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Enhancing Strategic Discourse Systematically using Climate Metaphors

Widespread comprehension of system dynamics in weather patterns as a resource

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References

Prepared in anticipation of the [United Nations Climate Change Conference](#) (Paris, 2015)

Introduction

There is considerable familiarity with the dynamics of climate and weather through the seasons and in different locations. These provide a rich source of metaphor, widely shared, and frequently exploited as a means of communicating subtle insights into social phenomena, strategic options and any resistance to them.

It is however now difficult to claim any coherence to the strategic discourse on which humanity and global governance is held to be dependent. This is evident in the deprecation of one political faction by another, the exacerbation of conflictual perceptions by the media, the daily emergence of intractable crises, and the contradictory assertions of those claiming expertise in one arena or another. The dynamics have been caricatured as blame-gaming, as separately discussed (*Blame game? It's them not us!* 2015). These dynamics are reflected to a high degree in movements of public opinion, as increasingly enabled by social media.

Many dialogue and discourse techniques are enthusiastically proposed (as "models") and applied -- typically subject to some form of intellectual copyright or franchising arrangement. In practice they seem to have been largely irrelevant to the vicious cycles of current crises, especially those on a larger scale (Middle East, climate change, refugees, endangered species, nuclear weapons, trafficking in persons, corruption, drugs, etc). Arguably they have also been inadequate to the many virtual wars that have been declared (*Review of the Range of Virtual Wars*, 2005). Typical of discourse at every level of society -- from the individual to the global -- is both the degree of definitive assertion and the essential circularity of argument. Vicious cycles of violence and crisis would seem to be naturally reinforced by vicious cycles of fruitless argument.

Given the psychological engagement and familiarity with weather and climate phenomena, and their use as metaphors to describe social dynamics, the question here is whether the systemic integrity of the phenomena is suggestive of insights which could be adapted to strategic discourse. The inquiry is a development of earlier explorations (*Climate of Change Misrepresented as Climate Change: insights from metaphorical confusion*, 2008). Given the challenge of authoritative directives, and their seeming ineffectiveness globally, the case for using metaphor more systematically might also be made more fruitfully as an exercise in playfulness -- even game-playing (*Playfully Changing the Prevailing Climate of Opinion: climate change as focal metaphor of effective global governance*, 2005).

The approach takes account of the possibility that thinking regarding climate change holds a vital key to rethinking remedial response. Weather metaphors may prove a vital means of clarifying the "whether metaphors" of relevant strategic decision-making. The concern here is systemic, namely the means of enhancing recognition of the known interrelatedness of weather phenomena, as previously

discussed (*Correlating a Requisite Diversity of Metaphorical Patterns*, 2015). That discussion explored both *Psychosocial unease and cognitive weather* and *Crises framed by weather metaphors*.

In seeking patterns of coherence, however, the latter also explored the significance of a classical Chinese system which interrelates patterns of change specifically with regard to their relevance to decision-making (*Cognitive implication in a Chinese system articulated through weather-related metaphors*, 2015). That system is extensively based on metaphor expressed in poetic form. These help to reframe the polarizing tendency -- in debate emphasizing assertion or denial in its various manifestations -- where a richer framework may be appropriate, favouring recognition of both or neither.

The following is therefore an exploration of ways of rethinking current approaches to [argument mapping](#), [debate graphing](#), [decision mapping](#) and [discourse analysis](#). It notably takes account of emerging insights into use of [force-directed graph drawing](#), as previously described (*Eliciting Memorable Spheres and Polyhedra from Hyperspace: integrative connectivity of problems, strategies, themes, groups or people*, 2015). Any such focus on "spheres" echoes the aspirations to elusive, integrative globality -- whose "nature" might indeed be best understood through metaphors from nature. That focus on "polyhedra" transforms into 3 dimensions the current dysfunctional binary preoccupation with taking "sides" in any dispute (*Us and Them: relating to challenging others*, 2009). Beyond such "sidedness", the question is whether there could be memorable visual articulations of systemic complexity as a powerful catalyst for richer forms of discourse (*In Quest of Mnemonic Catalysts -- for comprehension of complex psychosocial dynamics*, 2007).

Given that strategy is fundamentally concerned with the time dimension, the argument goes further by exploring how the variety with which engagement is required could be fruitfully mapped onto four-dimensional forms so extensively studied in mathematics and the physics of spacetime How does a global civilization navigate the [adaptive cycle of resilience](#) through time?

Is the forthcoming [United Nations Climate Change Conference](#) (Paris, 2015) to be understood solely in binary terms of rise/fall, hot/cold, agree/disagree, transparent/unsaid, or positive/negative? Will it only engender an unmemorable 700-page, 40 chapter "non-binding, voluntarily implemented action plan" -- as with the long-forgotten *Agenda 21* (1992)?

The case for polyhedral game-playing in discourse is provocatively highlighted here by the intense popular global preoccupation with a spherical polyhedron, namely the [truncated icosahedron](#). This is the stitching pattern of the memorable soccer football, and about which there is universal consensus, despite being marred by long-denied corruption. The recognized importance of "interplay" then merits adaptation to patterns of cognitive discourse -- and the possibility of stitching them together otherwise, as separately argued (*Global Brane Comprehension Enabling a Higher Dimensional Big Tent?* 2011). It is in this spirit that the widely appreciated metaphor of [Spaceship Earth](#) is usefully challenged by the possibility of the design implications of Timeship Earth -- if civilization is indeed to travel viably into the future.

Systematic global insight of memorable quality?

Reframing disagreement: In a documentary in 2015 celebrating the highly acclaimed mathematician [John von Neumann](#), another highly acclaimed mathematician, [Freeman Dyson](#), declared that he had had radically different views from the former with respect to the value and use of nuclear weapons. Von Neumann's research had notably been significant to development of the nuclear physics required for the [hydrogen bomb](#). Through his innovation in game theory, he is credited with the strategic doctrine of [Mutually Assured Destruction](#) (MAD). Both mathematicians shared space at the prestigious [Institute for Advanced Study](#) at Princeton.

The future may well consider it extraordinary that the two mathematicians were unable to deploy their mathematical skills to offer a more fruitful understanding of their radical difference in perspective. It could then be argued that the MAD strategy of "mutually assured destruction" is effectively the prevailing metaphor fundamental to the many binary us-and-them arguments of current global strategic articulation.

As expressed by [Margaret Thatcher](#), and echoed by politicians since then: [There Is No Alternative](#) (TINA). Unfortunately those advocating alternatives could be recognized as perceiving there to be "no alternative" to the alternatives they themselves advocate. Curiously it could even be argued that MAD is effectively fundamental to the "viability" of the participation of various "sides" in the democratic process -- just as it is claimed to have been with respect to the prevention of World War III.

More powerful metaphors: It is in this context of impoverished strategic metaphor, that there is a case for looking everywhere for any indication of a richer pattern of insight (*In Quest of Uncommon Ground: beyond impoverished metaphor and the impotence of words of power*, 1997). Rather than the focus on particular "models", such a "meta-quest" could be framed in terms of criteria for a "meta-model" and for a "meta-systemic" perspective, as can be variously argued (*Criteria for an Adequate Meta-model*, 1971; *Requisite Meta-reflection on Engagement in Systemic Change? Fiat, fatwa and world-making in a period of existential radicalisation*, 2015).

A valuable challenge to the adequacy of any new initiative in this respect is the classical Chinese *Book of Changes* (*I Ching* or *Yi Jing*). From a Western mathematical perspective it is noteworthy as having been an inspiration to the development by [Gottfried Leibniz](#) of his early understanding of the binary coding system, now so fundamental to the development of the computer technology of the current global information-based civilization. How might subtler mathematical insights than those employed in the [Von Neumann computer model](#) emerge, given the challenge they have represented to mathematicians such as [Alan Turing](#)?

Beyond logic? Turing had foreseen the possibility of a form of universal computing machine -- as discussed separately (*Imagining Order as Hypercomputing: operating an information engine through meta-analogy*, 2014). As noted there, a recent report draws attention to new investigations into the possibility of such a machine -- one that can solve the unsolvable ([Michael Brooks](#), *Turing's Oracle: the computer that goes beyond logic*, *New Scientist*, 16 July 2014). As the editorial notes:

We already have machines that answer our questions in ways we can't fully appreciate: from quantum computers, whose

physics remain opaque, to data-crunching black boxes that translate languages and recognise faces despite knowing nothing of grammar or physiology... Turing showed that any computer predicated on human logic alone will struggle with the same questions we do... But **Turing also conceived of an "oracle" that might transcend these limitations**... Conventional computers give us the answers to questions that we can articulate... Turing's oracle could address issues we can't even articulate... *[emphasis added]*

As noted by Brooks:

In his short life Turing never tried to turn the oracle into reality. Perhaps with good reason: most computer scientists believe **anything approximating an oracle machine would soon fall foul of fundamental restrictions on how information and energy flow in the universe**. You could never actually make one.... two researchers are now seeking to prove the sceptics wrong. Building on theoretical and experimental advances of the past two decades, [Emmett Redd](#) and [Steven Younger](#)... think a "super-Turing" computer is within our grasp. With it could come insights not just into the limits of computation in the cosmos, but into the most intriguingly powerful computer we know of within it: the human brain. *[emphasis added]*

In cybernetic terms, the requirements include the capacity to encompass the radical difference in perspective of Dyson and Von Neumann. Ironically this difference could be described metaphorically in terms of the radical disagreement between observers on opposite sides of the globe as to whether the Sun was overhead or invisible at a given time. Such differences are reconciled by recognition of the mechanics of rotation of a sphere in relation to the Sun. Seemingly mathematicians have been unable to recognize that differences of perspective may be a feature of the topology of the form on which observers in disagreement are located. What is the topology that offers the [requisite variety](#) to encompass such differences?

Quest for a perfect language: One approach has been the quest for a perfect language, originally articulated by Gottfried Leibniz as *Characteristica Universalis* in 1679 and by [Gottlob Frege](#) in 1879, as variously presented and argued (Marco Carapezza and Marcello D'Agostino, *Logic and the Myth of the Perfect Language, Logic and Philosophy of Science*, 2010; Peter Hylton, *Ideas of a Logically Perfect Language in Analytic Philosophy; Is a Logically Perfect Language Possible? Physics Forums*, 2004; [Umberto Eco](#), *The Search for the Perfect Language*, 1993). In his argument, Eco recalls the mythical [Language of the Birds](#), now so ironically echoed by Twitter, as separately highlighted (*Re-Emergence of the Language of the Birds through Twitter?* 2010). The possibility has not yet proven to be of any relevance to the governance of a civilization in crisis.

Especially striking (if not literally so) is the total inability to deal creatively with disagreement in such a perfect logical framework. Disagreement is simply wrong and is to be designed out on the assumption that its potential threat is meaningless. In that mode, physics offers the delightful concept of "not even wrong". Any "language of the birds", through its exemplification of the theory of harmony, is far more capable of encompassing various degrees of disagreement as complementary tonal modalities, as extensively explored by [Ernest McClain](#) (*Myth of Invariance: the origins of the gods, mathematics and music from the Rg Veda to Plato*, 1976). In strange counterpoint to the strategic preoccupation with governance, there is now widespread popular preoccupation with music -- worth exploring as a feature of the democratic deficit.

Stuart Parkinson (*The Will-ists Versus the Should-ists: Learning to deal with the world as it is, not as we want it to be. The Globalist*, 9 August 2015)

Monetarists and Keynesians, Democrats and Republicans, Roundheads and Cavaliers, Jets and Sharks -- they're all at the opposite ends of a particular spectrum. And they rarely agree on much, other than when and where the next fight is going to take place. Look carefully, however, and there is another pair of opposites when it comes to seeing successfully into the future. I call them the "should-ists" and the "will-ists." "Should-ists" are people who tell you what "should" happen in the future...

Don't get me wrong. The world would be a lot worse place without its fair share of "should-ists". Just don't rely on them for their predictions of what will actually happen. It's not their fault. It's just not their calling.

Memorable viability: In parallel with such abstract considerations, many "models" for socio-economic governance have been presented over the past decades by eminent individuals and groups. Most would appear to be characteristically unmemorable. Given the rate of emergence of crises, their value might be caricatured by a simple adaptation of the argument of [James Hillman](#) and [Michael Ventura](#) (*We've Had a Hundred Years of Psychotherapy - And the World's Getting Worse*, 1993).

Given the lack of progress, there is therefore a case for exploring the decision-enabling implications of the *Book of Changes* -- recognized over centuries as relevant to the processes of governance (Tze-ki Hon, *The Yijing and Chinese Politics*, 2012). It is distinguished by a form which is designed to be memorable -- notably through extensive use of accessible metaphor, typically avoided in conventional presentation of models.

Rather than a binary preoccupation with whether any proposal is right or wrong, is there not a case for exploring more creatively in what way it fits into a larger pattern -- as with the environment which so notably features "good weather" and "bad weather", variously appreciated? Given the extent to which inequality is upheld as a major sociopolitical issue, it is useful to explore climate as indicative of a pattern for the coherent processing of inequalities.

Towards memorable framing of global climate of governance processes?

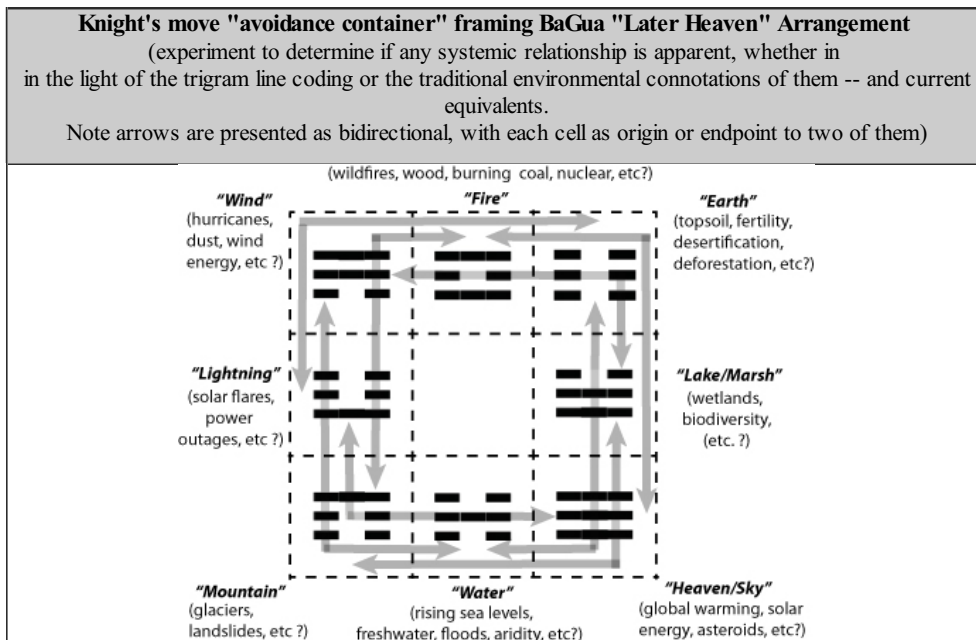
As noted above, in a discussion of *Correlating a Requisite Diversity of Metaphorical Patterns* (2015), sections included:

- Relevance of weather metaphors to existential unease
- Psychosocial unease and cognitive weather
- Crises framed by weather metaphors

With respect to the subsequent discussion of *Cognitive implication in a Chinese system articulated through weather-related metaphors* (2015), specific attention was given to the question of memorability. The argument was that any "weather categories" should be memorable as metaphors. Preliminary attention can be given to the terminology by which the 8 primary conditions distinguished by the *Book of Changes* give rise to unique single letter abbreviations (in English) -- following the coding approach favoured with respect to climate regimes (as discussed in that argument). Possibilities noted include:

- Heaven (H), Creative (C), Unconstrained (U) or **Sky (S)**. The last seems to be the best in that it combines both an association with weather ("clear skies") and creativity ("blue sky"), whilst avoiding the spiritual associations alienating to some
- Receptive (R), Ground (G) or **Earth (E)**. The last seems most appropriate and is most common.
- **Wind (W)** or Breeze (B). The first seems most appropriate and is most common, despite the constraint on the following
- Water (W), Gorge (G), River (R), or **Abysmal (A)**. Of these Gorge and Abysmal are common associations in Chinese commentary. River may be too specific. There is therefore a preference for Abysmal (but in the form of Abyss) as the invisible underwater depths -- avoiding confusion with use of Wind (W)
- **Lake (L)** has Marsh (M) as a common alternative. The first seems more appropriate
- **Thunder (T), Mountain (M), and Fire (F)**, as commonly used. require no modification for distinctive mnemonic purposes

The point to be stressed is that **the climate metaphors are not understood there in isolation but rather as offering a sense of the coherent system of which they are indicative**. Hence the importance of memorability. The question to be asked is how memorable is any conventional classification of climates, irrespective of how recognizable are the categories of weather. Given the current arguments for biomimicry, a separate case was made for "naturomimicry" (*Naturomimicry: sourcing nature for strategic metaphors*, 2012). This explored the relationship of the BaGua dynamics to Knight's move thinking as follows.



The question of memorability can also be asked of the clusters of the [periodic table of chemical elements](#), recognized as a challenge to memory (Kyle Buchanan, *Memorize the Periodic Table: the fast and easy way to memorize chemical elements*, 2013). A better recognized challenge is that of the [multiplication table](#), given the importance it now has in a quantitative society (*How to Easily Memorize the Multiplication Table; Teach the Times Tables with Pictures and Stories*). Learning the complex set of interrelated [metabolic pathways](#) is playfully enabled by a set of songs (Harold Baum, *The Biochemists' Songbook*, 1995). What might be the corresponding challenges for a qualitative array of relevance to "cognitive weather"? Are there (cognitive) weather pattern songs? If not, why not? Will the outcome of the UN Climate Change Conference be expressible in song? If not, why not?

Memorably configured would the set of hexagrams enable qualitative possibilities analogous to the quantitative possibilities enabled by the abacus?

The above distinction of what amounts to a set of 8 climate "primitives" is encoded as a set of 8 trigrams, known as *BaGua*. It is the combination of these 8 with each other that forms the 64 basic conditions of change (namely 8x8), as distinguished by the *Book of Changes*. Each of these conditions can transform into others in the pattern, making a total of 64x6 processes, namely 384.

Again it should be stressed that the distinctions made in this way in nature, effectively with respect to climate, are used metaphorically to distinguish decision-making options considered as offering insight with respect to governance. In the case of governance of any collective, the pattern can therefore be considered indicative of the possible conditions of a decision-making climate.

The relative lack of clarity with regard to climate classification, as noted above, and the extensive use of weather metaphors to frame existential "ease" and "dis-ease", suggest a reevaluation of the classic Chinese pattern of *BaGua* as a device for holding and interrelating weather as existentially experienced.

As the "Book of Changes", the *I Ching* (an articulation of the *BaGua* pattern) is known to have been influential in Chinese politics over several thousand years (Tze-ki Hon, *The Yijing and Chinese Politics*, 2012). It offers an explicit interplay between weather and decision-making through the metaphors on which it based. Ironically, whether it is to be recognized as the earliest *Global Weather Model*, it could also be recognized as the earliest *Global Whether Model* -- to be compared with modern exploratory simulations of relevance to forecasting, decision-making and governance.

