



laetus in praesens

Alternative view of segmented documents via Kairos

17 June 2023 | Draft

Polyhedral Configuration of 384 Governance-relevant Yi Jing Transformations

Experimental interactive mapping of 64 6-linked hexagrams using force-directed layout

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References

Introduction

The experimental configurations presented here follow from a previous exercise in adapting the remarkable articulation of the commentary on the 64 conditions interrelated in the traditional Chinese *Yi Jing* (Richard Wilhelm, *The I Ching or Book of Changes*, 1967). That exercise adapted the commentary in metaphoric terms to render it variously applicable to governance-related preoccupations (*Transformation Metaphors -- derived experimentally from the Chinese Book of Changes (I Ching) for sustainable dialogue, vision, conferencing, policy, network, community and lifestyle*, 1997).

Despite the coherence of the original, as widely known, a continuing concern has been how best to configure the seemingly complex pattern in order to render it more comprehensible and memorable through a variety of visual presentations in 3D. These contrast with traditional circular configurations in 2D. An early variant, the so-called Shao Yung circle of hexagrams, confirmed the early intuitions of [Gottfried Wilhelm Leibnitz](#) in developing the binary coding system now fundamental to computer operations (James A. Ryan, *Leibniz' Binary System and Shao Yong's "Yijing"*, *Philosophy East and West*, 46, 1996, 1; Anne D. Birdwhistell, *Transition to Neo-Confucianism: Shao Yung on Knowledge and Symbols of Reality*, 1989).

The circular form was explored as the basis for ordering patterns of transformation (*Networking Alternation: an alternation network of 384 pathways of organizational transformation interpreted for networks in the light of the Chinese Book of Changes*, 1983; *Diagram of 384 Relationships between I Ching Hexagrams*, 1983).

The *Yi Jing* remains one of the most remarkable efforts to interrelate an extensive range of psychosocial and value-related conditions traditionally deemed fundamental to governance in China. It is also remarkable for the enduring appreciation in which it has been held. The focus contrasts with current conventional Western preoccupation and modelling of resource-related issues -- assumed to be the key to the resolution of global challenges and crises (*Recognizing the Psychosocial Boundaries of Remedial Action*, 2009).

The announced return of the United States to membership of UNESCO in 2023, after an absence of five years, has been presented as a necessary means of counter-balancing the cultural influence of China on world order (*China concerns prompt US move to rejoin Unesco*, *The Guardian*, 12 June 2023; *US decides to rejoin UNESCO and pay back dues, to counter Chinese influence*, *ABC News*, 12 June 2023). The concern is notably with respect to policies relating artificial intelligence, particularly as developed and deployed by American corporations (*China, AI and a say on world order: Why the US wants back in UNESCO*, *France24*, 13 June 2023).

Of some relevance is UNESCO's strategic approach and programmatic focus (*The Dialogue among Civilizations and Cultures*, UNESCO, Executive Board, 179th, 2008) consistent with that articulated by the United Nations (*Global Agenda for Dialogue among Civilizations*, *UN Resolution A/56/6*, 2001). This contrasts with efforts to promote a singular cultural perspective as a means of reinforcing monopolar hegemony -- for which a comprehensible model of requisite complexity has yet to be articulated (*Club of Rome Reports and Bifurcations a 50-year overview*, 2018).

Ironically the further development of the visual presentations of the current exercise has been enabled by lengthy exploratory exercises

with ChatGPT, as previously described (*Use of ChatGPT to Clarify Possibility of Dialogue of Higher Quality*, 2023; *Coherence of Sustainable Development Goals through Artificial Intelligence*, 2023; *Artificial Emotional Intelligence and its Human Implications*, 2023). Those exercises included the enhancement (with the aid of ChatGPT) of earlier **force-directed layout** applications which had established proof-of-concept -- but without enabling direct access to the commentaries as currently demonstrated (*Eliciting Memorable Spheres and Polyhedra from Hyperspace*, 2015).

