis. It cannot be too strongly emphasized that people live, to some degree, in relation to that vertical axis -- and perhaps to a greater degree than it is assumed that they live in relation to the horizontal axis. People may well be obliged to live "betwixt and between" them (cf. *Living as an Imaginal Bridge between Worlds Global: implications of "betwixt and between" and liminality*, 2011).

As a trigger for the imagination, there is a case for use of the jargon phrase common in relation to acquisition of a new vehicle, namely the felt need for a "new set of wheels" to navigate liminal experience. Arguably the "Tabular Era" has successfully engendered one set of "cognitive wheels" -- a pattern echoed in the construction of automobiles, trucks and railway boxcars. Transportation around the global

is now dominated by use of box-like containers consistent with that pattern.

The suggestion here is that nested circles offer a relation to a universe of knowledge informed by paradoxical hyperbolic principles -- the latest pattern esteemed to be of relevance to the organization of the physical universe. This has itself been held to be essentially based on information -- as in proposals by [Craig Hogan](#) regarding the "digital universe" (Michael Moyer, *Is Space Digital?* *Scientific American*, 17 January 2012).

Of relevance to imagining how a "new set of wheels" might be recognized to enable movement in other dimensions, is the work of [Arthur M. Young](#) (*The Geometry of Meaning*, 1976). As the developer of the [Bell helicopter](#) he went on to reflect on the design and operational principles of a "psychopter" as the "winged self" (cf. *Engendering a Psychopter through Biomimicry and Technomimicry: insights from the process of helicopter development*, 2011).

The question evoked here is how this "psychopter" might well need to be understood as a "hypercopter" (already cultivated as a metaphor). Imagination is encouraged by subsequent development of the helicopter and a degree of superficial resemblance to the nested circle image through configurations of rotor blades. The design in one dimensional framework may well prefigure the possibility in another (as suggested by the argument for technomimicry). Is this suggestive of the design for a "set of wheels" for those "kinesthetically intelligent" with respect to cognitive transformations (cf. *Navigating Alternative Conceptual Realities: clues to the dynamics of enacting new paradigms through movement*, 2002; *Entering Alternative Realities -- Astronautics vs Noonautics: isomorphism between launching aerospace vehicles and launching vehicles of awareness*, 2002).

## Necessary "tuning" of any periodic representation

The concern here has **not** been to clarify attributions of cognitive transformations **within** any cluster but rather to consider how the various clusters might be related as a framework within which such attributions could be more fruitfully considered. This is usefully understood as a process of "tuning" relying on a sense of harmony as separately discussed (*Tuning a Periodic Table of Religions, Epistemologies and Spirituality -- including the sciences and other belief systems*, 2007). Any harmony may also be visual in terms of the mnemonic qualities of the symmetry in the columns and rows of the images above.

Of particular interest to the tuning process are the insights offered by the Chinese eightfold *Ba Gua* system. This is valuable both through the linear encoding used, through the categories associated to it, through the transformations recognized between them, and through the metaphors by which they are variously rendered comprehensible. The eight are traditionally organized as distinct "houses" -- of relevance to the further articulation echoed in the eightfold pattern of periods in the table (cf. *Organization of I Ching hexagrams in terms of traditional "houses"*, 1995). The distinctions may be notably explored through music (cf. [D. C. Harvey](#), *The I Ching Hexagrams Directly Translated Into Music, Math, Geometry and the Zodiac Calendar*).

The cognitive approach to tuning is further clarified by the widespread enthusiasm for solving the puzzles exemplified by [sudoku](#) and [Rubik's Cube](#), and their more complex variants. This clarifies the sense in which the columns and rows of a table may be shifted in relation to one another in the tuning process. An analogous process could be envisaged in relation to attributions within the pattern of circles. With respect to tuning, it is also of interest how a form of table organization is evident in the [fret](#) of a stringed instrument -- a tabular constraint which is transcended through the skills of the player. This interpretation helps to make the point that there are a variety of choices possible in [tuning systems](#) -- suggesting that attributions may well be made in different ways according to preferences. There are many techniques for theoretical comparison of tunings, utilizing mathematical tools such as those of linear algebra, topology and group theory.