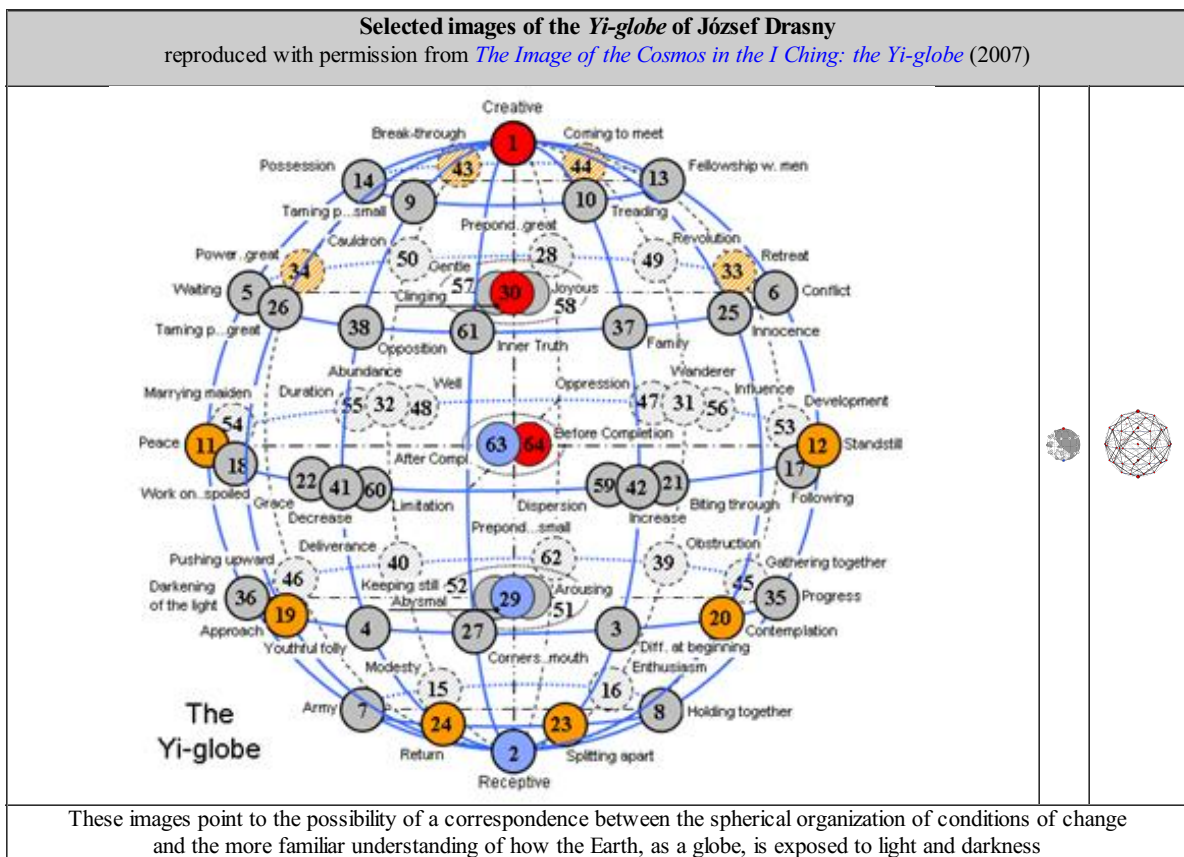
Curiously, whether literally or metaphorically, the weather is a major determining factor regarding whether to undertake one initiative rather than another. Ironically the technologies of weather modification tend to be as controversial as those of whether modification.

Drawing inspiration from a Chinese framework could be seen as consistent with the argument of [Susantha Goonatilake](#) (*Toward a Global Science: mining civilizational knowledge*, 1999). This draws attention to the creativity from which non-western cultures may benefit in drawing upon the connectivity enabled by metaphors engendered by their culture.

Visual representations of globality of requisite variety for global governance

The illustrations below are intended to elicit reflection on mapping surfaces of requisite complexity to encompass climate conditions. This follows the suggestion above that these might usefully correspond in terms of weather metaphors to the pattern of conditions in the *Book of Changes*, especially with respect to comprehension of the dynamics of changes from one condition to another -- which are the essential challenge of governance. The images give focus to the question as to **what new form might a pattern of global coherence need to take in order to hold strategic developments** of a similar complexity to the changes in weather and climate.

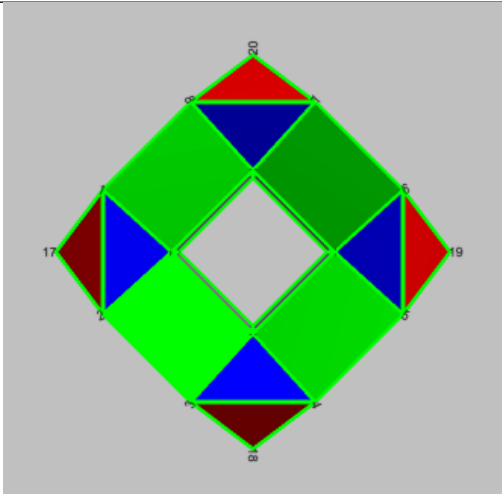
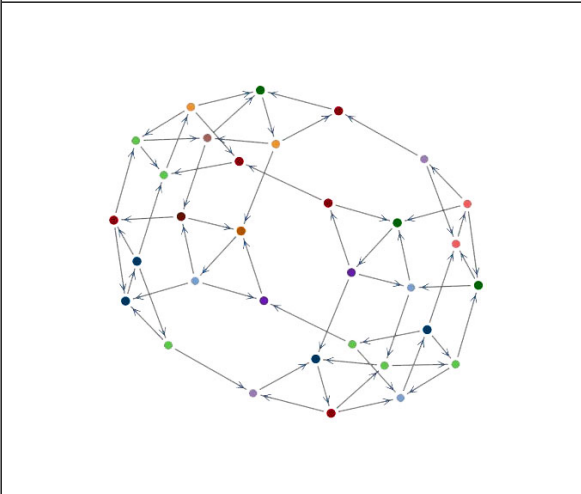
Beyond trends in opinion polls and ratings: What might correspond to the daily representation by meteorologists of air currents and temperature changes? Is there a need to comprehend patterns of complexity of a higher order? **Should the imagination be challenged with regard to the adequacy of the conventional focus on globality understood as a sphere?**



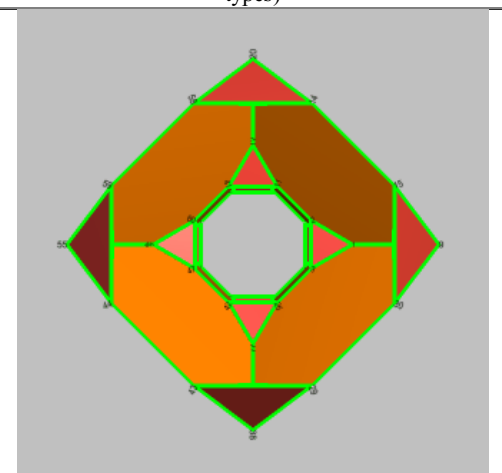
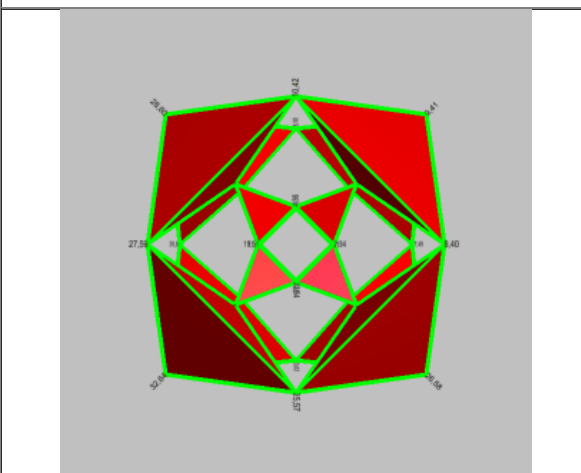
Following numbers as a key to comprehensible patterns: In the visualizations which follow -- of forms with a symmetry which renders them memorable to some degree -- the quest for patterns of interest in this respect is guided by the principle of "follow the numbers". This is usefully to be compared with the widespread analytical approach framed by the catchphrase "follow the money".

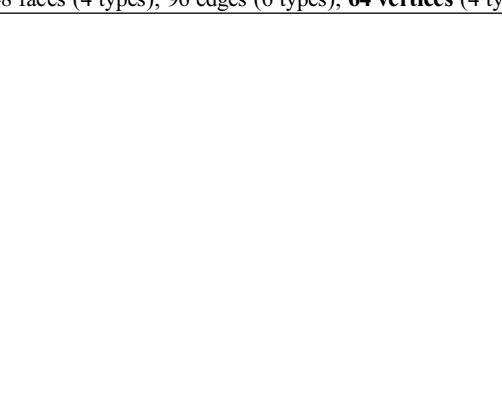
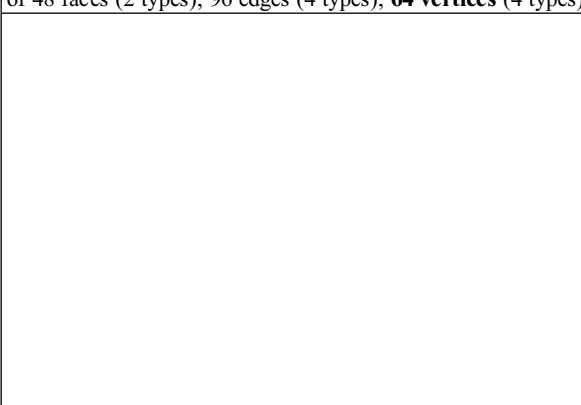
The challenge would appear to be to frame binary preoccupations by subtleties of different order, as may be variously recognized. Thus 2 can be placed in a context of 4, of 8, of 16, or of 64. The pattern may be enriched through 3, giving 12, 96, 192, or 384, for example. Similarly these can be enriched by 5, giving 20, 30, 60, and the like. Polyhedra offer a means for giving memorable form to such patterns and the distinctions and relations between them, as separately argued (*Geometry of Thinking for Sustainable Global Governance: cognitive implication of synergetics*, 2009) in the light of the magnum opus of Buckminster Fuller (*Synergetics: explorations in the geometry of thinking*, 1975-1979)..

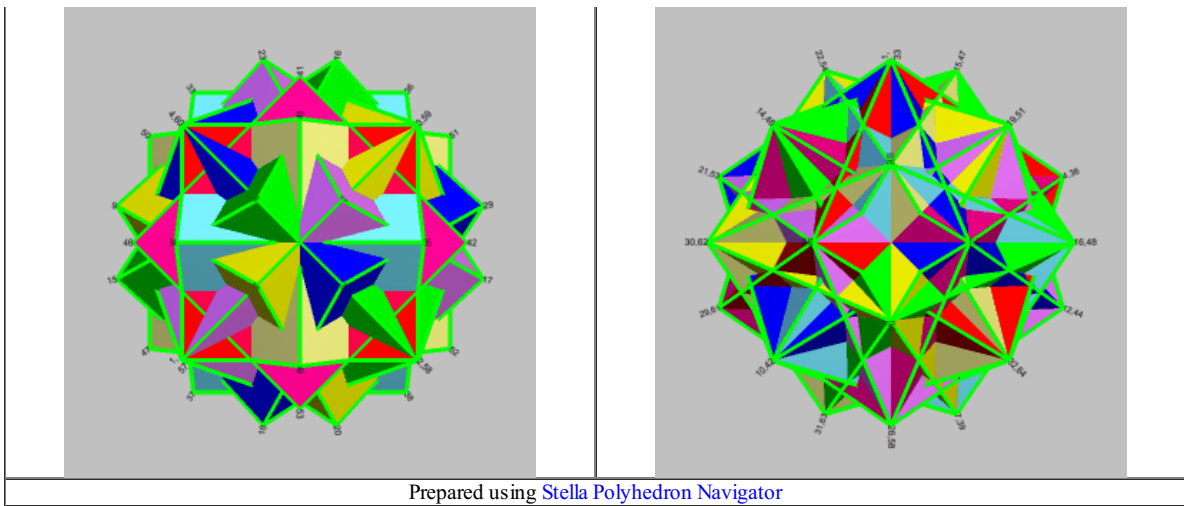
It is on this basis that the following images and animations were prepared using [Stella Polyhedron Navigator](#). The first is a [toroidal polyhedron](#), one of the [Stewart toroids](#). It is one of the few 3D polyhedra which has only 64 edges, if these are indeed to be considered of value to representation of the 64 conditions of the *Book of Changes*. Of some relevance is the implication that each of the following images can be readily inscribed within a sphere -- a circumsphere.

Drilled truncated cube	
of 32 faces (5 types), 64 edges (9 types), 32 vertices (4 types) [totalling $128=2^7$]	
Animation with faces non-transparent	Screen shot of interactive <i>force-directed version</i> (with node labelling)
	

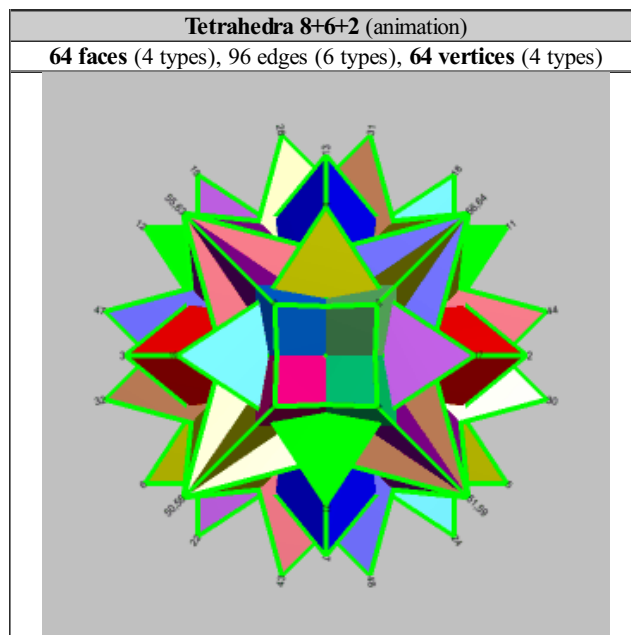
The variant on the right above resulted from exporting that on the left via a [.OFF format](#), as described previously (*Use of force-directed layout to elicit memorable polyhedra*, 2015). The following images are those of several of the relatively few forms which have 64 vertices, if the conditions of change could best be associated with them. Together with that above, there are striking commonalities. The fact that it is of toroidal form suggests that the more fundamental understanding of "holes" might merit careful consideration, as remarkably discussed by Roberto Casati and Achille C. Varzi (*Holes and Other Superficialities*, 1994) -- with respect to the borderlines of metaphysics, everyday geometry, and the theory of perception (as they summarize in the [entry on holes](#) in the *Stanford Encyclopedia of Philosophy*).

Selected polyhedra with 64 vertices based on a truncated tesseract	
3D projection of the 4D polychoron Truncated tesseract ("Tat") of 48 faces (7 types), 112 edges (15 types), 64 vertices (8 types)	3D projection of the 4D polychoron Rectified tesseract ("Rit") of 64 faces (4 types), 96 edges (4 types), 64 vertices (4 types)
	

Cubes 4+3+1 (animation) of 48 faces (4 types), 96 edges (6 types), 64 vertices (4 types)	Cubes 8 (animation) of 48 faces (2 types), 96 edges (4 types), 64 vertices (4 types)
	



The following image is distinguished by having both 64 edges and 64 faces.



Four-dimensional requisite for a time-bound global civilization?

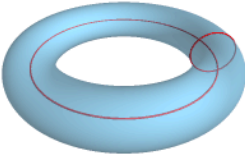
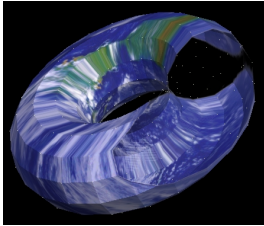
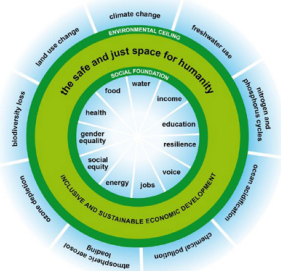
Shape of society? Considerable resources are devoted by astrophysicists to the challenge of determining the [shape of the universe](#). It is however curious that, for a global civilization in crisis, little attention is given to what might be understood as the "shape of global society" -- a shape which might enable more fruitful understanding of differences in perspective. What indeed is the form of the container in which we "live and move and have our being"? In the case of the global structure of the universe, debate currently focuses on

- whether the universe is infinite or finite in extent
- whether the geometry of the global universe is flat, positively curved, or negatively curved
- whether the topology is simply connected like a sphere or multiply connected, like a torus

Appropriate to this argument is the extent to which shapes favoured as containers of identity are 2D polygons (hexagon, pentagon, and various stars -- Star of David, Star of Islam, as noted above). It could be argued that some flags depict multiple stars, but without any sense of the 3D polyhedron any given set would form from the set of such figures. In that sense, as discussed below, what is the shape of the European Community with its focus on 12 stars, or the USA with its 50 stars? What indeed might be the shape of the elusive [international community](#) now upheld as being so vital to global governance?

As with the universe, if the global structure of society is to be understood in topological terms as "multiply connected" (like a torus), this would call into question the prevalent assumption of conceiving it to be "simply connected" (like a sphere). Multiple connectivity could be consistent with current explorations of [small world theory](#). With respect to use here of the drilled truncated cube as a polyhedral mapping surface, its specifically toroidal nature is noteworthy. How might the relation between sphere and torus then need to be understood, given the subtle comprehensibility of the following transformation? (*Topological Clues to a Memorable 12-fold Systemic Pattern*, 2011)

Recognizing cognitive and strategic relationships between sphere and doughnut		
Sphere-Torus transformation	Earth understood as a hollow torus	Oxfam Doughnut by Kate Raworth

(reproduced from <i>Wikipedia</i>)	(cutaway projection of globe onto torus)	<i>(A Safe and Just Space for Humanity: can we live within the doughnut?, 2012).</i>
		

As asked, argued and illustrated from a physics perspective by Anders Sandberg: *What would the Earth be like if it was the shape of a donut?* (*Andart*, February 2014). More relevant to this argument are the cognitive implications, most notably suggested by Oxfam, as depicted in the right-hand image above and discussed separately in relation to remedial strategies (*Exploring the Hidden Mysteries of Oxfam's Doughnut: recognizing the systemic negligence of an Earth Summit*, 2012; *Recognizing the Psychosocial Boundaries of Remedial Action: constraints on ensuring a safe operating space for humanity*, 2009). Especially intriguing are the implications of the central hole in contrast to the integrity associated with that of a sphere. Is there a "hole" in global civilization of particular functional significance of which concern with the ozone hole is merely symptomatically indicative (*Cognitive Mystery of Holes, Lacunae and Incompleteness*, 2014).

Pseudoscience? As a container, how is any sense of *closure* of global society to be understood in terms of boundedness (*Hilary Lawson, Closure: A Story of Everything*, 2001)? Given the enthusiasm of physics for sets of "dimensions" from 11 to 26 as necessary to the explanation of reality, how many dimensions might then be appropriate to explaining society? More challenging is the arrogant implication for governance that, as recently argued: *We are the most powerful species in the known universe, and with great power comes great responsibility* (*The Human Universe: should we take responsibility for the cosmos?* *New Scientist*, 29 April 2015). HQ of the universe? Ironically arrogance is not a concept meaningful to science, despite the strange resemblance it bears to gravity -- itself a continuing mystery to science.

With the *age of the universe* now estimated at some 14 billions of years, it is curious that humanity has seemingly such a limited understanding of time, especially as it relates to governance and the foreseeable changes to its own global environment over the coming decades. Is that understanding of commensurate complexity to the challenges, in the light of arguments summarized by *Robin Le Poidevin* (*The Experience and Perception of Time. The Stanford Encyclopedia of Philosophy*, 2015; *Travels in Four Dimensions: the enigmas of space and time*, 2003). As might be expected, contrasting views are presented in a compilation from an anthropological perspective (Wendy James and David Mills, *The Qualities of Time: anthropological approaches*, 2005). It is in this complex of assertions, enigmas and denials that the current assumption regarding the fourth-dimensionality of time merits continuing consideration (*William J. Friedman, About Time: Inventing the Fourth Dimension*, 1990).

Given the preceding points made with regard to the memorable patterning insights offered by the *I Ching*, some preliminary clarification is required with regard to the interest engendered in the past by the controversial arguments promoted by *Terence McKenna* (*Derivation of the Timewave from the King Wen Sequence of Hexagrams*). These purported to predict, in the light of mathematical analysis, the ebb and flow of novelty in the universe as an inherent quality of time (*John Sheliak, A Mathematical and Philosophical Re-Examination of the Foundations of TimeWave Zero and Novelty Theory*). The arguments evoked considerable interest with respect to 2012 *eschatological beliefs* -- which ironically now take non-religious forms.