As presented here, enabling user interaction with dynamic presentations frames the question of how the coherence of conditions fundamental to viable global governance are to be rendered comprehensible -- given the variety of systemic transformations which merit consideration. It might also be asked to what extent pre-trained artificial intelligence is able to integrate the relationships encoded by the hexagram transformations of the *Yi Jing*. Given the binary encoding fundamental to those distinctions, of particular relevance is their relationship to the set of 16 **logical connectives** explored with ChatGPT as fundamental to dialogue of higher quality.

As noted in concluding the final interaction with ChatGPT, of particular potential interest is the ability of an AI-enabled smartphone (or similar device) to record and analyze dialogue in real-time and present its development visually in the form of an evolving map -- as suggested by the technology long-developed to present "passing patterns" in ball games for the benefit of spectators and for subsequent analysis by players and coaches.

The argument concludes with discussions of polyhedra as mnemonic aids to "re-membering" psychosocial coherence and the challenge of interrelating incommensurable dimensions of governance.

Interactive polyhedral configurations adapted metaphorically to issues of governance

As indicated below, equivalent configurations each enable access to 64 distinct documents on 64 interrelated conditions of: community, conferencing, dialogue, lifestyle, network, and policy.

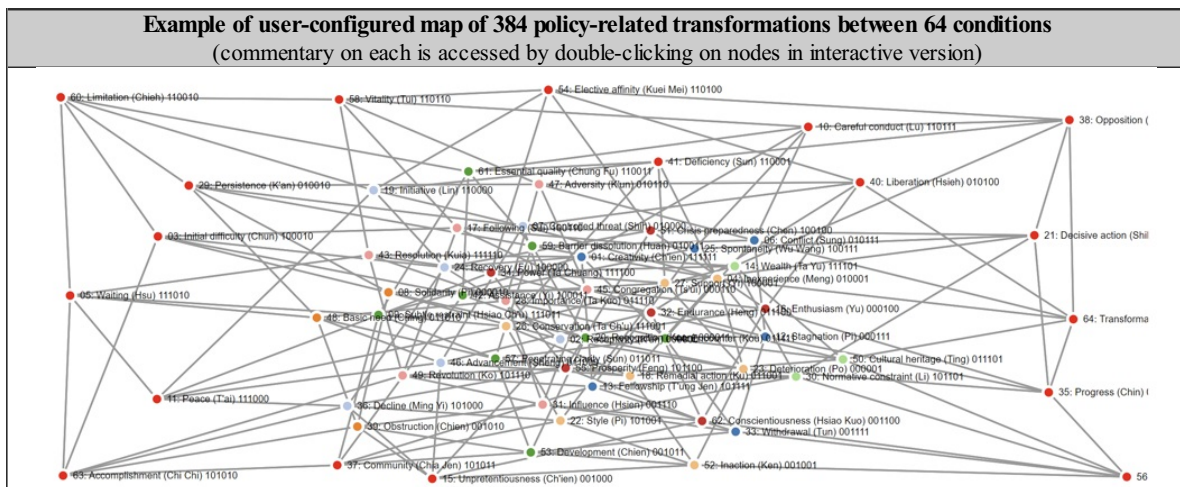
The nodes in configurations presented are titles of web documents describing each *Yi Jing* condition -- each displayed by double clicking on the relevant node. The nodes in the presentation can be repositioned to reconfigure the map -- as enabled by the force-directed layout.

Links within the configuration indicate transformations between the 64 conditions -- as indicated by changes in hexagram binary coding appended to the name of the node (with the original Chinese term). Each nodal condition is potentially able to transform into 6 other conditions. The conditions for each transformation are presented in the commentary.