There is a sense, worthy of some suspicion, that the number pattern of the periodic table is (unconsciously) "played with" in the derivation of coherence of psychosocial significance:

- 26 (namely  $3 \times 8 + 2$ ) as the number of letters considered necessary for the Latin alphabet
- 9 (as  $18/2$  or  $8+1$ ) as promoted in the [enneagram of personality types](#)
- 16 (as  $2 \times 8$  or  $18-2$ ) as promoted in the [Myers-Briggs Type Indicator](#)
- 12 (as  $10+2$ ) as favoured in a variety of systems of organization (cf. *Checklist of 12-fold principles, plans, symbols and concepts*, 2011)
- 6 (as  $8-2$ )
- 10 (as  $18-8$  or  $8+2$ )

Related issues are discussed separately (*Patterns of Conceptual Integration*, 1984; *Patterns of N-foldness: comparison of integrated multi-set concept schemes as forms of presentation*, 1980; *Representation, Comprehension and Communication of Sets: the role of number*, 1978).

An interesting tuning challenge derives from the combination of considerations of the 8-fold *Ba Gua* pattern, with those suggested above in relation to electronic components/functions, and with those deriving from cybernetic insights. The work on the Chinese articulation, from a cybernetic perspective, by Maurice Yolles and colleagues is of particular relevance (*Toward a formal theory of socioculture: a yin-yang information-based theory of social change*, *Kybernetes*, 2008). Especially intriguing is the relation between the 8-fold *Ba Gua* pattern and the 5-fold *Wu Xing* pattern. The comparison of the latter with that of the 5-fold Pythagorean pattern of [Hygiea](#) is of particular interest in relation to understandings of health and systemic viability, by extension (cf. *Cycles of enstoring forming mnemonic pentagrams: Hygiea and Wu Xing*, 2012; *Potentially health developmental integrity from 5-fold symmetry*, 2012).

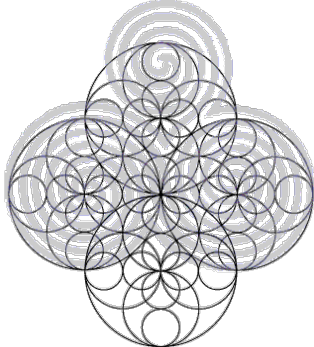
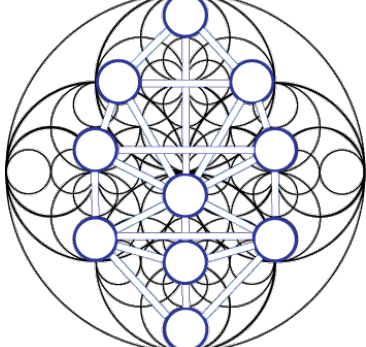
The musical metaphor is helpful in reframing the contrast between the horizontal and vertical axes -- given the distinction made between "technicality" and "musicality" in assessing musical performance in competitions. This offers an understanding of preoccupations with respect to the horizontal axis as appreciation of the tangibles of convention, most notably in the form of consumerism. Those of the

vertical axis then relate to the imaginal dimension fundamental to a sense of fulfilment and meaningful quality of life.

## Recognition of cultural icons within a pattern of nested circles?

If, as noted above, human perception can be understood as intimately associated with hyperbolic geometry, there is a case for exploring how this is evident in symbolic and aesthetic intuitions that have proven to be enduringly attractive to cultures -- over centuries. In the quest for a "new set of wheels" it is then appropriate to note how expression may continue to emphasize any "old set of wheels" whose value continues to be recognized. This suggests the existence of many attempts to "pack" the variety of subtle distinctions of significance into comprehensible form -- perhaps to be recognized as traditional vehicles for experiential navigating of hyperspace.

Especially intriguing is the manner in which such an "old set of wheels" may be recognized -- to some degree -- within a nested pattern of circles grounded in hyperbolic geometry. The following images are tentative experiments in that exploration.

<b>Circle pattern placed over a threefold spiral</b> Celtic <a href="#">triskele</a> from stone carving in a prehistoric monument <a href="#">Brú na Bóinne</a> , Ireland -- a <a href="#">World Heritage Site</a> , built around 3200 BC	<b>Interlinking of elements of circle pattern</b> to form the classic configuration of the <a href="#">Kabbalah</a> , originating in Judaism, and adopted by other religions.
	