Whilst this focus is now readily deprecated as pseudoscience, as with the predictive value of the *I Ching* more generally, such definitive judgement distracts from a degree of human incompetence in the face of emerging crises -- and from the incapacity to engage more effectively with time in that regard. The **demand of science to rely on a worldview calling for 11 to 26 incomprehensible dimensions might then be more appropriately understood as exemplifying pseudoscience** -- if, as science claims, the need is for a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe.

It is readily forgotten that the pattern of hexagrams and their relationships derives directly from the binary coding system so valued by science. The issue here is how that pattern offers a memorable framework through which to engage more effectively with time and the diversity of conditions which could be usefully recognized as the qualities of time -- distinctions currently beyond the capacity of science.

In this light, given the sidedness of arguments regarding climate change -- and a quest for consensus reminiscent of that of the vain quest for unity of science -- it would be helpful if the subtle n-dimensional insights of physics could be applied to improvement of strategic discourse within the immediate global context of humanity.

Static flat world and perspective sides? As indicated above, there is a curious assumption that there are typically only two sides to an argument, or to a difference of opinion -- with the other readily framed as nonsensical (*Alan Sokal and Jean Bricmont, Fashionable Nonsense: postmodern intellectuals' abuse of science*, 1998). There is the further assumption that one side (the right one) should have no relation to the other -- the "underside", only too readily associated with wrongness and evil. The assumption may be presented metaphorically in terms of the right end and the wrong one -- as when the other is understood to have "the wrong end of the stick". This suggests an even more linear framing than that based on sides -- perhaps to be understood as "endedness"..

There may of course be many sides, just as there may be many factions in a democratic system -- however much each regrets the existence of the other. Little effort is made to configure the multiplicity of sides as a polyhedron as would then be appropriate -- a

terahedron for 4 sides or a dodecahedron for 12 sides. Curiously this is despite the enthusiasm for 12-foldness in social undertakings -- including roundtables -- as separately indicated (*Checklist of 12-fold Principles, Plans, Symbols and Concepts*, 2011; *Implication of the 12 Knights in any Strategic Round Table*, 2014). Typically, even declarations of fundamental strategic principles are presented as lists of points -- without aspiring to any higher pattern of order reflective of the functional connectivity between them.

Whilst understandings of globality may be readily associated with a sphere -- echoing the form of the planet -- that sphere is strangely assumed to be static, even flat in the eyes of award-winning author **Thomas L. Friedman** (*The World Is Flat*, 2005), as separately discussed (*Irresponsible Dependence on a Flat Earth Mentality -- in response to global governance challenges*, 2008).

In topological terms, this geometry figures curiously in the expectation of arguments for adherence to a "global plan" -- possibly even of divine inspiration (*Adhering to God's Plan in a Global Society: serious problems framed by the Pope from a transfinite perspective*, 2014). A "plan", framing a "raft of proposals", is readily upheld as a modern magic carpet through which the impossible may be achieved -- with the expectation that only the misguided will not strive to be "on board". Unfortunately a plan is also the epitome of sidedness, necessarily having a relatively invisible underside -- from which improbable surprises emerge, as explored by **Nassim Nicholas Taleb** (*The Black Swan: the impact of the highly improbable*, 2007).

Dynamics over time: The above argument suggests that if a representation of 3D globality is portrayed in 2D, such a depiction is inadequate for comprehension of the subtleties of a 3D world. Similarly, for a global civilization evolving over time, any assumption that it can be adequately portrayed in 3D is dangerously inadequate for comprehension of the subtleties of a 4D civilization.

The concern here is the manner in which globality is also readily assumed to be peculiarly static, as separately argued (*Dynamic Transformation of Static Reporting of Global Processes: suggestions for process-oriented titles of global issue reports*, 2013).

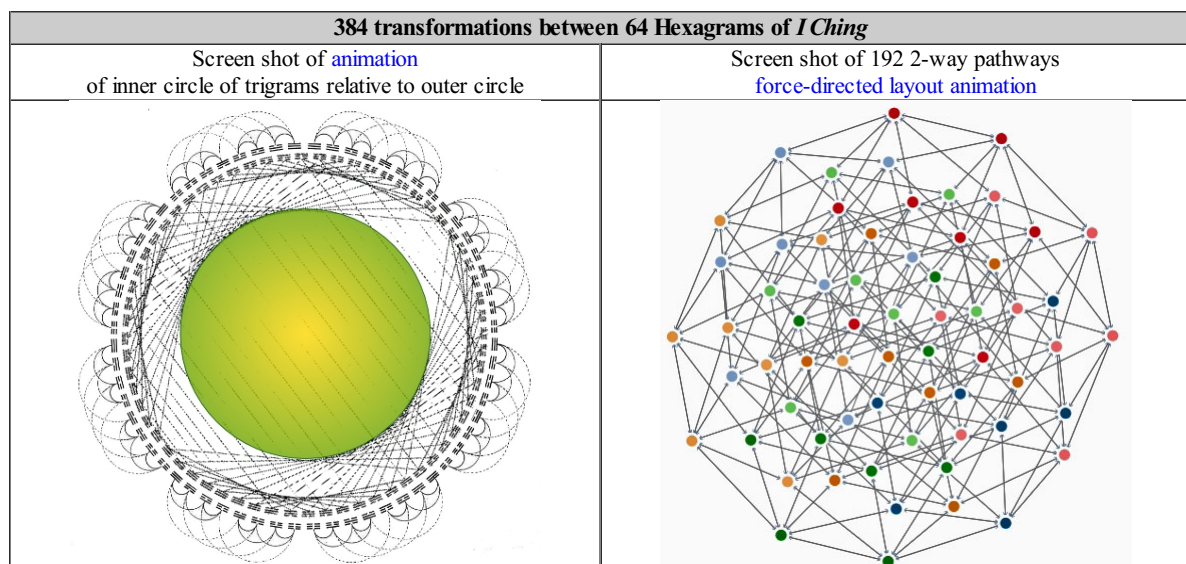
Given that there are many issues which necessitate comprehension with respect to their evolution over time -- such as climate change, overpopulation, environmental degradation and resource overshoot -- there is a case for examining how such comprehension is to be enabled. It is difficult enough to project 3-dimensional understanding into 2 dimensions to enable documents to be printed. Web technology does however increasingly enable representation in 3 dimensions. Much is currently made of the possibility of 3D printing -- although there is little call for such representation in matters of governance, however much it may be vital to military undertakings.

From 3D to 4D? In the light of such analogies, the challenges of a global civilization in crisis may therefore call for new capacities to represent and comprehend 4-dimensional patterns -- beyond the use of equations readily adapted to thousands of dimensions, but incomprehensible in consequence. How are 4 dimensions to be rendered memorable, if they are indeed of relevance to governance? Expressed otherwise, **if the "ordinary" language of conventional international governance is demonstrably inadequate to the challenges, what images might best trigger reflection on the "extrordinary" patterns -- only too readily assumed to be irrelevant?**

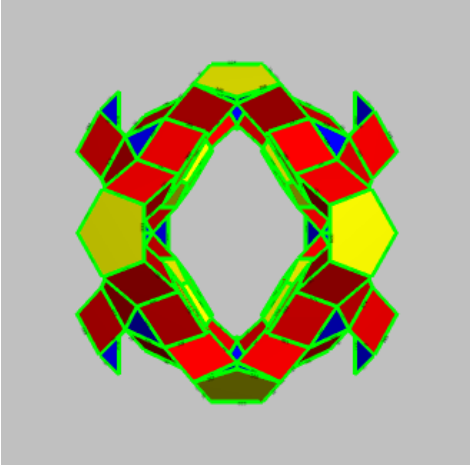
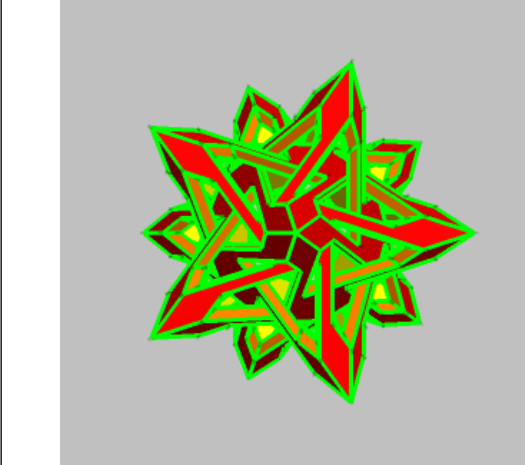
How might a global civilization be understood as travelling through time, namely navigating the **adaptive cycle of resilience** , in the light of the arguments of **Thomas Homer-Dixon** (*The Upside of Down: catastrophe, creativity, and the renewal of vivilization*, 2006)?

The question is especially relevant to any strategic decision, given the consequences it is expected to have over time -- as well as the unexpected surprises. These take on unusual significance now that the cloak of secrecy and stealth is being systematically cultivated, most obviously with respect to negotiations, as in stealthily *Imposing TTIP-TTP-TISA as the caliphate of normality?* (2015), or conventions of a similar nature (*Global Strategic Implications of the "Unsaid"*, 2003).

Use of IChing transformations as an example: If the *I Ching*, as the *Book of Changes*, offers a comprehensive indication of the set of possible changes of "climate" over time (as a consequence of a strategic decision), this suggests that these might best be portrayed through some kind of emulation of 4D. As indicated above, with each of the 64 conditions potentially transforming into each other, consideration could be given to 64x6 transformations (namely 384). Since the transformations are in both directions, these might also be considered as only 192 bidirectional pathways.



If the mapping challenge is switched to the 384 transformations between the 64 conditions, the following forms merit consideration.

Prism-expanded rhombicosidodecahedron (animation)	Topo small stellated dodecahedron
of 200 faces (18 types), 384 edges (32 types), 176 vertices (16 types)	of 204 faces (5 types), 660 edges (11 types), 384 vertices (8 types)
	

Comprehending the shapes of time through uniform polychora

Analogy and symmetry: In the purely spatial terms of geometry, a [4-polytope](#) (also called a polychoron, polycell, or polyhedroid) is a 4-dimensional [polytope](#). It is a connected and closed figure, as with its 2-dimensional analogues: the polygon, and the 3-dimensional the polyhedron. **The emphasis is here is on the association of the 4th dimension with time** -- a preoccupation seldom (if ever) considered in the literature on 4-polytopes, although significant to consideration of spacetime (Yasha Neiman, *Causal cells: spacetime polytopes with null hyperfaces*, 2012). Whether as a spatial or temporal dimension, its comprehension and representation poses particular challenges -- since such forms cannot be "seen" in 3-dimensional space, as is evident, by analogy, in the difficulty of representing 3-dimensionality on a flat surface.

Just as symmetry makes it easier to understand and distinguish different 3D polyhedra, some degree of comprehension is however enabled by the distinctions between the uniform polychora, as variously documented ([George Olshevsky](#), *Uniform Polytopes in Four Dimensions*, 1997-2006; [Jonathan Bowers](#), *Uniform Polychora*, 2006; [Jonathan Bowers](#), *Uniform Polychora and Other Four Dimensional Shapes*, 2014). An extensive classification of [uniform 4-polytopes](#) is also presented by *Wikipedia*, also variously depicted. Note also the *Wikia List of Polychora by Type*. Valuable clarifications are provided by [Richard Klitzing](#) (*Polytopes and their Incidence Matrices*, 2015)

Enumeration: Of direct relevance to the argument here, [64 convex uniform 4-polytopes](#) are recognized, and presented by *Wikipedia* according to the classification of [George Olshevsky](#). These include 6 regular convex 4-polytopes (excluding the infinite sets of the [duoprisms](#) and the antiprismatic hyperprisms). Somewhat ironically, this suggests that these might well be usefully represented as vertices on some of the 3D polyhedra depicted above.

Of further relevance to the discussion below, Bowers clusters 1845 uniform polychora (including the non-convex) into 29 categories. This set is generally thought to be complete, **but not proven to be so**. Given the limited familiarity with these forms, **it is appropriate to stress the controversy surrounding use of terms such as polychoron, the various naming conventions proposed, and the variety of forms distinguished to date** [see *Wikipedia discussion*].

The [Stella4D](#) variant of the [Stella Polyhedron Navigator](#) (used for the depictions above) generates remarkable interactive views of known uniform polychora including the 64 convex forms and the infinite prismatic families [see *Stella 4D Manual*, with its relevant discussion of the *Fourth Dimension*]. The screen shots below were made with this facility.

Terminology: A flavour of these strange forms -- of relevance to any discussion of a time-bound universe and the "shapes of time" -- is offered by the 29 categories distinguished by Bowers and featuring in the Stella 4D polytope library. Fundamental to the controversy are the deprecated (but memorable) neologisms promoted by Bowers and the (essentially unmemorable) conventions of mathematics helpfully indicated by [George Olshevsky](#) (*Glossary for Hyperspace*, 2001), clarifying the use of acronyms promoted by Bowers (*Naming the convex uniform polychora*). Note the formal *complete list of 64 non-prismatic convex uniform polychora* in *Wikipedia*. Variants of the terminology are also reconciled by [Richard Klitzing](#) (*Regular Polytopes*)

The extraordinary terminology might be considered especially relevant to imaginative engagement with such forms. A language for the shapes of time to which governance is obliged to respond? Or **is it to be assumed that administrative English is adequate to the governance challenges of navigating through time?**

As with multiple distinctions for a phenomenon in some languages, do the shapes of time merit similar distinctions?

As indicated by its extensive use in the checklists above and below, a [vertex figure](#) (abridged to "verf"), or [vertex configuration](#), needs to be understood as the shape obtained from drawing a small [hypersphere](#) around any vertex of a uniform polytope (*What Does a 4-Dimensional Sphere Look Like?* 2002). Loosely speaking, it is the $(n-1)$ -dimensional polytope formed at the stump when a corner is truncated from an n -dimensional polytope or compound polytope -- namely the cross-section of an n -dimensional polytope or compound polytope very close to a vertex. The vertex figure shows exactly how a polytope's facets fit together to surround a vertex.

Categories of uniform polychora (notably including the non-convex)

29 Categories of uniform polychora (notably including the non-convex) (reproduced from Jonathan Bowers, <i>Uniform Polychora</i> , 2006, with minor editing and addition of emphases)	
<p>Category 1: Regulars (Polychora 1-17): These are the 16 regular polychora plus the only faceting of <i>hex</i> - "<i>tho</i>" - there are 17 polychora here. Verfs are regular polyhedra, and in <i>tho</i>'s case the verf is a <i>thah</i>. [images]</p> <p>Category 2: Truncates (Polychora 18-38): These are the truncated and quasitruncated polychora, there are also three ditrigonary truncates. Verfs are pyramids of regular polygons or semiregular polygons. [images]</p> <p>Category 3: Triangular Rectates (Polychora 39-59): These are the rectified <i>pen</i>, <i>tes</i>, <i>ico</i>, <i>hi</i>, <i>sishi</i>, <i>gaghi</i>, and <i>gogishi</i> and their two primary facetings. There are 7 regiments represented here with three members each (<i>rit</i> and <i>rico</i> has more regiment members mentioned in <i>Cat. 12</i> and <i>Cat. 6</i> respectively). There verfs are triangle prisms along with their facetings. [images]</p> <p>Category 4: Ico Regiment (Polychora 60-72): These are the facetings of <i>ico</i>, one of them, <i>ih</i>, has <i>pyrito-ico</i> symmetry, 6 have tessic symmetry, while the other 6 have demitessic symmetry. Verfs are facetings of the cube. There's also a prominent compound called "<i>Gico</i>". [images]</p> <p>Category 5: Pentagonal Rectates (Polychora 73-132): These are the polychora that belong to the <i>rox</i> army composed of the <i>rox</i>, <i>righi</i>, <i>ragishi</i>, and <i>rigfix</i> regiments. The 5 regiments each have 15 members, there are also two coinciding members and five exotic members in each regiment, which are no longer counted as polychora. The verfs are variant facetings of variant pentagon prisms. [images]</p> <p>Category 6: Sphenoverts (Polychora 133-297): These are the cantellates (also called small rhombates): of the polychora along with others with similar verfs. Verfs are wedges and their facetings, each of the 24 regiments have 7 members (<i>rico</i> has had 3 members already counted in <i>cat. 3</i>). <i>Sirgax</i> belongs to this group.</p> <p>Category 7: Bitruncates (Polychora 298-306): These nine polychora (<i>deca</i>, <i>tah</i>, <i>cont</i>, <i>xhi</i>, <i>shihi</i>, <i>dahi</i>, <i>gixhi</i>, <i>gic</i>, and <i>ghihi</i>): are the bitruncates, they all have disphenoid verfs. <i>Cont</i>, <i>gic</i>, and <i>deca</i> have only one type of cell. There are also two fissary cases <i>sitphi</i> and <i>gitphi</i> which have only one type of cell, their verfs are compounds of three disphenoids. [images]</p> <p>Category 8: Grombates (Polychora 307-329): These 23 polychora are also known as the great rhombates and their kin. There verfs are scalenoids (a scalene like disphenoid).</p> <p>Category 9: Omnitruncates (Polychora 330-351): These 22 polychora are also known as the maximized polychora. Their verfs are irregular <i>tets</i>.</p> <p>Category 10: Prismatorhombates (Polychora 352-441): These 90 polychora are grouped into 30 regiments of 3, they seem to be quite attractive. Their verfs are trapyr and facetings. One of my favorites is <i>giphix</i>.</p> <p>Category 11: Antipodiumverts (Polychora 442-481): These 40 polychora are grouped into 5 regiments of 7 and 1 regiment of 5. They have triangle antipodium shaped verfs along with facetings. The small prismates, like <i>sidpith</i>, belong here. There are some scaliforms in the <i>sidpith</i> regiment also. [images]</p> <p>Category 12: Podiumverts (Polychora 482-511): These 30 polychora are grouped into 4 regiments of 7 and the extra two members of the <i>rit</i> regiment (<i>sto</i> and <i>gotto</i>). Their verfs are triangle podiums and their facetings, <i>sixhidy</i> belongs here. Previously known as frustrumverts. There are some scaliforms amongst the <i>gittith</i> regiment. [images]</p> <p>Category 13: Spic and Giddic Regiments (Polychora 512-551): These 40 polychora are split into 2 regiments of 20. Spic has 48 <i>octs</i> and 96 <i>trips</i> as cells, <i>Giddic</i> has 48 <i>octs</i> and 48 <i>quiths</i> as cells. They both have a sort of square antiprism verf. Each regiment also has 2 fissary members.</p> <p>Category 14: Skewverts (Polychora 552-611): These 60 polychora are split into 4 regiments of 15, their verfs are skewed wedges and facetings. Many of these are very intricate. The regiments are <i>skiviphado</i> (tessic), <i>gik vixathi</i>, <i>sik vipathi</i>, and <i>skiv datapixady</i> (last three are <i>hyic</i>).</p> <p>Category 15: Afdec Regiment (Polychora 612-664): The <i>afdec</i> regiment has 53 members plus one fissary member called <i>affic</i> which</p>	<p>Category 17: Sishi Regiment (Polychora 764-777): <i>Sishi</i> is the regular small stellated 120-cell which has a dodecahedron shaped verf, these 14 polychora are its non-regular, non-swirlprism facetings. There are also 2 fissaries and several exotic-celled members. Three of these have verfs shaped like the three ditrigonary polyhedra. <i>Paphicki</i> and <i>paphacki</i> (the small and great prismaauri) are also here. [images]</p> <p>Category 18: Ditetrahedrals (Polychora 778-888): These polychora all have 600 vertices, there are 3 regiments of 37, each regiment also has 4 fissaries, 20 exotic-celled cases, and 11 coincident cases. The three regiments are the <i>sidxaxhi</i>, <i>dattady</i>, and <i>gadtaxady</i> regiments. <i>Sidxaxhi</i>'s cells are 600 <i>tets</i> and 120 <i>sidxids</i>, verf is <i>tut</i> like. <i>Dattady</i>'s cells are 120 <i>gissids</i> and 120 <i>sidxids</i>, verf is also <i>tut</i> like. <i>Gadtaxady</i>'s cells are 120 <i>gissids</i>, 600 <i>tets</i>, and 120 <i>gids</i>, verf is a golden cuboctahedron (looks like a <i>co</i>, but squares are turned to golden rectangles). <i>Sitphi</i> and <i>Gitphi</i> can also go here as well as a similar compound which shows up in the <i>dattady</i> regiment.</p> <p>Category 19: Prisms (Polychora 889-962): These 74 polychora are the prisms of 74 of the 75 uniform polyhedra (we excluded the cube since the cube prism is the tesseract). Verfs are pyramids of the polyhedron verfs.</p> <p>Category 20: Miscellaneous (Polychora 963-984, 1846-1849): These 22 polychora include <i>iquipadah</i>, <i>gaquipadah</i>, the newly discovered <i>ondip</i> type, the antiprisms, snubs, and swirlprisms. The grand antiprism (gap) belongs here. This set contains all sorts of odd shaped polychora. Several scaliforms would fit amongst these, since many are swirlprisms. [images]</p> <p>Category 21: Padohi Regiment (Polychora 985-1065): The <i>padohi</i> regiment now has 81 members (it once had 354, where most of them were exotic-celled or coincident). If we added the fissaries back in, the <i>padohi</i> regiment would double in size. <i>Padohi</i>'s verf is a pentagonal antipodium. It's cells are 120 <i>sissids</i>, 120 <i>ikes</i>, 720 <i>stips</i>, and 1200 <i>trips</i>.</p> <p>Category 22: Gidipthi Regiment (Polychora 1066-1146): The <i>gidipthi</i> regiment also has 81 members since it is the conjugate of the <i>padohi</i> regiment. It's verf is a pentagonal podium. It's cells are 120 <i>sissids</i>, 120 <i>ikes</i>, and 120 <i>gaddids</i>. Many of its members are very intricate.</p> <p>Category 23: Rissiditixhi Regiment (Polychora 1147-1303): The <i>rissiditixhi</i> regiment (sometimes called the <i>rissids</i>) has 157 members (once it had 316) it also has a few fissary cases. It's verf is a ditrigon prism. Cells are 120 <i>sidxids</i>, 600 <i>octs</i>, and 120 <i>gids</i>. Some strange looking verfs show up in this regiment.</p> <p>Category 24: Stut Phiddix Regiment (Polychora 1304-1382): The <i>stut phiddix</i> regiment now has 79 members (once it had 238). Its verf is a triangle cupola, cells are 600 <i>tets</i>, 120 <i>sidxids</i>, 600 <i>coes</i>, and 720 <i>stips</i>. There are some beautiful polychora amongst the stuts.</p> <p>Category 25: Getit Xethi Regiment (Polychora 1383-1461): The <i>getit xethi</i> regiment also has 79 members (once it had 238). Its verf is a triangle cupola, cells are 600 <i>tets</i>, 120 <i>sidxids</i>, 120 <i>gaddids</i>, and 120 <i>quit gissids</i>.</p> <p>Category 26: Blends- (Polychora 1462-1473): These 12 polychora belong to the strange <i>sabbadipady</i> regiment which also contains 4 fissaries, its cells are 120 <i>gissids</i>, 720 <i>stips</i>, 720 <i>pips</i>, and 120 <i>quit sissids</i>. The verf looks like a triangle antipodium with a pyramid stuck on it's base. Some of the facetings have some really odd verfs.</p> <p>Category 27: Sidtaps and Gidtaps (Polychora 1474-1491): These 18 polychora are split into 2 regiments of 9, there were also some exotics here two as well as scaliforms. The <i>sidxtaps</i> (or the <i>sadsadox</i> regiment) are based off of the blended compound of 10 <i>roxes</i> (which is no longer a compound, but a true polychoron). Likewise the <i>gidtaps</i> (<i>gadsadox</i> regiment) is based off of the blended compound of 10 <i>raggixes</i>. These are also known as the baby monster snubs and are related to the <i>idcossids</i> and <i>dircospids</i>. The verfs are facetings of a 2-pip blend</p> <p>Category 28: Idcossids (Polychora 1492-1668): The <i>idcossids</i> once had 2749 polychora, but nearly all of them were exotic-celled or coincident, etc., now only 177 are left (however there are scaliforms here). Even the polychoron that the <i>idcossids</i> were named after was exotic-celled. The <i>idcossids</i> are based off of the 10-<i>padohi</i> compound, were the verfs are facetings of a pentagonal antipodium duo-combo. Many of these have millions of pieces. I now consider <i>sadros daskydox</i> as the head of this regiment (the conjugate of <i>gadros daskydox</i>).</p> <p>Category 29: Dircospids (Polychora 1669-1845): The <i>dircospids</i> are</p>