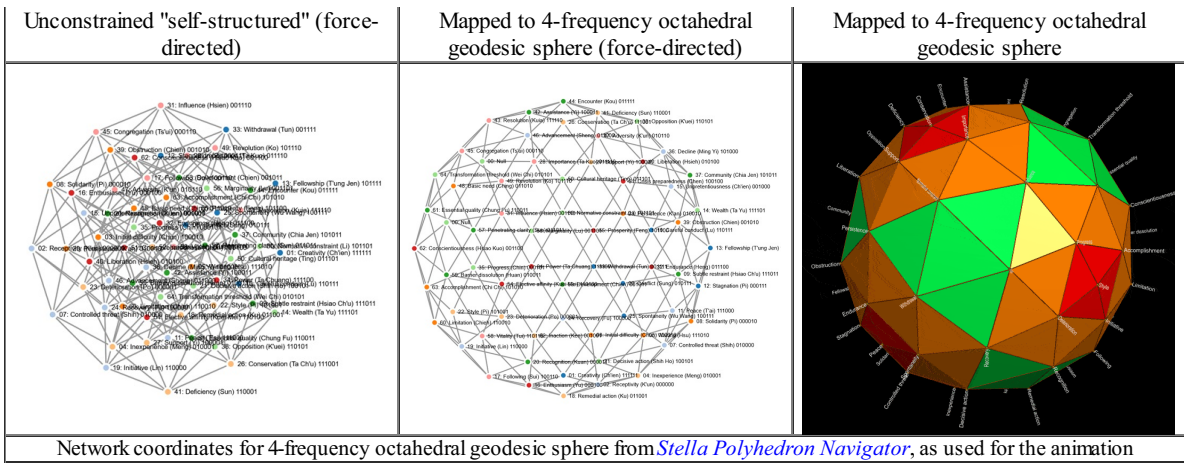
Access to the distinct metaphorical adaptations of the relevant commentary on the *Yi Jing* hexagrams is enabled via:

- [Experimental Polyhedral Configuration of 384 Community-relevant Yi Jing Transformations](#)
- [Experimental Polyhedral Configuration of 384 Conferencing-relevant Yi Jing Transformations](#)
- [Experimental Polyhedral Configuration of 384 Dialogue-relevant Yi Jing Transformations](#)
- [Experimental Polyhedral Configuration of 384 Lifestyle-relevant Yi Jing Transformations](#)
- [Experimental Polyhedral Configuration of 384 Network-relevant Yi Jing Transformations](#)
- [Experimental Polyhedral Configuration of 384 Policy-relevant Yi Jing Transformations](#)
- [Experimental Polyhedral Configuration of 384 Vision-relevant Yi Jing Transformations](#)

In an initial approach no effort was made to map the interactions between conditions onto an explicit polyhedron. It was assumed that the "self-structured" force-directed graph layout would offer insight in that respect. One [version of that variant remains accessible](#) as the basis for the following map.



Rather than the early "self-structuring" approach (below left and above), a visually clearer alternative possibility proved to be the 4-frequency octahedral geodesic sphere with 66 vertices, 128 faces and 192 edges (below left). The 64 hexagram names of the *Yi Jing* can be mapped to all but 2 of the vertices. The 192 transformation links between the 64 nodes could then be used as the basis for the force-directed graph presentation (below centre). It is of course the case that in both approaches the transformations are reversible, namely the 192 links are two-way -- 384 transformations.



The current mapping frames the need for any more appropriate distribution, especially given the manner in which 2 vertices are not employed to enable greater clarity in the global presentation (centre and right above). Especially relevant to that distribution is the work of József Drasny (*The reconstruction of the Yi-globe: the spherical arrangement*, 2007/2011), as discussed separately (*Projections onto other surfaces and forms*, 2010).

With minor amendments to the force-directed application, nodes and/or labels could be distinctively coloured (selected for reconfiguration or deleted). Specific labels could be increased in size. Links could offer access to commentary specific to each transformation. Zooming into the map could be enabled, or increasing the scale for larger displays. Labels could be presented in other languages, including the original Chinese (indicated in each commentary).