<p>The spiral pattern was enlarged without deformation to fit within the major horizontal circles. This positions the origin of the upper spiral within the smallest circle. Variants of the pattern exist, some having been redrawn with modern techniques. Used extensively in Ireland, the image features as the logo of the futures research organization <a href="#">Mankind 2000</a>.</p>	<p>The classic Kabbalah configuration has been slightly deformed, although retaining topological invariances. The deformation is primarily required in fitting the upper horizontal circles -- then no longer vertically aligned with those of the two lower horizontals. Other approaches to "fitting" involved greater deformation.</p>

The attraction of some representations of the Christian cross, most notably the [High Cross](#) of Celtic Christianity, may be partly associated with the focus it gives to some dimensions of the pattern of circles.

It is noteworthy, in an explication of the nature of hyperspace, that an image of the Kabbalah is reproduced by [Clifford A. Pickover](#) (*Surfing Through Hyperspace: understanding higher universes in six easy lessons*, 2001). He relates the Kabbalah to current insights into [superstring theory](#), pointing out that the significance associated with the 10 linked circles of the image are understood to be hypostatized attributes "allowing the infinite to meet the finite". "Hypostatization" is the process of making into substance, namely making material an abstraction (with due regard to the fallacy of [misplaced concreteness](#)). For Pickover:

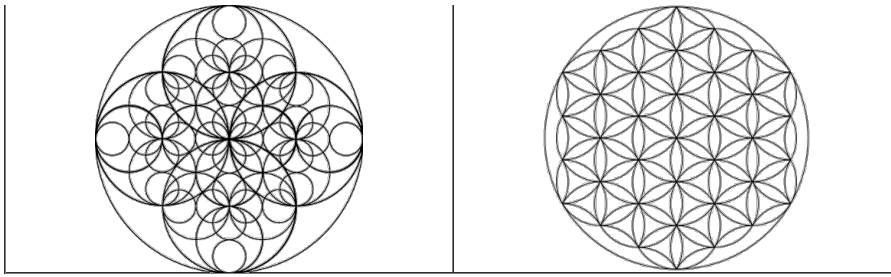
Similarly physical reality may be the hypostatization of these mathematical constructs called "strings"... the basic building blocks of nature... strings exist in a strange 10D universe... Using hyperspace theory, "matter" is viewed as vibrations that ripple through space and time... theoretical physicists have been using strings to explain all the forces of nature -- from atomic to gravitational... String theorists claim that six of the ten dimensions are "compactified" -- tightly curled up (in structures known as [Calabi-Yau spaces](#)) so that the extra dimensions are essentially invisible. (p. 15)

Pickover then relates superstring theory to the subsequent development of [membrane theory](#):

In this new theory, life, the universe, and everything may arise from the interplay of membranes, strings and bubbles in higher dimensions of spacetime. The membranes may take the form of bubbles, be stretched in two dimensions like a sheet of rubber, or wrapped so tightly that they resemble a string. (p. 18).

The pattern of circles explored here also lends itself to mappings of the traditional relationship between the [chakras](#) in the tantric and yogic traditions of Hinduism and Buddhism. It could also be explored in relation to the geometrical figure composed of multiple evenly-spaced, overlapping circles, now called the [Flower of Life](#). The circles in this case are arranged to form a flower-like pattern with a sixfold symmetry (as shown below), with the centre of each on the circumference of six surrounding circles of the same diameter. Many spiritual beliefs have been associated with the pattern, considered by some to be a symbol of sacred geometry depicting the fundamental forms of space and time.

<b>Contrasting tiling patyterns</b>	
<b>Circle pattern combining Tao and Lauburu</b> (as described above)	<b>Flower of Life</b> (reproduced from <i>Wikipedia</i> )



Comparison of the circular images above makes apparent that both can be considered as tiling patterns or [tessellations](#) -- a theme of extensive mathematical investigation. The comparison highlights their respective embodiment of different principles of symmetry within a circle. The question is then the nature of the organization in a hyperspace of higher dimensionality which would hold and reconcile both such patterns -- and others. The argument has been developed with respect to the discovery of mathematics of "objects" of very high orders of dimensionality -- upheld as offering a key to the universe and its comprehension (*Potential Psychosocial Significance of Monstrous Moonshine: an exceptional form of symmetry as a Rosetta stone for cognitive frameworks*, 2007).

One strategically relevant application of such possibilities of "reconciliation" through higher dimensionality can be explored with respect to the 5-fold and 6-fold stars which are so fundamental to cultures currently in violent opposition. Each could be considered an "old wheel" valued by that culture -- effectively a monocycle. As tilings, these cannot be reconciled in 2D. They can however be reconciled in 3D through a particular spherical polyhedron, as argued separately (*Middle East Peace Potential through Dynamics in Spherical Geometry: engendering connectivity from incommensurable 5-fold and 6-fold conceptual frameworks*, 2012).