has 48 *cotcoes* for cells. *Afdec* has 48 *coes* and 48 *goccoes* for cells, its *verf* is rectangle trapezoprism (which I first called an *antifrustrum*).

Category 16: Affixthi Regiment (Polychora 665-763): The *affixthi* regiment has 99 members plus one fissary member (*affidhi*). *Affixthi*'s cells are 600 *octs*, 120 *dids*, 120 *gidditdids*, and 120 *gaddids*. Its *verf* is similar to *afdec*'s except that the bases have different shaped rectangles (an *oct* *verf* and a *did* *verf*).

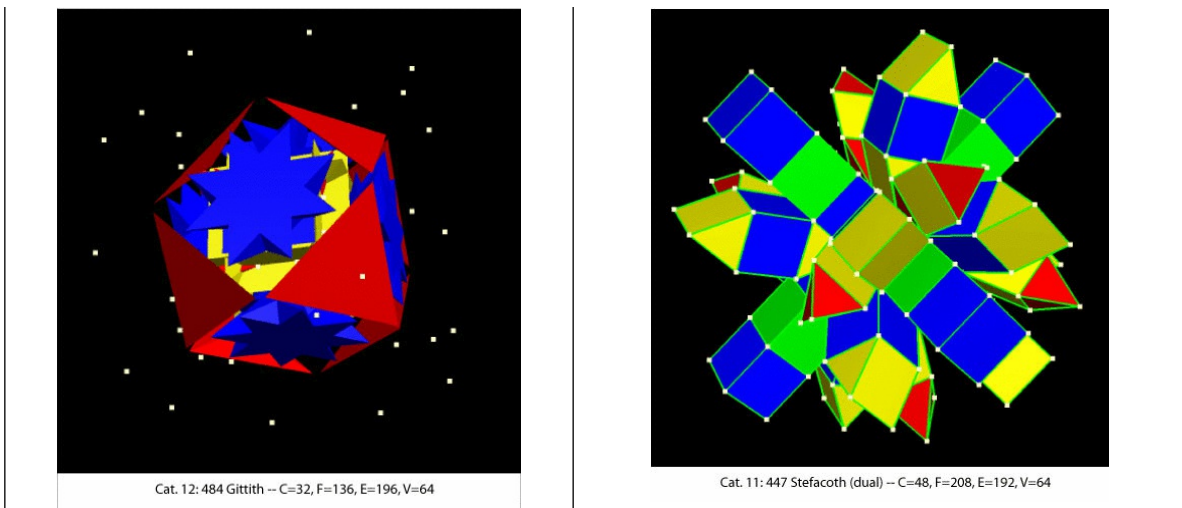
based off of the 10-*gidipthi* compound, only 177 are left as true polychora plus many scaliforms. The *verfs* are facetings of a pentagonal podium duo-combo. *Gadros daskydox* is considered the head. The *dircospids* are so far the most complex of the uniform polychora.

64 convex uniform polychora: Oshevsky helpfully distinguishes these as follows, notably with indications of the (many) alternative terminologies employed, including the acronyms of Bowers (as employed in the Stella 4D library of polytopes). The need for such acronyms is evident from the unmemorability of the formal names, however meaningful they may be to some. Ironically the acronyms recall the succinct metaphorical terms (in Chinese) for each of the 64 hexagram-encoded conditions of the *Book of Changes*.

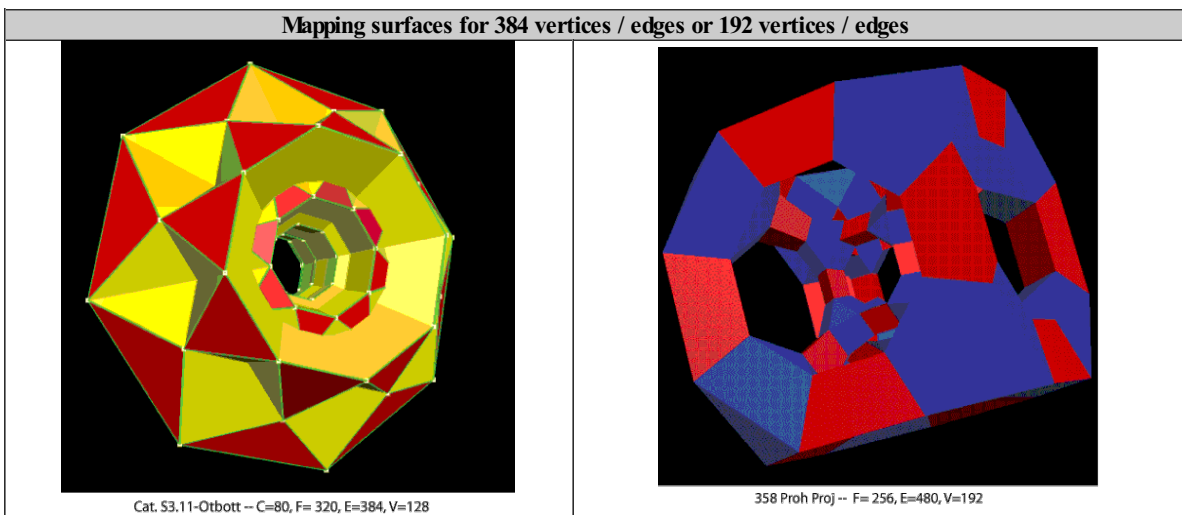
Complete list of 64 non-prismatic convex uniform polychora (each item preceded, for convenience, by addition of the mnemonic acronym of Jonathan Bowers with an indication of the corresponding Category appended, if identifiable from Stella 4D)	
<p>Section 1: Polychora #1-9: based on the pentachoron (5-cell)</p> <p>1: Pen (Pentachoron) 2: Rap (Dispentachoron) [Cat. 3] 3: Tip (Truncated pentachoron) 4: Srip (Small prismatodispentachoron) 5: Spid (Small prismatodecachoron) [Cat. 11] 6: Deca (Truncated-tetrahedral decachoron) 7: Grip (Great prismatodispentachoron) 8: Prip (Diprismatodispentachoron) [Cat. 10] 9: Gippid (Great prismatodecachoron) [Cat. 9]</p> <p>Section 2: Polychora #10-21: based on the tesseract (hypercube) and hexadecachoron (16-cell)</p> <p>10: Tes (Tesseract) 11: Rit (Tesseractihexadecachoron) 12: Hex (Hexadecachoron) [Cat. 1] 13: Tat (Truncated tesseract) 14: Srit (Small prismatotesseractihexadecachoron) 15: Sidpith (Small diprismatotesseractihexadecachoron) [Cat. 11] 16: Tah (Truncated-octahedral tesseractihexadecachoron) [Cat. 7] 17: Thex (Truncated hexadecachoron) [Cat. 2] 18: Grit (Great prismatotesseractihexadecachoron) 19: Proh (Truncated-cubic diprismatotesseractihexadecachoron) 20: Prit (Rhombicuboctahedral diprismatotesseractihexadecachoron) [Cat. 10] 21: Gidpith: Great diprismatotesseractihexadecachoron)</p> <p>Section 3: Polychora #22-31: based on the icositetrachoron (24-cell):</p> <p>22: Ico (Icositetrachoron) [Cat. 1] 23: Rico (Disicositetrachoron) [Cat. 3] 24: Tico (Truncated icositetrachoron) 25: Srico (Small prismatodisicositetrachoron) [Cat. 6] 26: Spic (Small prismatotetracontaotachoron) [Cat. 13] 27: Cont (Truncated-cubic tetracontaotachoron) 28: Grico (Great prismatodisicositetrachoron) 29: Prico (Diprismatodisicositetrachoron) [Cat. 10] 30: Gippic (Great prismatotetracontaotachoron) [Cat. 9] 31: Sadi (Snub icositetrachoron) [Cat. 20]</p>	<p>Section 4: Polychora #32-46: based on the hecatonicosachoron (120-cell) and hexacosichoron (600-cell)</p> <p>32: Hi (Hecatonicosachoron) [Cat. 1] 33: Rahi (Icosidodecahedral hexacosihcatonicosachoron) [Cat. 3] 34: Rox (Icosahedral hexacosihcatonicosachoron) [Cat. 5] 35: Ex: Hexacosichoron) [Cat. 1] 36: Thi (Truncated hecatonicosachoron) [Cat. 2] 37: Srahi (Small prismatohexacosihcatonicosachoron) [Cat. 6] 38: Sidpixhi (Small diprismatohexacosihcatonicosachoron) [Cat. 11] 39: Xhi (Truncated-icosahedral hexacosihcatonicosachoron) [Cat. 7] 40: Srix (Icosidodecahedral prismatohexacosihcatonicosachoron) [Cat. 6] 41: Tex (Truncated hexacosichoron) 42: Grahi (Great prismatohexacosihcatonicosachoron) [Cat. 8] 43: Prix (Truncated-dodecahedral diprismatohexacosihcatonicosachoron) [Cat. 10] 44: Prahi (Rhombicosidodecahedral diprismatohexacosihcatonicosachoron) [Cat. 10] 45: Grix (Truncated-icosahedral prismatohexacosihcatonicosachoron) [Cat. 8] 46: Gidpixhi (Great diprismatohexacosihcatonicosachoron) [Cat. 9]</p> <p>Section 5: Polychoron #47: anomalous non-Wythoffian polychoron</p> <p>47: Gap (Grand antiprism)</p> <p>Section 6: Polychora #48-64: prismatic polychora: and infinite sets</p> <p>48: Tepe (Tetrahedral prism) [Cat. 19] 49: Tuttip (Truncated-tetrahedral prism) [Cat. 19] 50: Cope (Cuboctahedral prism) [Cat. 19] 51: Ope (Octahedral prism) [Cat. 19] 52: Ticcup (Truncated-cubic prism) [Cat. 19] 53: Sircope (Smallrhombicuboctahedral prism) [Cat. 19] 54: Tope (Truncated-octahedral prism) [Cat. 19] 55: Gircope (Truncated-cuboctahedral prism) [Cat. 19] 56: Sniccup (Snub-cuboctahedral prism) [Cat. 19] 57: Dope (Dodecahedral prism) [Cat. 19] 58: Iddip (Icosidodecahedral prism) [Cat. 19] 59: Ipe (Icosahedral prism) [Cat. 19] 60: Tiddip (Truncated-dodecahedral prism) [Cat. 19] 61: Sridip (Small rhombicosidodecahedral prism) [Cat. 19] 62: Tipe (Truncated-icosahedral prism) [Cat. 19] 63: Griddip (Truncated-icosidodecahedral prism) [Cat. 19] 64: Sniddip (Snub-icosidodecahedral prism) [Cat. 19]</p> <p>Section 7: derived from glomeric tetrahedron B4: all duplicates of prior polychora</p>

Polychora with 64 vertices: As an exercise in understanding how 64 conditions of changing climate might be coherently understood, the polychora with 64 vertices are presented below in separate slide shows. Appropriate to the inherent complexity of a condition of potential change, the **vertices in 4D should be understood as having a dynamic temporal component**, despite their conventional depiction as seemingly static points in the Category 12 images (on the left below). This is emphasized by the depiction of the duals of the Category 11 set (on the right below). In this case the 64 vertices take the form of cells, a display choice made because the non-dual form is visually of relatively little visual interest.

Potential polychora mapping surfaces for 64 conditions	
Category 12: Gittith regiment plus (edges added in some images)	Category 11: Sidpith duals plus (details are for non-dual variant)



Mapping surfaces with 192 or 384 vertices or edges: In an effort to obtain a means of comprehending the set of 384 transformations indicated by the pattern of the *Book of Changes*, the following slide shows indicate some of the forms capable of holding this pattern of 6x64 or 3x64 as a mapping. These images are especially relevant to further investigation of possibilities indicated by the drilled truncated cube (mentioned above, and discussed further below).



Five-fold ordering of strategic engagement with time

Clearly the many polychora depicted above are a major challenge to comprehension -- as is very probably appropriate to the subtleties of the spectrum of human collective engagement with time. One possibility for addressing this complexity as a cognitive challenge is -- somewhat ironically -- to view the set of polychora from a "five-dimensional" perspective -- rather than through their distracting variety in 4D.

This arguably follows from the degree of clarity and memorability achieved more generally through mapping of higher dimensionality onto a pattern of lower dimension:

- line to point -- as in "what is the point" of a "line of argument"
- matrix to line -- as in generation of check lists (of points) from information presented in tabular or 2D matrix form (the list of 64 uniform convex polychora provides an example, in contrast with their tabular presentation giving characteristics)
- sphere to flat map -- as with the generation of 2D maps of parts of the 3D globe (illustrated by the [Wikipedia List of map projections](#), notably using a [Table of projections](#))

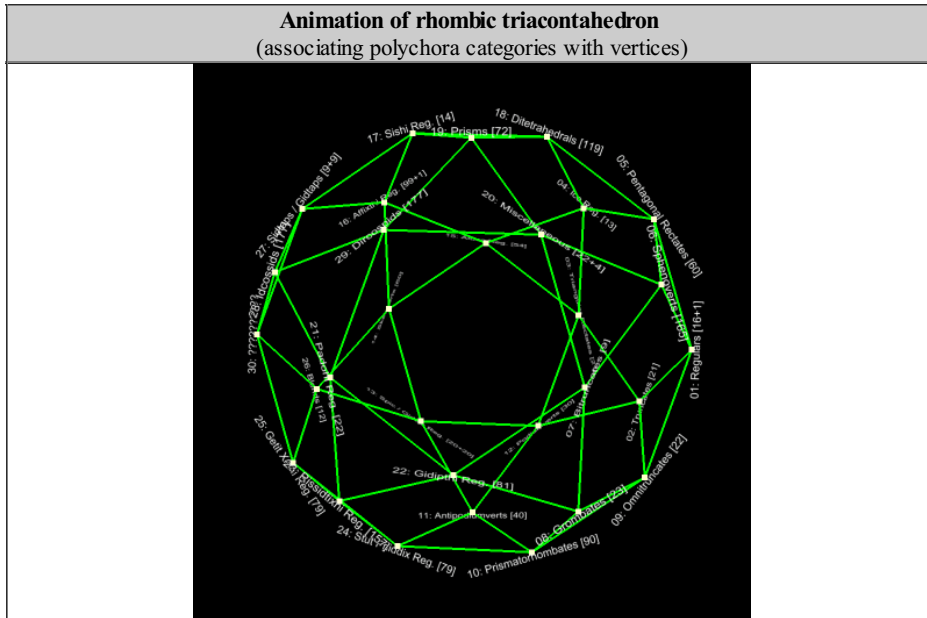
It follows, in a quest for memorability, that there is a case for representing the set of 4D polychora in 3D. More intriguing is the use of one or more polyhedra to that end, or even projections into 3D of particular polychora. This gives focus to the possibilities and desirability of "self-mapping" (as discussed below).

Assuming 30 categories of polychora: In the spirit of "following the numbers", the above-mentioned set of 29 uniform polychora (including the nonconvex) is assumed here to be a set of 30 -- especially given a lack (as yet) of any final conclusion as to the number of categories in the set, of the ongoing processes of reallocation of polychora between them, and of the lack of proof regarding the completeness of the set. Given the geometrical constraints, there is therefore greater probability that the number will be 30 rather than 29.