The justification for such representation has been presented separately in *Eliciting Memorable Spheres and Polyhedra from Hyperspace* (2015) in the quest for integrative connectivity of problems, strategies, themes, groups or people. Access to related experiments is offered separately (*Gallery of Experimental Polyhedral Configurations of Documents*, 2023). As part of the focus on comprehensible global packing of complexity, an overview of other experimental animations of a distinctive kind is also presented separately (*Selected videos, animations and images on Laetus site*, 2023).

Meriting further consideration is the 6-digit binary code distinguishing those 64 conditions. This contrasts with the 4-digit code by which the 16 logical connectives are conventionally distinguished as fundamental to the analysis of the natural language characteristic of public discourse. This suggests that the extra four conditions (indicated by the additional two binary digits) may well be what is missing from appropriate analysis. These may well be a feature of the corresponding "emotional connectives" which it is expected may emerge from development of artificial emotional intelligence. (*Varieties of Tone of Voice and Engagement with Global Strategy*, 2020).

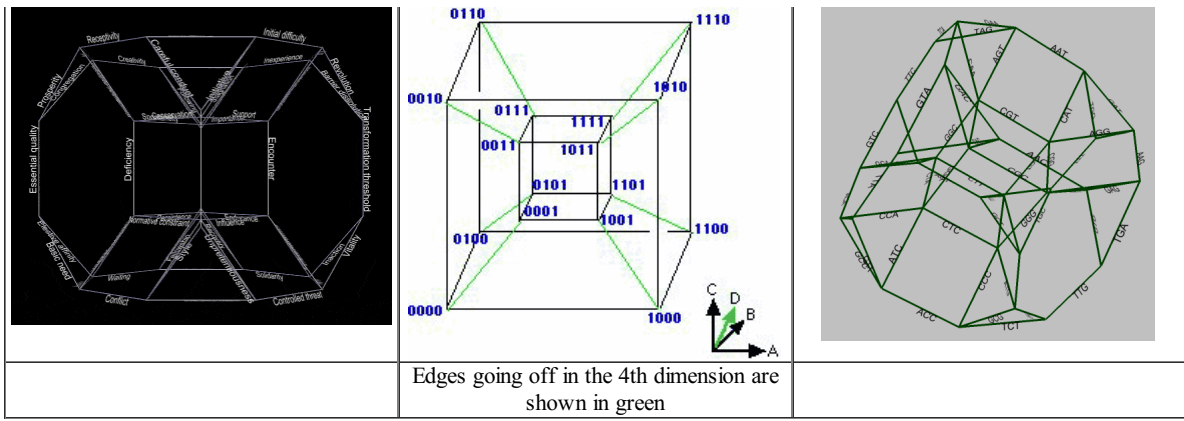
As a *pattern language* in its own right, the pattern of hexagram transformations is potentially of great relevance to a civilization faced with challenges of climate change, given the manner in which that pattern is metaphorically associated with the elements of the environment, as noted separately (*Cognitive Navigation of the Elements as Indicative Strategic Metaphors*, 2023). That argument explores the cognitive engagement via technomimicry with global entanglement of Earth, Air, Fire and Water. Widespread understanding of climate suggests a mode of engagement with potential strategic implications (*Enhancing Strategic Discourse Systematically using Climate Metaphors*, 2015). Speculatively this invites a play on words of relevance to future directions of governance (*Weather Metaphors as Whether Metaphors*, 2015).

Corresponding polyhedra potentially indicative of requisite complexity

The force-directed configurations presented are directly engendered as "polyhedra" from the pattern of transformations between the hexagrams, as defined by simple modifications to the binary coding with which they are associated. This contrasts with efforts to identify polyhedra which might otherwise be appropriate for mapping configurations of that complexity, as discussed separately (*Identifying Polyhedra Enabling Memorable Strategic Mapping*, 2020). Examples of the use of well-known polyhedra to map smaller collections of documents are presented separately (*Gallery of Experimental Polyhedral Configurations of Documents*, 2023).