Of particular relevance is the poorly understood degree to which any such patterns are as much inventions of the collective human mind as objective representations of an external reality. There is even the possibility that such patterns could be compared to a variety of interference patterns between such creations -- as with the manner whereby the pattern of circles (as discussed here) emerged from the geometrical relations between the traditional symbols of the Tao and the Lauburu. In relation to any such instituted pattern, there is a degree of mnemonic humour to traditional references such as "animals" going into [Noah's Ark](#) "two by two" to avoid the flood, where the Ark is then to be understood as a cognitive pattern. Associated number references include the "144,000" entering the Kingdom of Heaven, or the "10,000 things" of the *Tao Te Ching* -- as contrasted with the Tao.

Such associations suggest the value of assuming that there is a possibility of recognizing the variety of enduring, culturally-valued, integrative symbols as intuitive understandings and depictions of a pattern of higher dimensionality -- one which can only be partially understood and communicated (as with many insights of mathematics). Hence the merit of the challenge of hyperbolic geometry, comprehension of the [hypersphere](#), and the cognitive dynamics potentially associated with it. Relationships between partial understandings can be fruitfully explored through animation, as separately described (*Dynamic Exploration of Value Configurations: interrelating traditional cultural symbols through animation*, 2008).

## Conclusion

**Memorability and mnemonics:** The exercise can be framed as one of packaging of complexity to facilitate its memorability. In the case of the periodic table, few can distinguish the properties of many of the elements -- even if their names can be remembered based on some rote learning process, as with the multiplication table. The nested circle pattern offers a means of providing a mnemonic aid to distinguishing and interrelating a wide range of cognitive transformations embodied within it. The approach has the further advantage of being reminiscent of traditional symbols recognized as having an attractive integrative function. This offers a transition from explication to the implication characteristic of awareness of cognitive transformations -- with a degree of isomorphism consequent on form following function.

**Self-referential models:** Understanding the various patterns discussed above as "models" relates them to a cognitive equivalent of initiatives to design and construct a succession of vehicle models, especially including airplanes (as with the helicopter). The issues in the latter case are whether the vehicle will "fly" (in another dimension, how to acquire the skills to pilot it, its ability to carry passengers, and the confidence of the passengers in claims for its security and viability. This argument may be explored in the light of that for identification with a Mobius strip offered by [Douglas Hofstadter](#) (*I Am a Strange Loop*, 2007) -- and the challenge it might imply, as variously argued separately (*Sustaining a Community of Strange Loops: comprehension and engagement through aesthetic ring transformation*, 2010; *Consciously Self-reflexive Global Initiatives: Renaissance zones, complex adaptive systems, and third order organizations*, 2007).

**Recognizing the wheels of higher dimensionality:** Following the above-mentioned argument of Arthur M. Young (*The Geometry of Meaning*, 1976) with regard to the design of a psychopter (as a "winged self") by analogy with design of a helicopter, the imagination is challenged by how "new wheels" emerge -- in that case through the form of rotors and their blades (cf. *Engendering a Psychopter through Biomimicry and Technomimicry: insights from the process of helicopter development*, 2011). Given the imagination required by their discoverers to give form to new wheels -- notably inspired by helio-rotating seeds and birds, in the case of the helicopter -- what could trigger discovery of "wheels", and their requisite dynamics, appropriate to navigation within the spaces of new paradigms?

**Complementary imaginings:** There is the curious possibility that subsequent development of helicopters with multiple configurations of rotors could be understood as prefiguring imaginative insight into the need for new cognitive vehicles with multiple "rotors" -- such as the nested circle pattern above, and the echoes it offers to traditional cultural patterns understood here as intuiting their function. More curious is the possibility that the cognitive "rotors" now emerging are themselves intimately related to the process of imagination itself rather than simply being a product thereof. The distinct nested circles in the above pattern are then indicative of different forms of

"imagination" -- necessarily complementary, each correcting and counter-balancing the action of the other. This would usefully emphasize that undifferentiated imagination is inadequate to the challenge of the design and operation of a "counter-intuitive" vehicle to navigate sustainably within the spaces opened by the paradoxes of the emerging paradigm.

Thus complementarity is consistent with the argument made by Magoroh Maruyama for "polyocular vision" -- the rotors as the various "eyes" of the imagination -- or for a polysensorial engagement with reality.