With this provisional assumption, the 30 categories can then be usefully -- if not significantly -- mapped onto a single polyhedral form ([Spherical Configuration of Categories -- to reflect systemic patterns of environmental checks and balances](#), 1994; [Triangulation of](#)

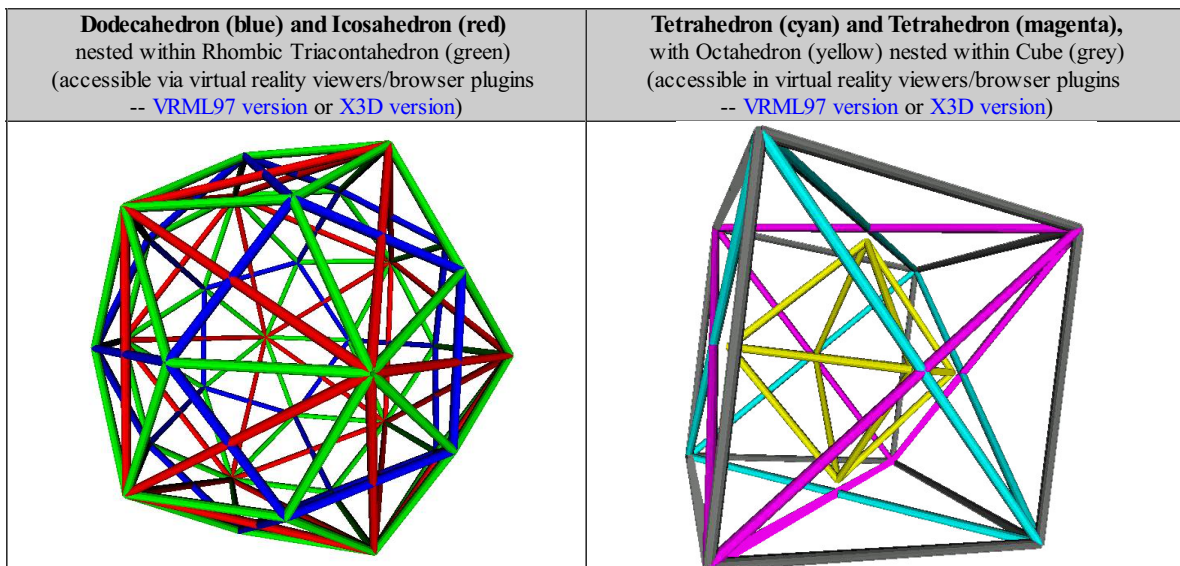
Incommensurable Concepts for Global Configuration, 2011). The form selected here for that purpose is the **rhombic triacontahedron** , given its unique properties in reconciling the forms of the 5 Platonic solids (K. J. M. MacLean, *The Rhombic Triacontahedron*, 2007; Robert W. Gray, *Rhombic Triacontahedron*, *Encyclopedia Polyhedra*, 2007).

With respect to the argument here regarding the climate of strategic discourse, a set of 30 categories in polyhedral configuration is a primary feature of the analysis by management cybernetician **Stafford Beer** (*Beyond Dispute: the invention of team synteegrity*, 1994). A more concrete appreciation of the significance of this form is offered by (X. W. Fang, et al. *Spatially Resolved Distribution Function and the Medium-Range Order in Metallic Liquid and Glass*, *Scientific Reports*, 2011). Given Beer's approach, there is some probability that a proof of a 30-fold set might be enabled by his insight. Together with that of Fuller (1975), Beer's insight was one basis for a polyhedral tensegrity mapping of the strategic issues of the 1992 Earth Summit (*Configuring Globally and Contending Locally: shaping the global network of local bargains by decoding and mapping Earth Summit inter-sectoral issues*, 1992).



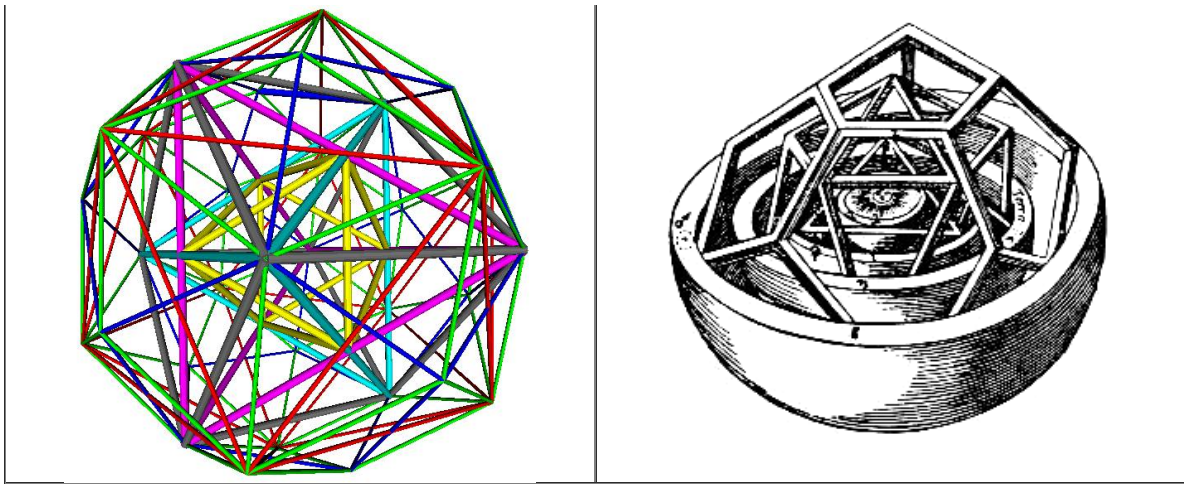
*** force directed version

Nesting polyhedra: The rhombic triacontahedron then suggests the value of nesting polyhedra of greater spherical symmetry within it. This possibility of *Nesting polyhedra to enable comparison of patterns of discourse* was previously considered and extensively illustrated in a section of a more general argument (*Embodying Global Hegemony through a Sustaining Pattern of Discourse: cognitive challenge of dominion over all one surveys*, 2015). That gave rise to the following images (with links to interactive 3D variants in virtual reality).



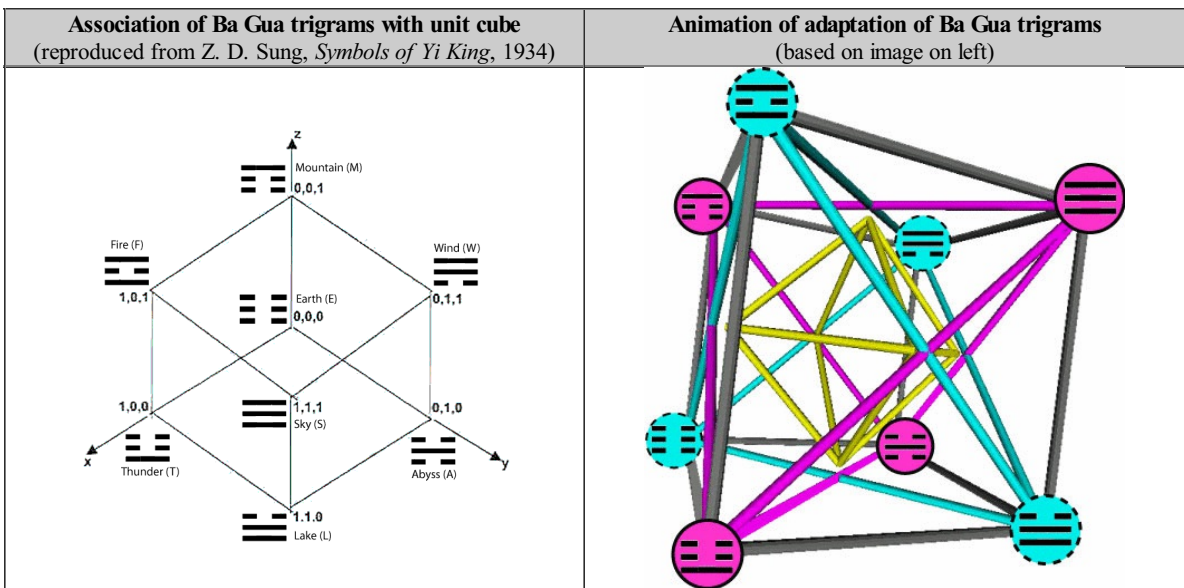
The complex on the right (above) can then be nested within the complex on the left (above) to give that on the left (below) -- recalling Johannes Kepler's memorable model of the solar system (on the right).

Nesting Platonic polyhedra	
<p>Rhombic Triacontahedron (green) as a nesting framework (virtual reality variants <i>static</i>: vrml or x3d; <i>mutual rotation</i>: vrml or x3d; "<i>pumping</i>": vrml or x3d; videos: "<i>pumping</i>" mp4; "<i>rotation</i>" mp4)</p>	<p>Polyhedral model of solar system of Johannes Kepler Reproduced from <i>Wikipedia</i> entry in <i>Mysterium Cosmographicum</i> (1596)</p>



Dynamic interpretation through weather/whether metaphors: At the centre of the complex on the right is the most fundamental Platonic form, namely the tetrahedron -- in two complementary forms. The tetrahedron is typically understood in static geometrical terms -- forgetting the argument of **R. Buckminster Fuller** that all **polyhedra are more appropriately understood as systems** (*Synergetics: Explorations in the Geometry of Thinking*, 1975). The question to be clarified is the cognitive dynamics associated with the tetrahedral pattern -- notably in relation to discourse, especially in the light of the complementarity between the two forms (*Geometry of Thinking for Sustainable Global Governance: cognitive implication of synergetics*, 2009).

One approach is through the unit cube within which the two tetrahedra are nested. As noted by **Martin Gardner** (*The combinatorial basis of the "I Ching", the Chinese book of divination and wisdom*, *Scientific American*, January 1974), a natural way of generating the eight Ba Gua trigrams in terms of the unit cube was indicated by **Z. D. Sung** (*Symbols of Yi King*, 1934). Noting that argument, that illustration was more recently reproduced by **Pieng-Lam Kho** (*YiJing (I-Ching) Matrices*, 2004). As the latter indicates, the convention used is 0 for broken line and 1 for solid line. **Note the possibility of alternative readings of the encoding, whether from left to right (of the numbers) or from bottom to top of the lines -- significant in the dynamics governed by chirality.** The eight sets of coordinates correspond to the eight trigrams, are complementary to the opposite cornered trigram of the cube.



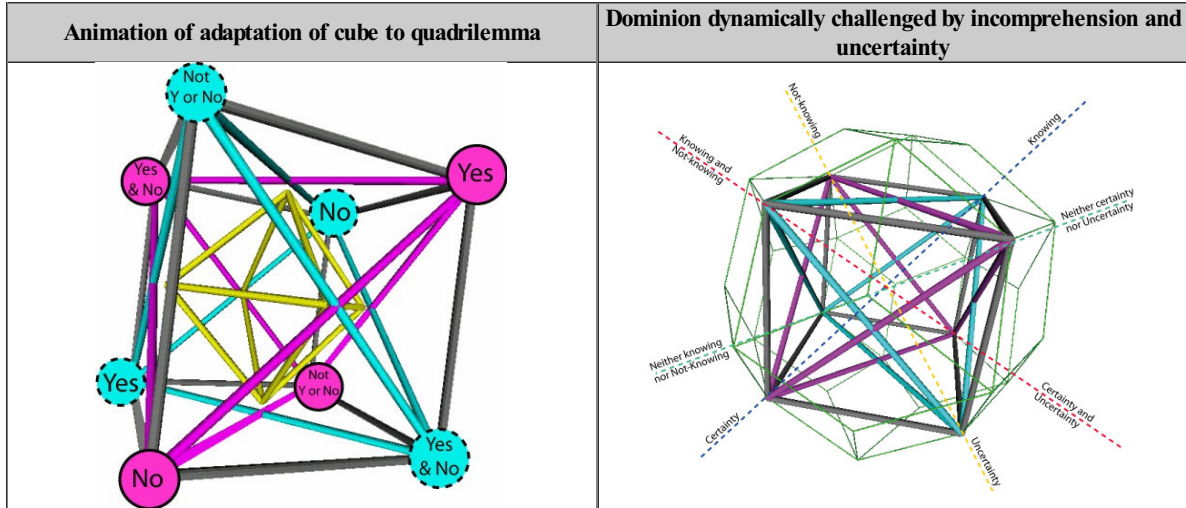
The tetrahedron can be used as a valuable mapping device for the quadrilemma articulated by **Kinhide Mushakoji** (*Global Issues and Interparadigmatic Dialogue; essays on multipolar politics*, 1988). This addresses the issue of transcending any dysfunctional oversimplification in discourse into binary form -- the "sidedness" of argument as challenged above. The four vertices of the tetrahedron can then be used to hold and distinguish:

Elements of the quadrilemma in discourse and logic						
A	assertion	confirmation	transparency	promotion	truth	positive
not-A	denial	denial	stealth	deprecation	falsehood	negative
A and not-A	assertion & denial	confirmation & denial	transparency & stealth	promotion & deprecation	truth & falsehood	positive & negative
neither A nor not-A	neither assertion nor denial	neither confirmation nor denial	neither transparency nor stealth	neither promotion nor deprecation	neither truth nor falsehood	neither positive nor negative

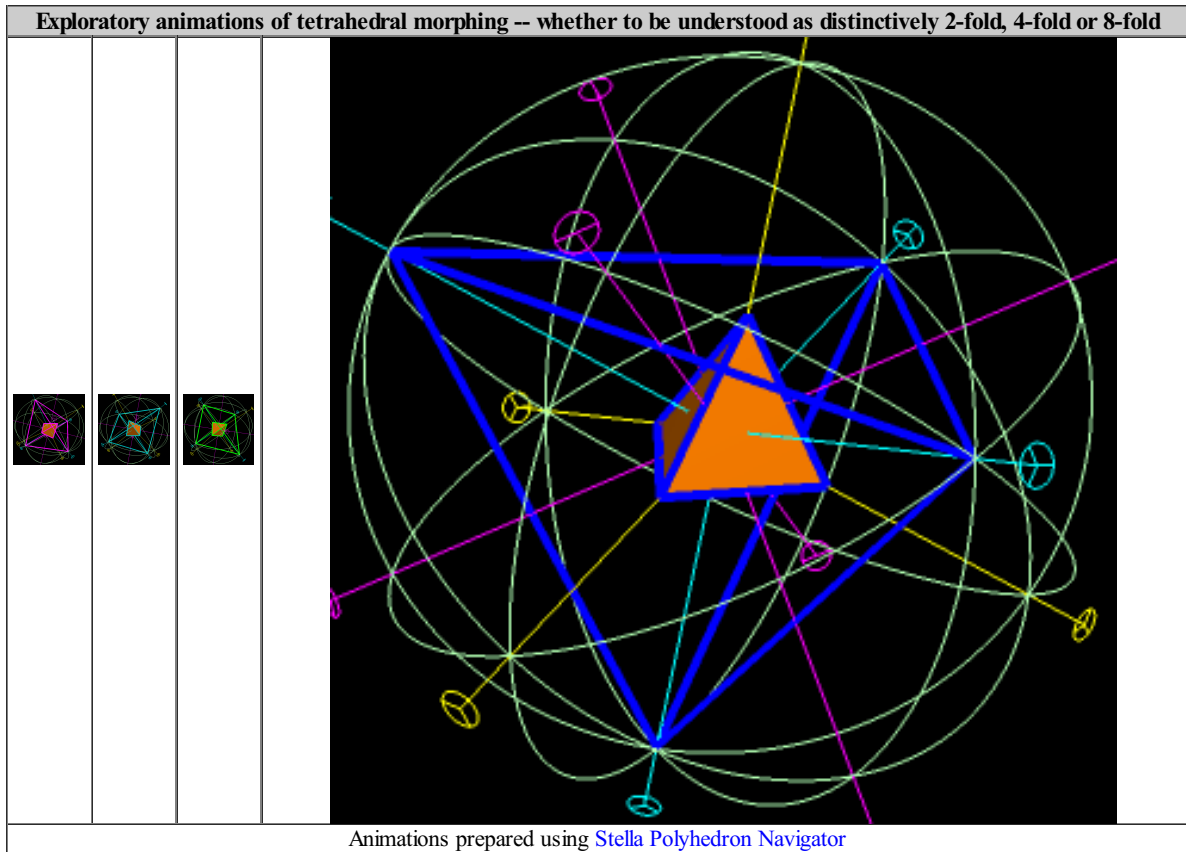
Using the polyhedral framework (above), the dimensions in relation to knowing (comprehension, understanding, certainty) and to not-knowing (incomprehension, misunderstanding, uncertainty, ignorance) can be suggestively interrelated as follows. This is consistent with the notorious poem of **Donald Rumsfeld** regarding the **known unknowns**, as discussed separately (*Unknown Undoing: challenge of*

incomprehensibility of systemic neglect, 2008).

The great value of the complementarity between the tetrahedra is that together they can then hold the dynamics of discourse. Use of the trigrams, understood through their weather-related metaphors, then offers a degree of coherence in systemic terms.



The challenge is then to acquire greater insight into the dynamics between the tetrahedra, as is explored in the animations below.



Cognitive "pumping" cycle with implications for collective discourse? The argument with respect to the dynamics of the complementary polyhedra suggests further reflection on the manner in which the polyhedral patterns (within which they are nested) should also be considered as necessarily dynamic rather than static.

The question is how the tetrahedra, octahedron, cube, icosahedron and dodecahedron "move" in relation to one another -- notably along axes of symmetry, as indicated in separate animations (in preparation). What are then the implications for discourse relating to governance? In the light of the animations above, such cyclic movement could be readily explored through animation. There is a sense in which such dynamics perform one or more "pumping" functions in cognitive terms. Those above are already reminiscent of the operation of chambers of the heart. Is the collective "heart of humanity" to be better articulated through such frameworks?

In relation to discourse and strategic formulation, one valuable indication is provided by the manner in which polyhedra can be formed by operations on each other -- most notably that of truncation. Stella4D provides a range of facilities through which a given polyhedra can be variously morphed into other forms through standard geometrical operations.

Much work in this respect has been done by Pieter Huybers (*Nested Polyhedra*, *Newsletter of the Structural Morphology Group*, 2007). He notes there that the envelope of a polyhedron can be formed by operations on polygons, notably rotation. This rotation takes place

along circular routes around the X- and Y-axis of the co-ordinate system, but not before the polygonal face has been translated over a certain distance along the Z-axis. In some cases an initial rotation around the Z-axis is also necessary. He has developed the CORDIN computer programme to offer ways for the visual presentation of spatial forms -- without the need to build them in reality.

This has been usefully contextualized by Peter Forbes (*Spatial Relations: the science of morphing has created a resurgence of geometry-led architecture*. *The Guardian*, 27 March 2003)

D'Arcy Thompson was primarily concerned with the shapes of living things and how they got that way, but he often referred to parallels with engineering. One of his most perceptive observations showed how the form of one creature could be derived from another by means of a systematic grid deformation. By this system, two apparently different fishes can be seen to be derived from each other; ditto the human skull from chimpanzees.

Although a purely formal process, an exercise in the science of morphology, biology provides plausible mechanisms. Nature as a designer can only work through evolution; one structure by definition has to be derivable from another....Many of the new shapes are tried out on computer first and a program called CORDIN... invented by Pieter Huybers [who] applies Thompionesque transformations to architectural designs and shows how what appear to be unrelated structures can be derived from each other. Usually, the overall shape is divided into triangles so that once the final form of a structure is found by means of the computer transformation, the space frame can be made by turning the triangles into struts.

Forbes notes that the driving force of modern architecture is geometry, and the computer has given a great fillip to the investigation of novel shapes -- as exemplified by the work of the artist Tony Robbin (*Engineering the New Architecture*, 1996), as a manifesto for the geometry-led architecture which is a particular focus of the Space Structures Research Centre (University of Surrey) using the Formian computer language to generate the triangulated truss structures of large complex domes and polyhedral configurations -- as well as four-dimensional structures (Tony Robbin, *Formian for Art and Mathematics, Space Structures 5*, 2002; *Shadows of Reality: the fourth dimension in cubism, relativity, and modern thought*, 2006).