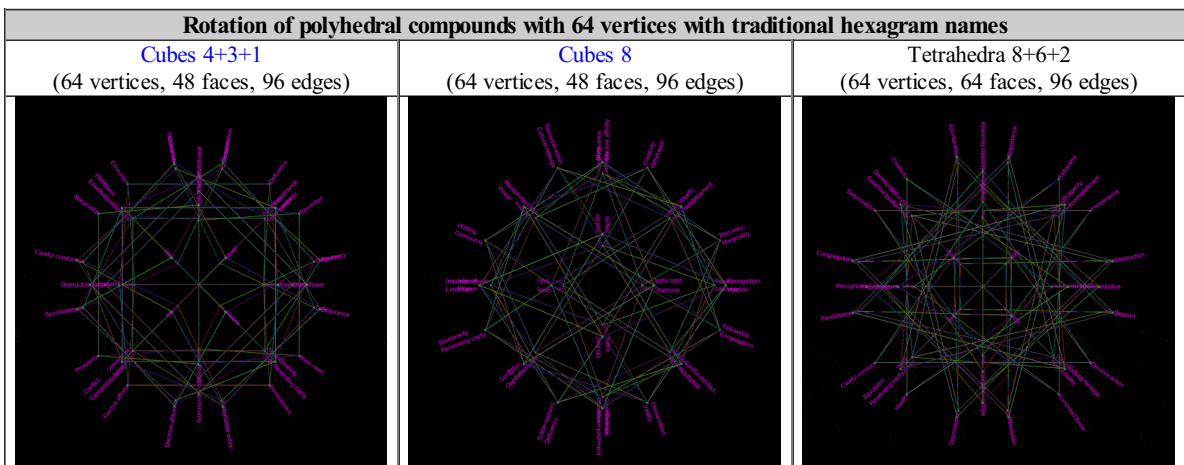
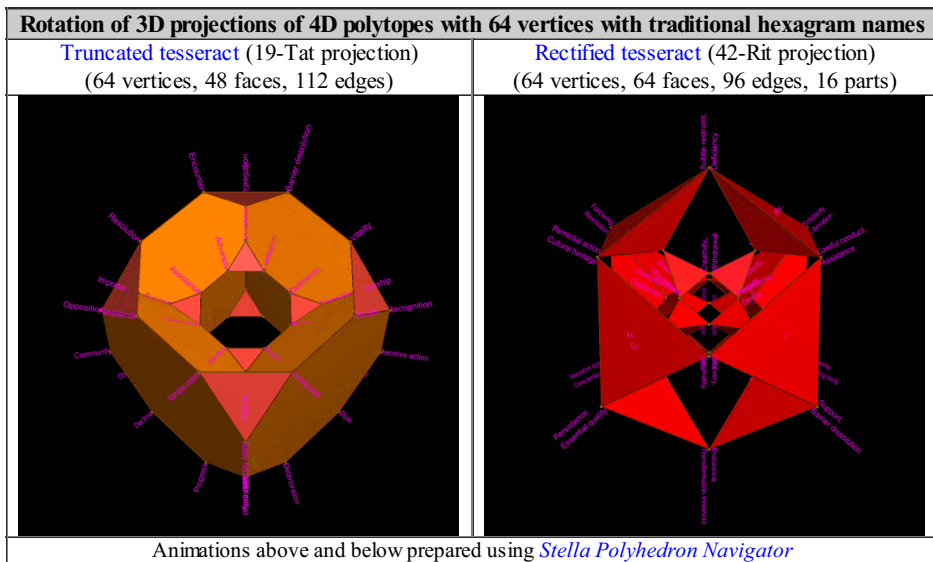
It is then appropriate to note the existence of polyhedra which could be considered of relevance to mapping the complex pattern of hexagrams -- and the transformations they imply. One point of departure is the use of the 64-edged drilled truncated cube, as separately explored (*Proof of concept: use of drilled truncated cube as a mapping framework for 64 elements*, 2015). An interactive 3D representation is available separately (*Experimental use of drilled truncated cube to map dynamics of 64 hexagrams interactively in 3D*) as discussed (*Dynamics of systemic connectivity as a challenge to invariance*, 2022). The following correspondences are reproduced from *Potential psychosocial implications of more complex polyhedra* (2021).