**Order as a product of the imagination:** Such possibilities necessarily depend upon the new ways of relating subjective and objective explored by authors mentioned in the previous paper (*In Quest of a Dynamic Pattern of Transformations: sensing the strange attractor of an emerging Rosetta Stone*, 2012). The most recent articulation is offered through the understanding of the cognitive implications of quantum mechanics fundamental to the new understanding of "matter" (Robert Jahn and Brenda Dunne, *Quirks of the Quantum Mind: both a reflection and a product of the mind*, 2012). In the sense that reality conceived as external offers a mirror through which cognitive transformations can be "re-cognized", the authors suggest that quantum mechanics offers the newest mirror engendered by humanity. They emphasize that quantum mechanics describes human experience of nature. Like any other model of human representation, it is both a reflection and a product of the mind. It is not a "description" of nature, rather it is fundamentally intuitive, "describing" a reality within which the perceiver is an active participant. This understanding merits consideration in the light of any consideration of a "periodic table" to which quantum mechanics is upheld as fundamental. This is reinforced by the sense in which humans are (if only deeply unconsciously) skillful players with the elements of the periodic table fundamental to their bio-physiological processes.

**Mirrors and speculation:** The potentially dangerous limitations of the table metaphor were highlighted above. It is curious that the form serves in many respects as a mirror of reality "elsewhere" and "elsewhen", especially in the form of a spreadsheet. It can even be considered a divining mirror through which speculation regarding the future is enabled -- as with its intense use in financial trading rooms. More curious is the manner in which computer-enabled visualization technology continues to reinforce the tabular form, as is evident in every kind of computer screen (with the symptomatic exception of radar screens and oscilloscopes). This is best contrasted with the greater extent to which round or oval mirrors are favoured in "self-reflection" -- examining oneself, especially one's face in confirming and refining a sense of identity. The argument above would then suggest a degree of embodiment of the vertical dimension of the circular pattern. The mythical theme of passing into the mirror is consistent with such "reflection" and its implications for strategic planning (*Stepping into, or through, the Mirror: embodying alternative scenario patterns*, 2008)

**Paradoxical engagement with a mirroring reality:** The various myths associated with the use of a mirror -- notably as an aid to speculation -- are related to some degree to those regarding the role of an "underworld" or an "overworld". This dimension might be usefully held by the vertical axis of the circular pattern -- the imaginary axis in contrast with the reality of the horizontal. As noted above, the paradoxical nature of that relationship, exemplified by the Mobius strip, can be considered a theme of Douglas Hofstadter (*I Am a Strange Loop*, 2007) as well as of Steven Rosen (*The Self-evolving Cosmos: a phenomenological approach to nature's unity-in-diversity*, 2008). As a rotor, the Mobius strip calls into question the very nature of a "model" of an external reality and its uptake. Configuration of such strips to form a Klein bottle, clarifies the limitations of any future model as a reality "container", is explored by Rosen -- although neither inhibits imaginative appreciation of models, as charmingly suggested by the connotation in the world of fashion. More provocatively it could be implicated in species maturity (*Self-reflective Embodiment of Transdisciplinary Integration (SETI): the universal criterion of species maturity?* 2008).

**Hyperdimensional law and order?** In contrast with tabular assumptions regarding "law and order", in the light of the exploration of cosmologists, it is at least appropriate to ask whether the experience of "reality" calls for more complex and subtle forms of "order" to which the "law and order" of conventional governance might aspire to conform. Would quality of life and the organization of programmes be experienced as more satisfactory if organized in terms of **hypercycles** rather than timetables (cf. (*System Dynamics, Hypercycles and Psychosocial Self-organization: exploration of Chinese correlative understanding*, 2010; *Adaptive Hypercycle of Sustainable Psychosocial Self-organization: designing a mapping of a Chinese metaphorical pattern language*, 2010)

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## References

Jeffery C. Allen and Dennis M. Healy, Jr. Hyperbolic Geometry, Nehari's Theorem, Electric Circuits, and Analog Signal Processing. *Modern Signal Processing*, 46, 2003 [text]

Luiz Bevilacqua, Augusto César N. R. Galeão, Flávio Pietrobon-Costa and Sonia L. Monteiro. Knowledge Diffusion Paths in a Research Chain. *Mecânica Computacional*, 29, 2010, pp. 2061-2069 [text]

Terrence W. Deacon:

- Incomplete Nature: how mind emerged from matter. W. W. Norton, 2012
- The Symbolic Species: the co-evolution of language and the brain. W. W. Norton, 1997