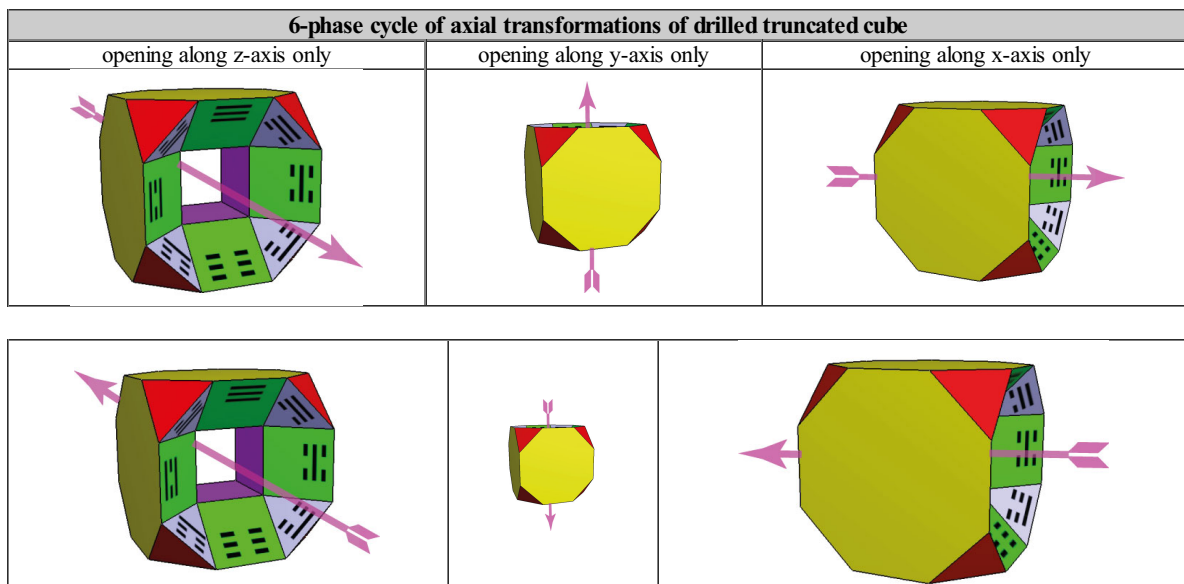
Consistent with this approach, following his study of the *Nature of Order* (2003-4), the recent work of Christopher Alexander has focused on geometric analysis Christopher Alexander (*Harmony-Seeking Computations: a science of non-classical dynamics based on the progressive evolution of the larger whole*, 2009).

Interplay of cognitive patterns in discourse on systemic change

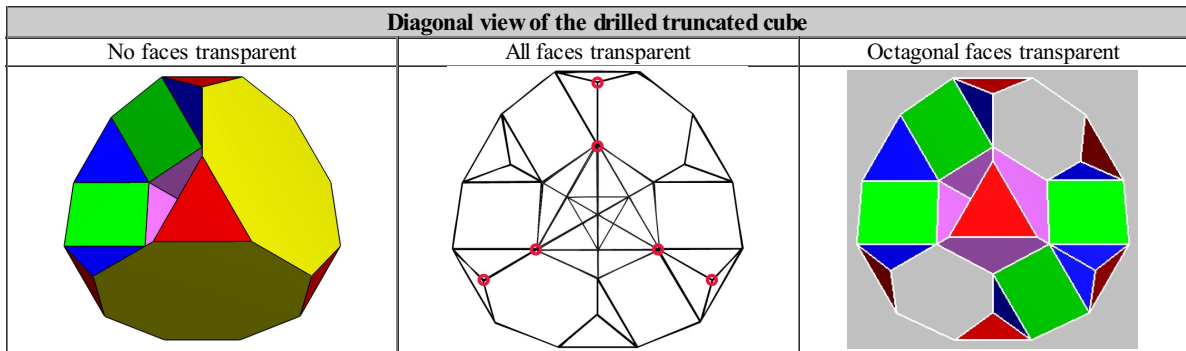
This argument derives from the ongoing detection of large numbers of systemic loops interrelating world problems -- "loops" taking the form of 3, 4, 5, and more polygons with potential interlocking between them, as described previously (*Eliciting Memorable Spheres and Polyhedra from Hyperspace: integrative connectivity of problems, strategies, themes, groups or people*, 2015). It was suggested above that the drilled truncated cube of 64 edges offered a convenient 3D polyhedron onto which the 64 convex uniform polychora (in 4D) could be mapped, if only experimentally.

Cyclic transformation of any polyhedral mapping? A simple pattern of transformation of the drilled truncated cube is illustrated by the following. The images are indicative of a way of thinking about cubic order as introduced above. They suggest a way in which the sides of a (closed) cube might open and close in relation to the axes in 3 dimensions. The opening through the toroidal hole can be understood as enabling or precluding movement in either direction -- making for 6 directional possibilities.

Given the climate preoccupation were, the hole be suggestively framed by the classic *BaGua* circle of 8 trigrams possibly arranged in the two contrasting classic orders ("Earlier" and "Later"). Together these give 2 x 8 trigrams in each direction, namely a total of 48 for all 3 dimensions -- and understood as increasing to 64 with the 4th dimension. The 6 directions are usefully renescent of the 6 basic possibilities of change from any given condition, as encoded by the system of hexagrams of the *I Ching*.

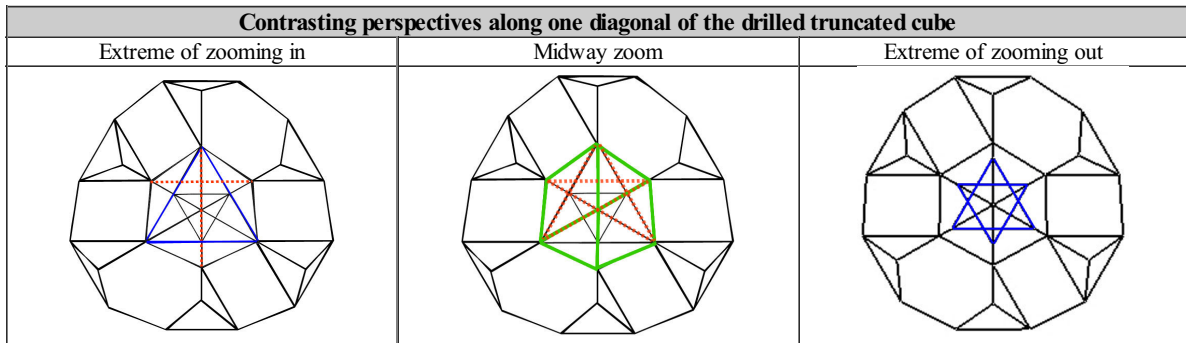


The complementary roles of closing and opening have been explored by [Orrin E. Klapp](#) (*Opening and Closing; strategies and information adaptation in society*, 1978). By contrast, the following images explore perspectives through a diagonal of the above form (as oriented below). Rendering the octagonal faces transparent offers the image on the right (below).

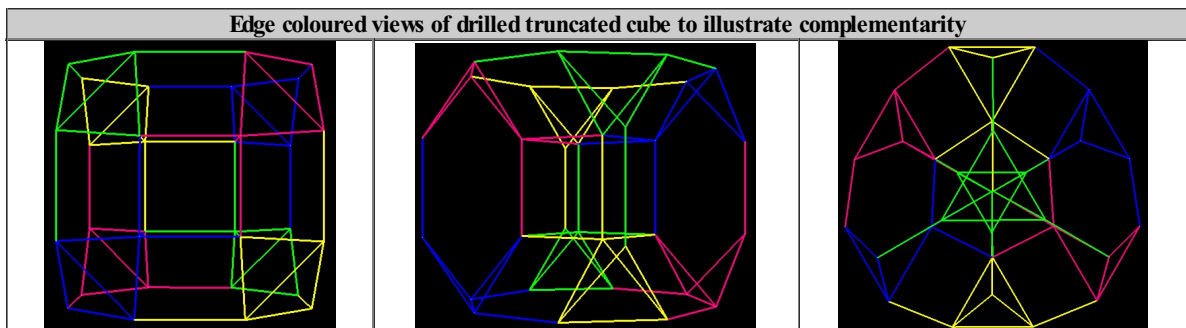


Of particular interest are the striking contrasts along the diagonal (as above) as the degree of zooming is increased or decreased (as illustrated below). According to the coincidence of edges in a given perspective through the face-transparent structure, these take the form of symbols recalling successively those of each of the three Abrahamic religions: the trinitarian triangle, the cube at Mecca, and the Star of David. In the case of the first two, associated symbols emerge from the perspective by highlighting proportions with red dotted lines. The symbols derive from the interplay between the upright triangle on the proximate end of the diagonal, the inverted triangle at the opposite end, and the inner cube. Such indications reinforce the arguments for mathematical theology, as separately explored (*Mathematical Theology: future science of confidence in belief*, 2011).

In that spirit it is also appropriate to note the pattern of 12-foldness, both in the circumference (below) and in the inner cube (above).



As a truncated cube, each triangular corner vertex can be tentatively associated with one of the 8 trigrams of the *Ba Gua* configuration of climate conditions (as argued above). In the following images, diagonally opposite corners are identically coloured. The distinctions between their patterns can be seen. As previously noted, the total number of edges coloured is 64, indicative of the pattern of conditions encoded by the 64 conditions of the *I Ching*.



Such images suggest the possibility of exploring the dynamics of such configurations as they might relate to the innovations of [Nikola Tesla](#) (*Reimagining Tesla's Creativity through Technomimicry: psychosocial empowerment by imagining charged conditions otherwise*, 2014). Especially intriguing is the possibility discussed there of *Imagining a method for adapting Tesla's insights to a psychosocial context*. Most notably, with respect to the above images, is the degree to which these can be used to demonstrate and explain the psychosocial relevance of the principles of Tesla's *rotating magnetic field*.

Mapping hexagrams otherwise: The representation in the left below constitutes an alternative to the conventional columnar representations of hexagrams in an effort to explore other mnemonic possibilities. The order follows that used in the lower right hand corner of the table in the Richard Wilhelm translation of the *I Ching*. Although this order is used in the *Wikipedia* entry on the *I Ching*, it

is not the order of the **classical King Wen sequence**. The lower, internal triangle, corresponds here to the lower trigram (in which the horizontal line corresponds to the lowest in the columnar hexagram representation). The upper lines correspond to the upper trigram (in which the central vertical line is the uppermost in the columnar hexagram representation). The convention of complete and broken line is maintained.

Mapping of <i>I Ching</i> hexagram encoding (each presented as an animation of 8 rows of 8 columnar variants)	
Triangular representation	Mapping onto double triangle pattern of Star of David

In the earlier exploration noted above (*Sustainability through Magically Dancing Patterns 8x8, 9x9, 19x19 -- I Ching, Tao Te Ching / T'ai Hsüan Ching, Wéiqi*, 2008), using one particular triangular design convention, it is therefore also of interest to explore the configuration of the 6 lines of the *I Ching* hexagram into a double triangle consistent with such traditional symbolic use. The following table **** was presented in that document (as Table 6: [Double triangular representation of hexagrams: Star of David](#))

This array has been presented in an experimental animation in a separate paper (*Mapping of I Ching hexagram coding onto Star of David*, 2008). With respect to higher dimensional ordering (discussed below), a natural group of transformations of hexagrams has been discovered during an investigation of the six-dimensional affine space over the two-element field by S. H. Cullinane (*Geometry of the I Ching*. 2006)

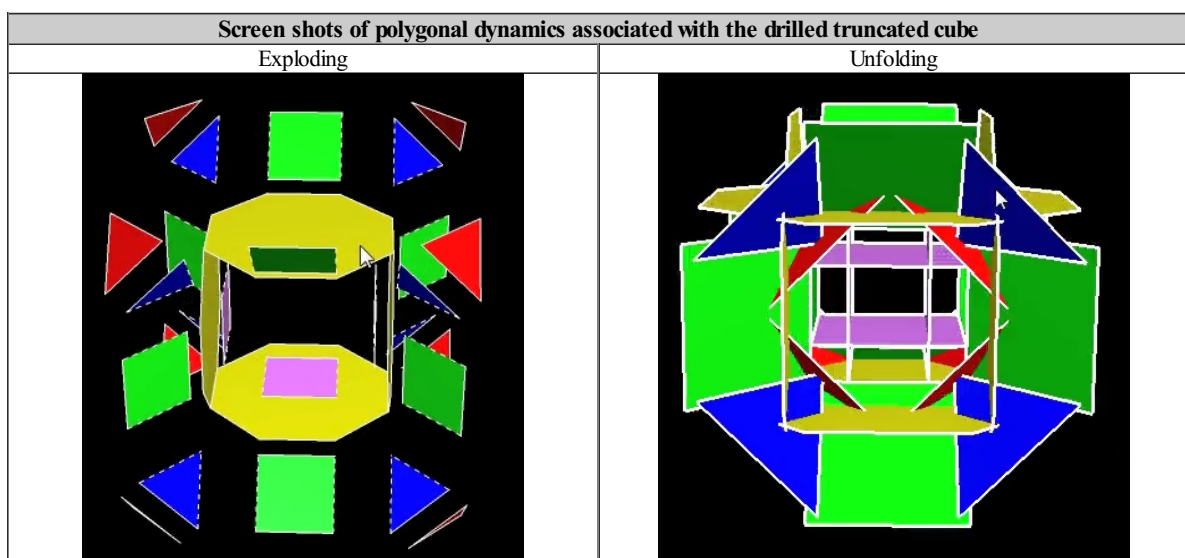
Dynamic between polytopes: However, given the emphasis here on time and dynamics in relation to systemic change, it is appropriate to understand that 3D form as implying a dynamic associated with the relations between the polygons (or polytopes) defining that form - - especially if aspects of that form are associated with the 64 polychora. The apparent invariance of the form is perhaps then to be better understood as akin to that of a **standing wave**.

Of further interest is the manner in which the drilled truncated cube might be integrated as an intermediary form in the dynamics associated with the cube nested with the other Platonic polyhedra within the rhombic triacontahedron (as illustrated above) -- and perhaps even to be considered as framing that complex within the inner cube.

Given the polygon manipulation capacities demonstrated by Pieter Huybers with the CORDIN application, the question is how to enable reflection on the role the polygonal components of the drilled truncated cube (as a striking example) might play in relation to the other polyhedra in that complex. Are the dynamics then to be understood in systemic terms -- as a complexification of the cognitive pumping cycle suggested above, perhaps in accordance with insights from [enantiodromia](#), as discussed separately (*Psychosocial Energy from Polarization -- within a Cyclic Pattern of Enantiodromia*, 2007)?

The following images offer additional ways of reflecting in visual terms on the systemic interplay of forms within a process of collective discourse in relation to systemic change and governance. Again it is appropriate to emphasize that the 64 distinctions it is sought to map can be understood as folding into and out of understandings of "climate" as might be generally understood. Climate metaphors *****

In addition to how these images may be indicative of the operation of some kind of cognitive pump or motor, the dynamic of the assembly of disparate polygons in the configurative phase of the cycles shown is a reminder of the above-mentioned challenge of configuring disparate systemic loops of problems and strategies.



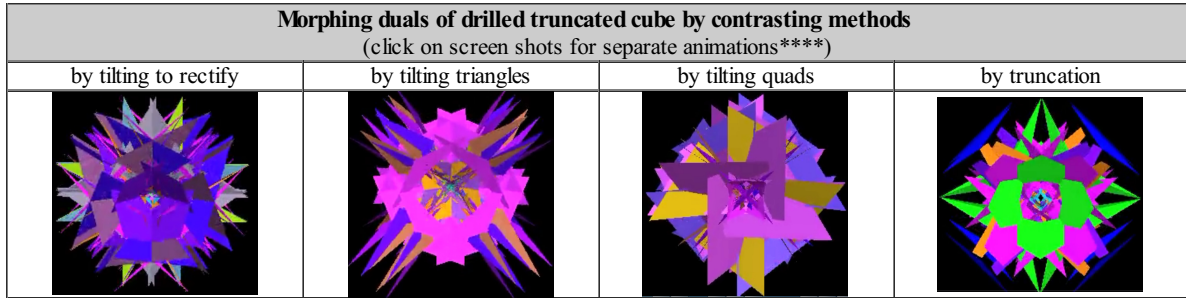
Requisite morphogenesis of cognitive models? The dynamics of unfolding and enfolding in the animations above also offer a visual illustration of the argument made earlier with respect to the quadrilemma. In particular phases in the cycle, it may be variously asserted (but not definitively) that the structure:

- is a cube
- is **not**-a-cube
- is **both** a cube **and** not-a-cube
- is **neither** a cube **nor** not-a-cube

Is there a case for recognizing any cognitive or strategic model in such terms, thereby responding to restrictive tendencies to over-determination when a degree of flexibility is required? **** Thom semiophysics

In that light, are the geometrical possibilities of morphing forms of potential relevance to how any cognitive model could lend itself to fruitful transformation, as suggested by the following screen shots and their associated animations?

- Morph duals by tilting to rectify
- Morph duals by tilting triangles
- Morph duals by tilting quads
- Morph duals by truncation

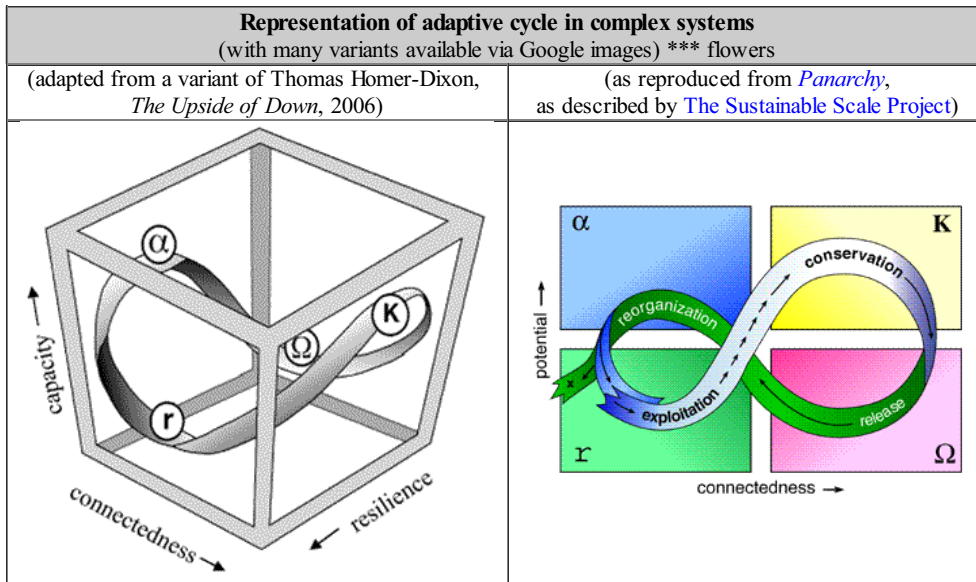


Five-fold cognitive dynamics of relevance to governance?

As noted by *Wikipedia*, the idea of [five-dimensional space](#) is an abstraction which occurs frequently in mathematics, where it is a legitimate construct. Whether or not the real universe in which we live is somehow five-dimensional is a topic that is debated and explored in several branches of physics, including astrophysics and particle physics. Given such a possibility, and the evident inadequacy of governance to date, **to what extent might a five-dimensional perspective merit careful attention with respect to psychosocial organization and dynamics?**

Clues are offered by the traditional importance associated with [quintessence](#). The perspective has been given one focus by [Peter Senge](#) (*The Fifth Discipline: the art and practice of the learning organization*, 1990). How is such insight related to the dualistic dynamics of the sidedness by which governance is undermined?

Further indications are offered by the adaptive cycle of resilience, as notably argued by [Thomas Homer-Dixon](#) (*The Upside of Down: catastrophe, creativity, and the renewal of civilization*, 2006).



A 3-fold cycle is a central feature of the [phenomenological epoché](#) of [Francisco Varela](#) (*The Gesture of Awareness*, 1999), as discussed and illustrated separately (*Present Moment Research: exploration of nowness*, 2001). [see also Claus Otto Scharmer. *Three Gestures of Becoming Aware: Conversation with Francisco Varela, January 12, 2000*].