Comparability of fundamental forms -- contrasted with 64-edged drilled truncated cube?		
Mapping of 64 hexagram names onto edges of drilled truncated cube	4-statement Venn diagram of a 4-dimensional cube as described by Tony Phillips	Mapping of 64 genetic codons onto edges of drilled truncated cube

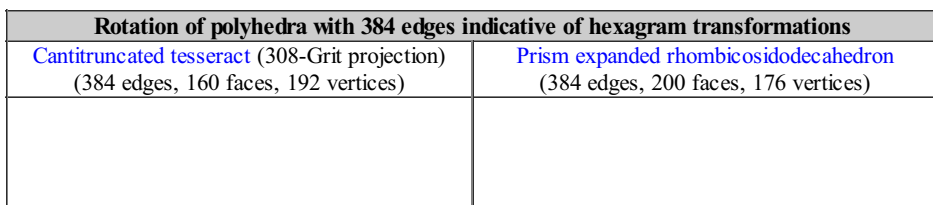


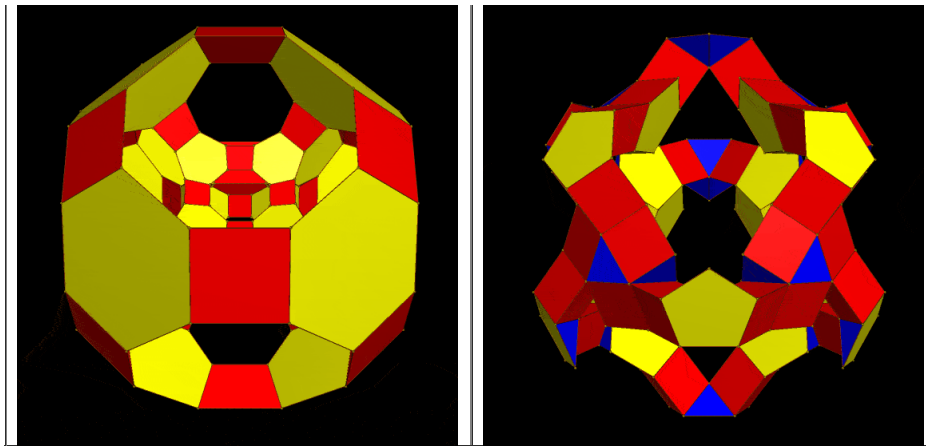
A disadvantage of the drilled truncated cube is the association of the 64 "conditions" with polyhedral edges, offering an implication that the nexus of transformation is at the vertices -- of which there are only 32. Being trivalent or quadrivalent, these are seemingly unsatisfactory as a means of representing the 6-valent transformations held to be associated with each condition.

The following polyhedral forms are of potential interest to any coherent configuration of psychosocial conditions with the potential for transformation. These are however 3D projections of four-dimensional polytopes (or polychora). Abridged versions of hexagram names are associated with the vertices (as above left) -- legible if magnified in a separate browser tab.



Switching the focus to the 384 links representing the 6 potential transformations from each of the 64 conditions, the following polyhedra are of interest, as previously discussed (*Four-dimensional requisite for a time-bound global civilization?* 2015). Both are 3D projections of a 4D form.





Polyhedra as mnemonic aids to "re-membering" psychosocial coherence

With the explosion of information and the calls on attention, individuals are variously challenged to perceive the coherence of systems -- potentially of increasing complexity. The challenge is evident in the case of decision-makers and of society more generally (*Societal Learning and the Erosion of Collective Memory*, 1980; *Memetic and Information Diseases in a Knowledge Society*, 2008).