Marlene Johansson Falck. Electrifying Performances and Brains that Fuse: metaphor and the cognitive function of electricity. In: *Technology, Language and Thought: Extensions of Meaning in the English Lexicon*. Luleå University of Technology, 2005 [text]

Paul Feyerabend:

- Against Method: outline of an anarchistic theory of knowledge. Verso, 1975
- Conquest of Abundance: a tale of abstraction versus the richness of being. University of Chicago Press, 1999

Michael Foley. The Age of Absurdity: why modern life makes it hard to be happy. Simon and Schuster, 2011

D. Gentner and D. R. Gentner. Flowing Waters or Teeming Crowds: mental models of electricity. In: D. Gentner and A. L. Stevens (Eds.), *Mental Models*. Lawrence Erlbaum Associates, 1983, pp. 99-129 [text].

D. Gentner and P. Wolff. Metaphor and Knowledge Change. In: E. Districh and A. Marbnau (Eds.). *Cognitive Dynamics: conceptual change in humans and machines*. Lawrence Erlbaum Associates, 2000, pp. 295-342 [text]

Madhu S. Gupta. Escher's Art, Smith Chart, and Hyperbolic Geometry. *IEEE Microwave Magazine*, October 2006, pp. 66-76 [text]

Edward F. Haskell. Generalization of the structure of Mendeleev's periodic table. In: E Haskell (Ed.), *Full Circle; the moral force of unified science*. New York, Gordon and Breach, 1972, pp. 21-87.

Douglas Hofstadter. *I Am a Strange Loop*. Basic Books, 2007

Robert G. Jahn and Brenda J. Dunne. *Quirks of the Quantum Mind: both a reflection and a product of the mind*. ICRL Press, 2012

Alexsander Marincic. The Smith Chart. *Microwave Review*, 4, 2, December 1997 [text]

Ronald K. Mitchell:

- Transaction Cognition Theory and High Performance Economic Results. The International Centre for Venture Expertise, University of Victoria, 2001 [text]
- Transaction Cognition Theory of Global Entrepreneurship. In: Jerome A. Katz and Dean A. Shepherd (Eds.) *Cognitive Approaches to Entrepreneurship Research*, Emerald Group Publishing, 2003, pp. 183-231.

A. A. Muller, P. Soto, D. Dascalu, D. Neculoiu and V. E. Boria. A 3-D Smith Chart Based on the Riemann Sphere for Active and Passive Microwave Circuits. *U.P.B. Sci. Bull., Series C*, 74, 2012, 2 [text]

Clifford A. Pickover. *Surfing Through Hyperspace: understanding higher universes in six easy lessons*. Oxford University Press, 2001

Stephen Prothero. *God Is Not One: the eight rival religions that run the world -- and why their differences matter*. HarperOne, 2011

Kate Raworth. *A Safe and Just Space for Humanity: can we live within the doughnut?*, Oxfam, February 2012 [text]

Steven M. Rosen:

- Dimensions of Apeiron: a topological phenomenology of space, time, and individuation. Value Inquiry Book Series, 2004 [text]
- The Self-evolving Cosmos: a phenomenological approach to nature's unity-in-diversity. World Scientific, 2008

Denis H. Rouvray and R. Bruce King (Eds.), *The Periodic Table: Into the 21st Century*, 2005; *The Mathematics of the Periodic Table*, 2005)

J. W. van Spronsen. *The Periodic System of Chemical Elements; a history of the first hundred years*. Amsterdam, Elsevier, 1969

Nassim Nicholas Taleb. *The Black Swan: the impact of the highly improbable*. Random House, 2007

O. E. Williamson. *The Mechanisms of Governance*. Oxford University Press, 1996

Yongle Wu, Yaxing Zhang, Yuanan Liu and Haiyu Huang. Theory of the Spherical Generalized Smith Chart. *Microwave and Optical Technology Letters*, 51, 2009, 1, pp. 95-97 [abstract]

Maurice Yolles, B.R. Frieden and G. Kemp. Toward a formal theory of socioculture: a yin-yang information-based theory of social change. *Kybernetes*, 37, 2008, 7, pp. 850 - 909 [abstract]

Arthur M. Young. *Geometry of Meaning*. Delacorte Press, 1976

C. Zelle. A spherical representation of the Smith chart. *Microwave Magazine*, 8, 2007, 3, pp. 60-66 [abstract]



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