Five-fold dynamic: In arguing for recognition of a 5-fold dynamic, it is somewhat ironic to note the correspondence between fundamental traditional understandings of East and West, as exemplified by the pentagrams of [Hygeia](#) and [Wu Xing](#), discussed separately in detail, and from which the following images were reproduced (*Cycles of enstoring forming mnemonic pentagrams: Hygieia and Wu Xing*, 2012).

Hygeia (Hugieia) Pentagram of Pythagoreans	Chinese 5-phase Wu Xing cycle
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<p>Reproduced from Hygiea entry in <i>Wikipedia</i> (G. J. Allman <i>Greek Geometry From Thales to Euclid</i>, 1889, p.26) with labels added</p>	<p>Adapted from Wu Xing entry in <i>Wikipedia</i> Interaction arrows: black=generating white=overcoming</p>

The dynamics of the tetrahedra, and those above, point to new ways of understanding the circularity of arguments and the so-called vicious cycles with which wicked problems are associated in undermining strategic coherence as conventionally understood. Arguments relating to the spiral representation below are developed separately in further ([Adaptive Hypercycle of Sustainable Psychosocial Self-organization: designing a mapping of a Chinese metaphorical pattern language](#), 2010; [System Dynamics, Hypercycles and Psychosocial Self-organization exploration of Chinese correlative understanding](#), 2010)

Preliminary indication of potential relevance of a hypercycle perspective as implied by the changes encoded by the set of hexagrams representing conditions of change (from the so-called <i>Book of Changes</i>)		
Hexagram organization by "houses" (reduced version of image above)	Indication of transformation pathways between conditions represented by hexagrams in image on left (rings rotated to simplify graphics)	Illustrative representation of hypercycle (from <i>Principia Cybernetica</i> entry)

The integrative exercise above is potentially significant in relation to the original consideration of cyclic self-organization of social systems by [Erich Jantsch](#) (*The Self-Organizing Universe: scientific and human implications of the emerging paradigm of evolution*, 1980). As discussed in a commentary on [Embracing Difference: system dynamics](#) for the [Global Strategies Project](#) in the above-mentioned *Encyclopedia*, Jantsch draws attention to the work of [Manfred Eigen](#) in molecular genetics. Eigen explores the question of how new information originates (Manfred Eigen and [Peter Schuster](#), *The Hypercycle: A principle of natural self-organization*, 1979). This is a general problem of evolution, which Jantsch relates to development and to learning.

Decision-making capacity versus Distinction-making capacity: embodying whether as weather

It is curious to note the degree to which decisions are intertwined with distinctions. In the absence of distinction, no decision is required or possible. The issue is highlighted by [confirmation bias](#) (also known as "myside bias"), effectively obscuring the potential relevance of any distinctly contrasting perspective. This has been featured by *New Scientist*: [When things fall apart: How minor human errors turn into major disasters](#) (12 August 2015). It can be understood in terms of "conformity bias". The encoding used by the *I Ching* is explicitly designed in terms of distinctions, building primary distinctions (*yin* and *yang*) into an articulated pattern of distinctions.

The primary markers for such distinction recall the language of the calculus of indications of [George Spencer-Brown](#) (*The Laws of Form*, 1969). The result of this formal exercise to separate what are known as algebras of logic from the subject of logic, and to re-align them with mathematics, is the explicit, and extremely elegant logical re-integration of the observer -- effectively the decision-maker. His final chapter, entitled "reentry into the form" commences with: *The conception of the form lies in the desire to distinguish. Granted this desire, we cannot escape the form, although we can see it any way we please* (p. 69). It ends with:

An observer, since he distinguishes the space he occupies, is also a mark... In this conception a distinction drawn in any space is a mark distinguishing the space. Equally and conversely, any mark in a space draws a distinction. We see now that the first distinction, the mark, and the observer are not only interchangeable, but, in the form, identical. (p. 76)

Vital distinctions beyond dilemmas: A valuable approach to strategic decision-making is through the frequently cited challenge of a strategic dilemma, as in the case of climate change, refugees, jobs vs. development, and the like. If climate change is more than a strategic dilemma, how might it be considered otherwise? There is some irony to the apparent relevance of a 5-fold perspective, given the manner in which the pentagram -- like the pentagon -- is occasionally a focus of suspicion, justifying a degree of preoccupation the so-called wicked problems of policy-making.

There is therefore a case for considering dilemma within the context of a pattern of little-known lemmas which are an increasingly subtle challenge to decision-making capacity:

- **Trilemma:** Little is said of the possibility of a strategic [trilemma](#), extensively described by *Wikipedia*, and linking to [Lewis's trilemma](#) in religion As noted by N. Gregory Mankiw (*The Trilemma of International Finance*, *International Herald Tribune*, 10 July 2010). A trilemma describes a situation of choice among three options, each with some inevitable problems. The trilemma stems from the fact that in most nations, economic policy makers would like to achieve three conflicting goals:
 - Make the country's economy open to international flows of capital.
 - Use monetary policy as a tool to help stabilize the economy.
 - Maintain stability in the currency exchange rate.Variants have been argued (Joshua Aizenman and Rajeswari Sengupta, *The Financial Trilemma in China and a Comparative Analysis with India*; Gary A. Dymksi, *The Financial Trilemma and the Future of American Banking*, 2014; Maurice Obstfeld, et al, *Financial Stability, the Trilemma, and International Reserves*, *American Economic Journal*; Maurice Obstfeld, *Trilemmas and Trade-offs: living with financial globalisation*, Bank of International Settlements, 2015)
- **Quadrilemma (or tetralemma)** : Absent from *Wikipedia*, but noted above in the argument of Kinhide Mushakoji. As [tetralemma](#), this features prominently in the classical logic of India regarding fourfold negation (*Notes on the Tetralemma*, *Twelve Links*, 2006). It is a seldom-used and unconventional term describing a problem requiring a choice among four alternatives. An essay on the subject of health care options gave focus to use of the term (Burton A. Weisbrod, *The Health Care Quadrilemma: an essay on technological change, insurance, quality of care, and cost containment*, *Journal of Economic Literature*, 29, 1991)
- **Pentalemma:** Although various references are made, the most specific are the *The Pentalemma: an Erisian elaboration on the Catsukoti* (*The Open Source Religion Social Network*, 2006) and the *Need to recognize quintucrisis or this five headed monster* (*Global Sustainability Project of Rediluvism*). Of greater relevance to the argument here is the point made with regard to the framework of [Johan Galtung](#) (*Toward a Conflictology: the quest for transdisciplinarity*, 2008):
 - Expanding the conflict horizon from the dilemma to the trilemma yields compromise, a sometimes adequate way out; expanding to the Buddhist tetralemma yields the both-and and the neither-nor as ways out of a dilemma and can take the more advanced forms of creating new realities as negative or positive transcendencies. Combining the trilemma and the tetralemma, we get the the five-point outcome horizon the present author uses often in theory and in the practice of mediation,
- **Hexalemma:** Curiously the hexagram encoded decision-making conditions of the I Ching can be recognized as a set of 64 hexalemmas. Some reference is made to hexalemma in relation to *Derrida and Madhyamika Buddhism: from linguistic deconstruction to criticism of onto-theologies* (*Chinese Buddhist Encyclopedia*). In related discussion by Cai Zongqi (*Derrida and Seng-Zhao: linguistic and philosophical deconstruction*, *Philosophy East and West*, 1993):
 - Maadhyamika deconstructions and self-deconstructions follow a clearly directional path, defined by step-by-step advancements and negations of lemmas. The Maadhyamika tetralemma (*catuskoti*) effects a radical negation of all existing ontotheological positions and, if seen from these positions, represents a "non-sensical" position. When Ji-zang... undertakes the self-deconstruction of this Maadhyamika tetralemma, he continues to follow the path of *reductio ad absurdum* and reaches a hexalemma: neither-affirmation-nor-denial-of-both-being-and-nonbeing. This hexalemma itself seems to exemplify the most mind-taxing, the most "non-sensical" of the Maadhyamika "non-sense". Unlike Derrida, Maadhyamika Buddhists do not see their deconstructive "non-sense" as a consequence that needs justification. For them, such "non-sense" helps lead to religious enlightenment beyond language and conceptuality. Their deconstructive endeavors are geared to none other than this dawning of Nirvana upon the transcendence of language and conceptual thinking.
- **Heptalemma:** Allegedly significant in Jain Dharma (*Saman Suttam*)
- **Octalemma:** Discussed in relation to *Strategic Octalemmas* (2009) and by Edward Anderson to (*Problem of Time in Quantum Gravity*, 2012). The Euthyphro "dilemma" is restated as an octalemma by Richard Goode (*Nothing Is Permitted: an argument for moral eliminativism*).

Reflexivity and higher orders of cybernetics: So framed it is interesting to speculate on the relevance of such insights -- and the potentially "slippery" reading of the marks constituted by any hexagram -- with respect to currently emerging distinctions between different orders of cybernetics. These could be considered fundamental to the challenges of governance of a complex civilizational system endeavouring to navigate the adaptive cycle of resilience. Insights into more appropriate means of managing the associated connectivity and disagreement are now suggested by exploration of higher orders of cybernetics ([Maurice Yolles](#) and Gerhard Fink, *A General Theory of Generic Modelling and Paradigm Shift: cybernetic orders*, *Kybernetes*, 44, 2015).

These notably take account of self-reflexivity -- itself to be distinguished in varying degrees meriting exploration and recognition. As phrased by the authors:

- **First-order cybernetic feedback** is typically seen to be associated with Newtonian mechanical objectivity. It is therefore positivist, centring on systemic objects being observed by some external objective observer
- **Second-order cybernetics** embraces radical constructivism, allowing for instrumental learning and agnosticism towards objective reality..
- **Third-order simplex cybernetic spaces** should be seen to represent the observed and observing systems together forming another system, from which a new relativistic interactive worldview arises from self-observing viewers that have self-observed worldviews. Third-order cybernetics is also characterised by the way it resolves undecidabilities, these being constituted in the logic of the present moment by the anticipations of the system.
- It is possible to formulate a statement of **fourth order cybernetics** in terms of the higher levels of relationship between observed and observing systems.... However, a more pragmatic and satisfactory... approach allows one to respond to the variety in a complex situation with an invariant generic construct more capable of generating requisite variety. Higher orders of simplex

modelling have this capability since they provide new ways of explaining complexity by representing external influences as internal imperatives, thereby creating greater complexity for the immanent agency dynamics, but reducing undecidability. To explain the use of higher order models, rather than use observers relationships, a more minimal way is to adopt a concept of generic loop learning..., even if this redirects us away from... adaptability. Here then, fourth order cybernetics could be represented as triple loop generic learning (beyond the double loop generic learning of third cybernetics), referring to the way in which knowledge is not only acquired but also identified.

- On the way to developing our general theory, the paper gave examples of first, second, third and fourth order simplicity. Higher orders of simplex modelling under complexity exist through the conceptual generic concepts that define them. This is the result of conceptual emergence, important to processes of systemic modelling. So far we have not attempted to move beyond fourth order simplicity, awaiting for new concepts able to generate **fifth and higher orders of simplicity**. However, we have shown that higher order simplex models can be generated through the use of recursion

Especially relevant is the earlier collaboration of the principal author with a Chinese scholar (Ye Zude and Maurice Yolles, *Cybernetics of Tao, Kybernetes*, 39, 2010). As noted there:

Here, **autopoiesis** is a term that can now be simply seen as a network of processes that enables noumenal activity to become manifested phenomenally, and in autonomous systems this is conditioned by **autogenesis** -- a network of principles that create a second order form of autopoiesis that guides autopoietic processes. Autopoiesis may be thought as a process in which virtual images are manifested phenomenally. Autogenesis provides a network of principles that ultimately drives autopoiesis.

Just as systemic understanding of arrogance can be explored in terms of the mysterious nature of gravity, it is possible that degrees of self-reference can be fruitfully distinguished from the degrees of self-satisfaction which undermine flexibility in collective decision-making.

Music as a key to subtle distinction-making: Whether in terms of higher orders of dimensionality, lemmas or cybernetics, the subtlety implied would seem to defy the comprehension of most. Clearly governance is most readily grasped and pursued in terms of binary logic, even if this results in dilemmas. The possibility of subtler distinctions can however be explored otherwise through music where distinctions are readily recognized worldwide within tuning systems -- and in the light of an appreciation of contrast, complementarity and harmony.

More generally the argument could be developed through recognition of aesthetic appreciation of correspondences transcending the logical difficulties of the rational mind (*Theories of Correspondences and potential equivalences between them in correlative thinking*, 2007). The argument has been remarkably developed by Douglas Hofstadter (*Gödel, Escher, Bach: An Eternal Golden Braid*, 1979). A relevant development of this perspective was made in his subsequent work with Emmanuel Sander (*Surfaces and Essences: analogy as the fuel and fire of thinking*, 2013).

Curiously, in imagining 4D polychora mapped in some way onto 3D polyhedra, the conventional significance of edges, vertices and faces needs to be open to alternative interpretation -- especially given the dynamic dimension and its implications for transformative change over time. As stressed above the issue of coherent comprehension of complexity then becomes fundamental.

It is in this sense that their proportions and axes of symmetry may be far more readily understood (by many) through sensitivity to harmony in musical terms, as indicated above in the light of the work of Ernest McClain (*Myth of Invariance: the origins of the gods, mathematics and music from the Rg Veda to Plato*, 1976; *The Pythagorean Plato*, 1978). The point can be emphasized in relation to governance (*A Singable Earth Charter, EU Constitution or Global Ethic?* 2006; *Clues to Patterns of Dialogue from Song*, 2011; *Aesthetics of Governance in the Year 2490*, 1990).

In terms of comprehensible coherence, there is then a case for exploring the degree of correspondence between the following, and the enabling role of symmetry in music and other aesthetic forms (poetry, architecture, etc). Aspects of the argument are developed by Tony Robbin (*Shadows of Reality: the fourth dimension in cubism, relativity, and modern thought*, 2006). In terms of memorability, it is appropriate to note that online gaming may cultivate sets of fictional deities of various sizes.

Correspondences in dimensionality?					
"Dimensions" of physics	Logic	Cybernetic feedback	Governance	Religious pantheons	Music Pitch classes (notes) per scale
1		1st order	dictatorship imperialism; hegemony	Monotheism	monotonic: used in liturgy, and for effect
2	dilemma	2nd order	2-party: duumvirate	God vs. Satan	ditonic: prehistoric music
3: space	trilemma	3rd order	3-party: triumvirate ; troika	Trinitarianism	tritonic: prehistoric music
4: spacetime	tetralenms	4th order		Systems of four gods	tetratonic: prehistoric music
					pentatonic:

5: branes	pentalemma	5th order	Group of 5	5 Dhyani Buddhas	common in folk and oriental music
6	hexalemma				hexatonic: common in Western folk music
7	heptalemma		Group of 7		heptatonic: most common in modern Western scale
8	octalemma		Group of 8	8-fold way of Buddhism	octatonic: in jazz and modern classical music
10: spacetime (string theory)			Decemviri		
11: supergravity (M-theory)					
12:			Quorum of the Twelve	Dodekatheon; / Dii Consentes 12 Tribes of Israel, 12 Apostles, 12 Imams	dodecapphony
			Group of 20		
26: superstring theory			Vigintisexviri		
"Many": monster symmetry group	polylemma		multi-party; oligopoly	pantheons (Hindu, etc)	

Various explicit and implicit in the above arguments are the cognitive implications of increasing degrees of existential self-reference implied by increasing dimensionality. This can be speculatively explored up to a 20-fold distinction (*Distinguishing Levels of Declarations of Principles*, 1980).

Compactification and "cognitive intensionality": As queried above, why is it assumed that the challenges of global governance can be fruitfully addressed within the framework of a 3-dimensional worldview? Why is it legitimate that physics should argue the need for 26 dimensions (Ji-Huan He, et al., *Twenty-six dimensional polytope and high energy spacetime physics?* 2006)? The latter presents the geometrical forms and the combinatorial properties of higher dimensional polytopes for the dimensions from $n = 4$ to $n = 12$ as well $n = 26$.

Fundamental to any argument with an emphasis on recognition of patterns of numbers, is the case made from a cognitive psychological perspective by George Lakoff and Rafael Núñez (*Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2000) -- further to Lakoff's earlier collaboration with Mark Johnson (*Philosophy In The Flesh: the embodied mind and its challenge to Western thought*, 1999). In the former work, considerable emphasis is placed on the role of metaphor in mathematics. Given the arguments for cognitive embodiment by Lakoff, and separately by his co-author (Mark Johnson, *The Meaning of the Body: aesthetics of human understanding*, 2007), a further thread meriting exploration is that of structural morphogenesis as understood experientially -- notably in the light of the semiophysics of Rene Thom ***, as separately discussed (*Reframing the Dynamics of Engaging with Otherness: triadic correspondences between Topology, Kama Sutra and I Ching*, 2011).

Despite the deprecation of cognitive subtlety by physics -- however challenged by the role of consciousness with respect to observation -- there is increasing recognition of issues of self-reference and reflexivity (Hofstadter, 1979; Hilary Lawson, *Reflexivity: the post-modern predicament*, 1985). This is of particular concern in the higher orders of cybernetics explored by Yolles and Fink (2015). The issue may be related to the locus of the "extra dimensions" by which physics is rightly embarrassed. Understood in terms of compactification, they are understood to be "curled up" in some special way (*Curling Up Extra Dimensions in String Theory; How can one imagine curled up dimensions?*).

A relevant conjecture is offered in this respect by Arthur Young (*The Geometry of Meaning*, 1976):

If one thinks of normal time as being very long (even if not infinite), then inverse time (1/T) would be very short -- eternity in an instant. In the photon, it has long been known that the energy is inversely proportional to time ($h=ET$). This implies that in an "anti" world there might be an unlimited amount of energy in an instant of time, reversing our normal relationship between size and importance. The compaction of time would give it the character of omnipresence -- not going "backward" in time, away from the present, but instead going more deeply into the present. (p. 81)

Are there dimensions of governance and climate change which merit description in terms of being intensively "curled up"? (*World Introversion through Paracycling: global potential for living sustainably "outside-inside"*, 2013). However inadvertent, this may be the essential implication of an interpretation of the title of the compilation by Stephen Hawking (*The Dreams That Stuff Is Made Of: the most astounding papers of quantum physics -- and how they shook the scientific world*, 2011).

Given the implications of dice for decision-making, with its game-playing implications, it is ironically appropriate that the dice capable of enabling decisions in a full spectrum of dimensions have been described and remarkably illustrated by Jonathan Bowers (*Dice of the*

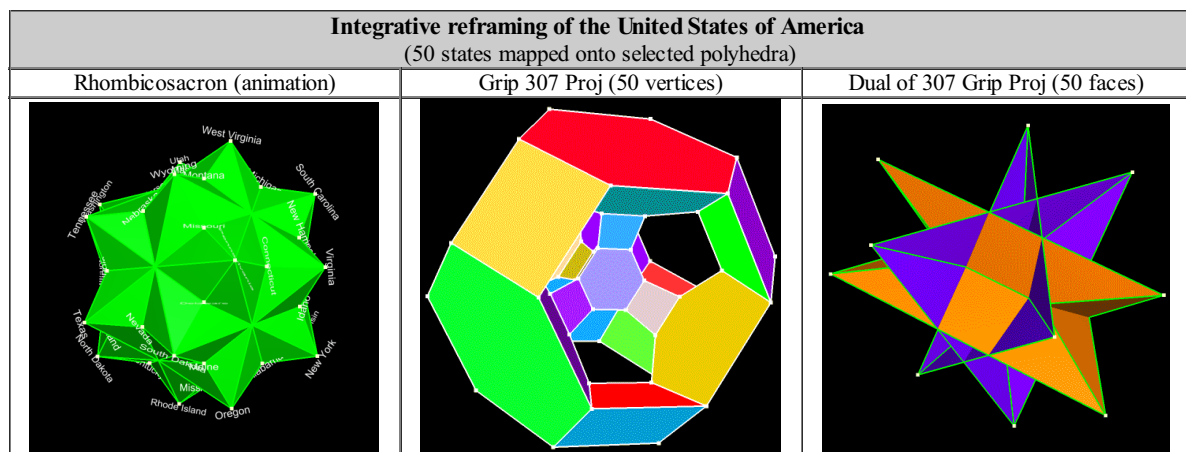
Dimensions; Four Dimensional Dice Up To Twenty Sides). The articulation notably makes use of the acronyms he has promoted for polychora.