The elusive coherence of the pattern of *Yi Jing* hexagrams constitutes a comprehensible challenge. The possibility of their mnemonic organization with the aid of polyhedra can therefore be recognized as relevant to the challenge of coherent governance, as variously argued previously (*Memorable Packing of Global Strategies in a Polyhedral Rosetta Stone*, 2023; *Time for Provocative Mnemonic Aids to Systemic Connectivity?* 2018). The quest can be understood in terms of the possibility of reconciling the "headless hearts" to the "heartless heads".

There is a long tradition to enhancing memorability, most notably described by Frances Yates (*The Art of Memory*, 1966). This notes the role of memory gardens, memory theatres and memory palaces as dating back over centuries. These contexts have been used as a focus for what is described as the "method of topoi", or as the "method of loci" (*How to Use the Method of Loci*, *Art of Memory Blog*; Igor Z Zagar, *Topoi in Critical Discourse Analysis, Lodz Papers in Pragmatics*, 6, 2010, 1). Imagined memory palaces are still used by memory champions and the few who practice the memory arts, but they are best known from Greco-Roman times.

The question underlying the polyhedral presentations above is the extent to which their architecture can be recognized in the same manner as that of memory palaces. Curiously particular polyhedra are much appreciated for their symbolism, especially in relation to sacred geometry. Less evident is how they can be employed in the method of loci. Potentially more curious is the metaphoric recognition traditionally evoked by the 6-line hexagram encoding and how this might be understood as related to the method of loci.

Somewhat ironically, polyhedral configurations are proving important to computer operations (Fabien Quilleré, et al, *Optimizing memory usage in the polyhedral model*, *ACM Transactions on Programming Languages and Systems*, 22, 2000, 5).

With respect to any "polyhedral" organization, the results of recent neuroscience research indicate the remarkable possibility of cognitive processes taking up even up to 11-dimensional form in the light of emergent neuronal connectivity in the human brain:

Using mathematics in a novel way in neuroscience, the [Blue Brain Project](#) shows that the brain operates on many dimensions, not just the three dimensions that we are accustomed to... The appearance of high-dimensional cavities when the brain is processing information means that the neurons in the network react to stimuli in an extremely organized manner. It is as if the brain reacts to a stimulus by building then razing a tower of multi-dimensional blocks, starting with rods (1D), then planks (2D), then cubes (3D), and then more complex geometries with 4D, 5D, etc. The progression of activity through the brain resembles a multi-dimensional sandcastle that materializes out of the sand and then disintegrates. ([Blue Brain Team Discovers a Multi-Dimensional Universe in Brain Networks](#), *Frontiers Communications in Neuroscience*, 12 June 2017)

Challenge of interrelating incommensurable dimensions of governance?

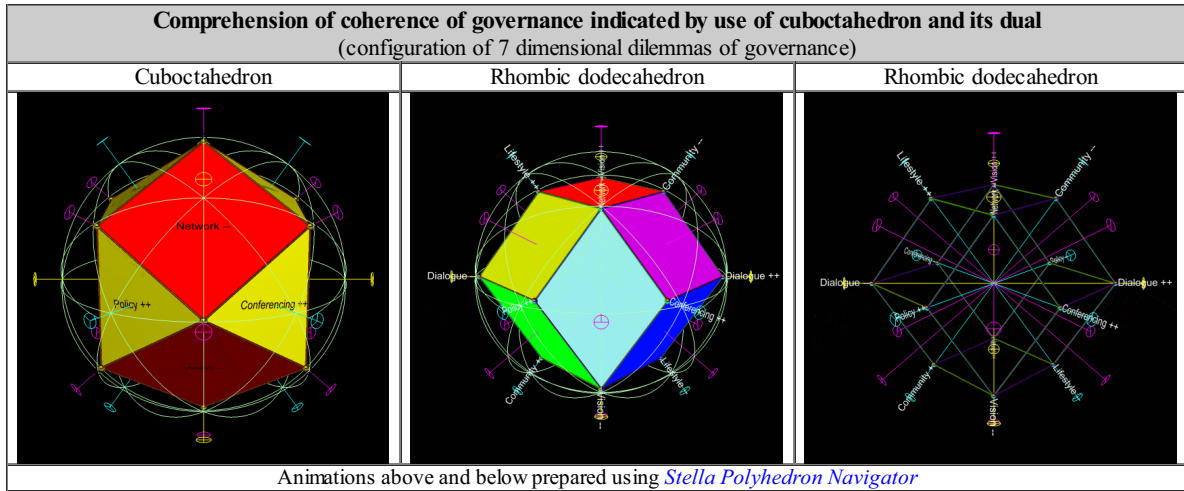
This document offers access to 7 contrasting dimensions of governance: dialogue, vision, conferencing, policy, network, community and lifestyle. Each could be qualified in terms of sustainability. However complementary they may be deemed to be in principle, each is associated with dilemmas -- and how they are to be understood as coherently interrelated remains a puzzle, whether or not this is denied or ignored. The 7-fold pattern could itself be contested.