From star-dom to whizdom to isdom?

Star-dom: Whilst polyhedra, especially those in 4D, do not commonly feature in global discourse, the [truncated icosahedron](#) -- as the memorable soccer football -- features prominently and universally in global exchanges, however these may be qualified in terms of game-playing, gambling and corruption. The contrast with 2D depictions of polygons merits careful consideration in the light of the symbolic significance so remarkably and fundamentally associated with symmetrical polygons in various religious, military and political symbols (in the form of stars) -- most notably figuring in the iconography of flags ([national flags with variously-pointed stars](#)).

There is thus the possibility that the current quest for any form of integrative reconciliation in the Middle East is "looking in the wrong place". There is a case for identifying the polyhedral form within which the 6-pointed [Star of David](#) and the 5-pointed [Star of Islam](#) -- and of many others -- can be reconciled geometrically (if only in polychora). Rather than framing conflict in terms of the 2 sides (exemplified by those stars), what might be the polyhedral form through which new insight could be enabled? The approach was specifically explored and illustrated in the case of the Middle East (*[Middle East Peace Potential through Dynamics in Spherical Geometry: engendering connectivity from incommensurable 5-fold and 6-fold conceptual frameworks](#)*, 2012).

Perhaps more provocatively, in the case of national flags depicting multiple stars, this multiplicity could be understood as an inherent lack of integrity, or one which can otherwise only be implied at best. This is the case of the USA, with the [50 5-pointed stars on its flag](#). The question might then focus on the polyhedral form which would best hold all 50 together -- whether as the vertices or faces of such a polyhedron. The simplest is the [rhombicosacron](#) with 50 vertices (being the dual of the [rhombicosahedron](#)). Stella4D indicates 7 other possibilities with 50 vertices, and 8 with 50 faces, including the rhombicosahedron. Such 8-fold possibility lends itself to a mapping in its own right. Edges could provide possibility for strips of red, white, blue.



With respect to the integrity of the European Community, a similar argument could be made with regard to the [Flag of Europe](#), consisting of a circle of 12 5-pointed stars. These of course are readily mapped onto a dodecahedron -- as well as onto more complex polyhedra, in the event of the extension of the Community. However the number of stars remains constant at 12, despite adherence of other states to the Community (currently 28) as well as the use of that flag by the Council of Europe (now with 47 member states). What complex polyhedron would enable memorable reconciliation of such patterns? Would alternation between several be appropriate in the European proposals for so-called [variable geometry](#) (*[Alternation between Variable Geometries](#)*, 1985)?

With respect to any issue, why is the focus currently on achieving consensus, unanimity, or bipartisanship, when greater strategic flexibility is offered by a polyhedral framework? **Instead of "which side are you on", the challenge becomes one of eliciting new forms of harmony from the complementary sides within a polyhedron** -- possibly coloured accordingly. Again it is probable that the difficulty of managing "sides" in any dispute is due to their representation in 2D -- effectively flattening what might otherwise be an appropriate polyhedral mapping. This "sidedness" might well be understood in terms of "beating the binary drum" -- recalling the oversimplification with which drumming has been associated in the past.

Given the extreme symbolic importance attached to stars and their geometry, it might be asked why consideration is not given to the geometrical process of so-called [stellation](#) of polyhedra, as argued with respect to the transformative insights of Christopher Alexander (*[Geometrical configuration of Alexander's 15 transformations](#)*, 2010)

From whiz-dom to wisdom: With the possibility of configuring states together as a polyhedron, there is the interesting implication that the key point in any discourse is effectively bounced from one side to another, as in many ball games. So framed the issue can then be understood as enhancing the quality of the passing patterns. As a container, the polyhedral context then constitutes a form of whiz-dome, as can be explored with respect to web site design (*[Transforming Static Websites into Mobile "Wizdomes": enabling change through intertwining dynamic and configurative metaphors](#)*, 2007).

Such possibilities point to the challenge of how wisdom may be fruitfully embodied by a collectivity -- collective wisdom in contrast with collective intelligence -- and how this might be reflected in a wizdome potentially characterized by an appropriate set of interrelated processes. The approach can be applied to the functional integration of global strategic coalitions -- Group of 5, Group of 7, Group of 20 -- as ****

Isdom?: The above argument has strongly emphasized the importance of time as a fourth dimension virtual to strategic coherence in governance. As argued separately, many studies explore the importance of the distinctions in the sequence from "data", through "information", then on to "knowledge", and finally to "wisdom" (*The Isdom of the Wisdom Society: embodying time as the heartland of humanity*, 2003). At each stage there is a much-studied challenge of "management" (as in "information management" and "knowledge management"). Arguments are also made for the importance of a corresponding "information society" or of a "knowledge society" -- perhaps expressed as a "knowledge-based society". But clearly it is easiest to argue the case for an "information" focus, especially to hardware, software and information vendors -- hence the title of the UN [World Summit on the Information Society](#).

It is more challenging to make a case for a "knowledge society", especially since "knowledge management" is in process of being disparaged as a fad term lacking any real content -- notably in those corporate environments that claim to practice it. And yet it is precisely the transfer of knowledge, in the form of "know-how" that has been a preoccupation of the United Nations over many development decades.

But, as Margaret Mead is reported to have declared on a memorable occasion: "We know all we need to know". The problem is that "we" do not know how to fit it together into a meaningfully communicable pattern which could catalyze appropriate action. As a philosopher, Mary Midgley (*Wisdom, Information and Wonder: what is knowledge for?* 1989) asks the pertinent question:

In what sense is a thing known if five hundred people each know one constituent of it and nobody knows the whole? Or again; what if this truth has a thousand constituents and half of them are not known to anyone, but only stored in libraries? What if all of them only exist in libraries? Is it enough that somebody knows how to look them up if they should ever be needed? Indeed is it enough that this person should have access to a system which will look them up? Does the enquirer even have to understand the questions which these truths answer? (p. 6)

Given the challenges of information overload and attention fatigue, the issue is very specifically highlighted with respect to text of any length -- as with that of global plans. The point has been recognized with respect to verification of a complex mathematical proof based on hundreds of articles spread across a wide range of journals, as in the case of the [Monstrous moonshine](#) conjecture.

When does inclusion of explanation exacerbate rather than alleviate? When does substitution of links become dysfunctional -- given the issue of a link-too-far, namely "link fatigue"? What can be appropriately "re-membered"? When does their absence of explanation exacerbate incomprehension and misunderstanding? How is complexity then to be rendered coherent? To what extent are either authors, reviewers or readers able to re-member a complex network of argument? Such issues of engaging with insight of any higher order appropriate to strategic governance merit particular appreciation (*Engaging with Insight of a Higher Order: reconciling complexity and simplicity through memorable metaphor*, 2014; *Requisite Meta-reflection on Engagement in Systemic Change?* 2015; *Investing Attention Essential to Viable Growth*, 2014)

Curiously transformations between polytopes -- through processes such as truncation -- offer means of exploring the issue. Does hypercompression of texts (as with Tweets), combined with their hypermultiplication, enable a knowledgable collectivity, as is increasingly assumed?

In fact there is no "we" with a shared awareness permitting coherent action. But as is noted on the cover of *The (Updated) Last Whole Earth Catalog* (1974): *We can't put it together; it is together*. It is wisdom that is called upon to respond to such dilemmas -- not knowledge. The polychoral approach above offers a dynamic framework through which to envisage the nature of a "wisdom society" -- as distinct from the much-studied "knowledge society".

The fundamental "dilemma" is evident in the higher the sense of possessing the answer for others, the greater the probability of that answer being denied as adequate by others. As modes of subunderstanding, how disparate modes of knowing are to be configured recalls the challenge of spherical packing of distinct polyhedra (*Implication of the 12 Knights in any Strategic Round Table*, 2014).

From space-ship design to time-ship embodiment as a requisite metaphor of governance

Spaceship Earth? The argument above stresses the extent to which engagement with time is minimized with respect to governance of strategic issues such as climate change -- in favour of habitual spatial preferences. So framed many collective initiatives may be understood as the creation of spatial frameworks in which the time dimension is secondary -- typically characterized by short-termism. This is only too evident in the elaboration of global action plans and the institutional frameworks designed to implement them.

This could be understood metaphorically as a commitment to spaceship design -- but with only limited capacity for travel through time. The point is exemplified by the various arguments for the appropriate governance of "Spaceship Earth", as with that of R Buckminster Fuller (*Operating Manual for Spaceship Earth*, 1969).

Timeship dimensionality? As discussed separately (*Embodying a Timeship vs. Empowering a Spaceship*, 2003), the metaphor of "space" vs "time" can be used in order to raise the question as to whether mainstream thinking (especially western) is now locked into a form of "space-based" thinking. This might be understood as distorting recognition of any "time-based" thinking that could be vital to meaningful development of society -- thereby ignoring the insistence of physicists on integrative understanding of [spacetime](#). In the light of [containerization](#) as a significant indicator of the globalization process, the point is made otherwise by a remarkable consideration of meta-containers by Alexander Klose (*The Container Principle: how a box changes the way we think*, 2015).

Klose frames his argument in the light of the seminal consideration of the container by George Lakoff and Mark Johnson (*Metaphors We Live By*, 1980):

According to Lakoff and Johnson, the primary... ontological metaphor is a container metaphor: *Each of us is a container, with a bounding surface and an in-out orientation. We project our own in-out orientation onto other physical objects that are bounded by surfaces. This we also view them as containers with an inside and an outside.* As a rule, ontological metaphors are not perceived as such, but rather as "natural language" that names the perception of things directly: *self-evident, direct descriptions of natural phenomena.*

According to this theory, by projecting their container-like self-perceptions onto the objects around them, the subjects separate themselves as closed-off, container-like entities from the containerlike objects in their environment. They constitute themselves as subjects separated by borders from the objects that surround them. Thus, humans conceive of themselves as containers through the metaphors that they choose within their "concept system", and they likewise form their surrounding (material) beings and objects. (p. 66-67)

As author of a seminal paper on *The Economics of the Coming Spaceship Earth* (1966), [Kenneth Boulding](#) later highlighted this role of metaphor in provocative terms: *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.* (*Ecodynamics: a new theory of social evolution*, 1978). Given the questionable consequences of inappropriate premature closure, metaphor (like parable) may indicate clues to creative self-reflexivity (*Paradoxes of Engaging with the Ultimate in any Guise: living life penultimately*, 2012).

Clearly the argument extends to global civilization and its governance by a so-called [international community](#) which may well be best understood as a metaphor ([Michel Rocard](#), *What Is the International Community?* *Project Syndicate*, 30 May 2013). Does viable global governance require the embodiment of a multidimensional container to which polychora offer pointers, as discussed above and separately (*Strategic Embodiment of Time: configuring questions fundamental to change*, 2010)? Of further relevance, weather could be considered the systemic container of civilization, whether metaphorically or otherwise. Exploiting the wordplay, whilst weathering crises is a valued requisite of governance, the ability to whether crises calls for insights of a more time-sensitive form.

The question so posed follows from previous explorations of the way in which thinking might be locked into a "static" approach, when a "dynamic" ([out-of-the-box](#)) approach could be more fruitful (*From Statics to Dynamics in Sustainable Community*, 1998). The issue is highlighted by the language currently used in envisaging a plan with which to "confront" ISIS. How is any plan to be viable when it derives from the geometry of a box-like strategic container? On the basis of what curiously twisted geometry does the plan "confront" the other "side"?

In quest of a means of transcending global "container-logic" -- perhaps to be recognized as "project logic" -- there is a case for recognizing the clues to "timeship embodiment" offered by music, most notably its role in African cultures (*Knowledge Gardening through Music: patterns of coherence for future African management as an alternative to Project Logic*, 2000). This would follow from the widespread natural musical capacity to extend distinction-making from the 2-fold to the 8-fold, at least (as noted above).

Given the focus above on the 4th dimension and polychora, such speculation can be extended (*Timeship: Conception, Technology, Design, Embodiment and Operation*, 2003). The latter included sections on:

Conceiving a timeship
Varieties of possible timeship
Web as timeship
Being the experiment

Imaginative technologies:
Comprehending new technologies
Array technology
Synchronic lines

Timeship design and operation:
Timeship design
Timeship embodiment
Timeship operation

The extent to which time is ignored, as with respect to resource overshoot, overpopulation and environmental degradation, suggests that complex Spaceship Earth designs may well be developed which prove unable to navigate the crises of the future as a Timeship. This recalls the adage: *the operation was a complete success, but unfortunately the patient died.* Sustainability (as currently conceived) might be said to be about achieving stasis and maintaining the status quo -- an idyllic aspiration to eternal timelessness.

With respect to the forthcoming UN Conference on Climate Change in Paris, there is considerable irony to the fact that it will be immediately preceded by the [World Radiocommunication Conference](#) (Geneva, November 2015) at which a decision on whether to [abolish the leap second](#) will be made. The challenge of climate change can of course also be framed in terms of time -- as with other crises such as the influx of refugees engendered by religious doctrine and systemic negligence.

With respect to the leap second, the irony is evident in the framing of that issue by the *New Scientist* -- using as cover title: *A Glitch in Time: we've lost control of the fourth dimension* (27 June 2015). Disagreement over whether to abolish or retain the leap second epitomizes the difficulties of discourse on even the most technical matters. However, with heavy symbolic implications and unknown consequences, in this case it is a matter of abandoning temporal connectivity with the universe in favour of synthetic time for the convenience of local busyness -- perhaps consistent with the arguments of [Jeremy Rifkin](#) (*Time Wars: the primary conflict in human history*, 1987).

Polychora and governance? If all polytopes (polyhedra) are indeed to be understood as systems, **what might be the polytopes with which the system of global governance could be most fruitfully associated?** Or should the answer be framed in terms of multiple polytopes (polygons, polyhedra, polychora) -- namely **a dynamic system of polytopes?**

Given the claims and multidimensional sophistication of mathematics, some trace of the relevance of polytopes and polychora to governance might be expected -- especially given the incidence of [wicked problems](#). This is not the case. However given the importance of [game theory](#) to strategy theory, there is an extensive literature on [Nash equilibria](#) polytopes (Robert Nau, et al. *On the Geometry of*

Nash Equilibria and Correlated Equilibria, *International Journal of Game Theory*, 2004; Yannick Viossat, *The Geometry of Nash Equilibria and Correlated Equilibria and a Generalization of Zero-Sum Games*, 2003). The notorious strategy **Mutually Assured Destruction** (MAD) is a form of Nash equilibrium in which neither side, once armed, has any incentive to initiate a conflict or to disarm.

In this respect, with governance recognized as a particular aspect of knowledge organization, it might be asked whether the relevance of polytopes of higher order merit consideration with regard to the fragmented management and organization of knowledge enabling governance -- and, most surprisingly, that if mathematics itself (*Is the House of Mathematics in Order? Are there vital insights from its design*, 2000). One interesting exception to the non-consideration of polytopes is the *Concept Visualization of Internet Traffic* (RaellicSystems, 2013). This is notably based on moving fields of Schläfli-Hess polychora and hyper-polygons.

Emergence of machine intelligence? Polychora do however figure in a discussion of *The Universal Mind: the evolution of machine intelligence and human psychology* (Xiphias Press, 2013). This occurs in a period of both a renewed \$100 million investment in the search for extraterrestrial intelligence and a provocative argument by the distinguished astronomer **Martin Rees** (*A New Hunt for ET could well find AI on non-Earthlike Worlds*, *New Scientist*, 13 August 2013). From his perspective, advanced AI would not be confined to Earth-like biospheres, and would evolve beyond such constraints into more powerful inorganic intellects on whose existence the search could well be focused. As he indicates, non-biological "brains" are likely to have insights as incomprehensible to humans as is string theory to a mouse.

If the understanding of "intelligence" and "life" is extended to include the inorganic, the nature of the order embodied by extraterrestrials may be imagined otherwise -- with implications for the psychosocial identity of biological life (*Imagining Order as Hypercomputing: operating an information engine through meta-analogy*, 2014; *Encountering Otherness as a Waveform In the light of a wave theory of being*, 2013; *Being a Waveform of Potential as an Experiential Choice: emergent dynamic qualities of identity and integrity*, 2013). Given the challenge of engaging with "aliens" on Earth, the argument can be taken further (*Sensing Epiterrestrial Intelligence (SETI): embedding of "extraterrestrials" in episystemic dynamics?* 2013). Unfortunately, like Schrodinger's cat, Rees's mouse could be considered a perfect embodiment of the string theory for which physicists so questionably endeavour to provide an "ex-planation" -- reminiscent of the point made by **Pablo Triana** (*Lecturing Birds on Flying: can mathematical theories destroy the financial markets?* 2009).

Of related interest to such understanding of "life" are the explorations of number patterns by cosmologists and mathematicians, as reported by Christopher Kemp (*Is the answer to life, the universe and everything 37 ?*, *New Scientist*, 20/27 December 2014) and discussed separately (*Memetic Analogue to the 20 Amino Acids as vital to Psychosocial Life? Number 37 as indicative of fruitful pathways of transformation?* 2015). Might the mystery of life and consciousness be far more intimately related to the dynamics between polytopes of higher dimensionality? Arguably the pattern of metabolic pathways so vital to life could be more fruitfully visualized on some such form.

With respect to the engagement of humanity with climate change, the ET criteria for higher orders of intelligence may well be associated with the capacity to mirror the environment consciously, exemplified by a **mirror test** of unexpected nature (*Self-reflective Embodiment of Transdisciplinary Integration (SETI): the universal criterion of species maturity?* 2008)

Implication of Euler's insights for strategic discourse? Given the emphasis above on the dysfunctional sidedness of arguments, notably in relation to climate change, it is appropriate to conclude with reference to **Euler's classical formula** (Abigail Kirk, *Euler's polyhedron formula, Plus Maths*; David S. Richeson, *Euler's Gem: the polyhedron formula and the birth of topology*, 2012):

$$V - E + F = 2.$$

This seemingly simple formula encapsulates a fundamental property of all 3-dimensional polyhedra -- where the number of **vertices** (V), less the number of **edges**, plus the number of **faces** is equal to 2. Known more generally as the **Euler characteristic**, this is also true of a sphere. It is however equal to 0 in the case of a torus or a Möbius strip, suggesting further considerations, as explored by **Steven Rosen** (*Topologies of the Flesh*, 2006; *Science, Paradox, and the Moebius Principle*, 1994)..

Given the metaphorical use of related terminology, it might be provocatively asked whether some corresponding formula exists regarding the "sides" or facets of any argument (as **faces**), the fundamental principles or values cited (as **vertices**), and the connectivity recognized (as **edges**) -- possibly as "pillars" (*Coherent Value Frameworks: Pillar-ization, Polarization and Polyhedral frames of reference*, 2008).

Does a coherent argument and organization then effectively take a polyhedral form -- whose memorability is associated with its axial symmetry and proportions (*Polyhedral Empowerment of Networks through Symmetry: psycho-social implications for organization and global governance*, 2008)? There is no lack of data by which this could be explored.

Can further insights of potential relevance to governance be derived from the cognitive indications of the arguments with respect to the more complex **Euler identity** of **George Lakoff** and **Rafael E. Núñez** (*Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2000). These are framed in terms of metaphor, :

$$e^{\pi i} + 1 = 0.$$

A much quoted comment with reference to the above has been made by **Benjamin Peirce**: *It is absolutely paradoxical; we cannot understand it, and we don't know what it means, but we have proved it, and therefore we know it must be the truth*. Metaphor has been exploited to facilitate its comprehension (*Understanding Without Proof*, 2004; *Intuitive Understanding of Euler's Formula*, 2010; Chris Fields, *Metaphorical Motion in Mathematical Reasoning: further evidence for pre-motor implementation of structure mapping in abstract domains*, 2013). If viable global governance calls for such insight, is the currently preferred mode of discourse "fit-for-purpose"?

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