As a challenge to the imagination, the argument can be speculatively developed with regard to how the dimensions might be understood as related -- exploiting polyhedra as a mnemonic aid. An obvious point of departure is the cuboctahedron with 7 axes through its 14 faces. The dimensions could be associated with those axes passing together through the centre. The two faces on the surface of the cuboctahedron through which a given axis passes could then be understood as indicative of "extreme" forms -- whether of dialogue, vision, conferencing, policy, network, community or lifestyle. Less evident is what might be considered "extreme". The art of governance could be framed in terms of balancing those 14 extremes in practice.

Such a 14-fold articulation is a surprising characteristic of coherence in a number of domains variously associated with management, as noted separately ([Pattern of 14-foldness as an Implicit Organizing Principle for Governance?](#) 2021). That exploration noted the curious extent to which the enduring appeal of sonnets has been associated with their 14-line structure ([Variety of Rhyming Patterns in Standard](#)

14-line Sonnets, 2021). That pattern was presented as a challenge to ChatGPT -- to reframe each of the UN's 17 Sustainable Development Goals in sonnet form. The results of a first iteration have been presented separately, without endeavouring to enhance their poetic appeal (*Experimental presentation of Sustainable Development Goals in sonnet form by AI*, 2023).

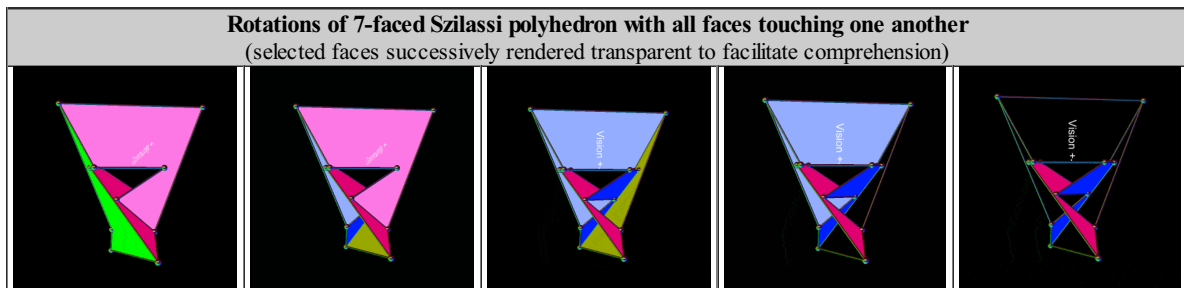
More intriguing to the use of the 14-faced cuboctahedron in this mapping exercise is the importance it holds through its dual the 14-vertexed rhombic dodecahedron. This is widely discussed as a means of representing on its vertices 14 of the 16 logical connectives fundamental to discourse analysis (*Oppositional Logic as Comprehensible Key to Sustainable Democracy*, 2018).



If the "dilemmas" are to be understood as transcended in some manner fundamental to the art of governance, potentially more intriguing is appreciation of the challenge of configuring seven such modalities together such that each shares a common boundary with the other. This contrasts with the cognitive mystery of the centre point of the interrelating axes in the animations above -- as a potential focus of governance.

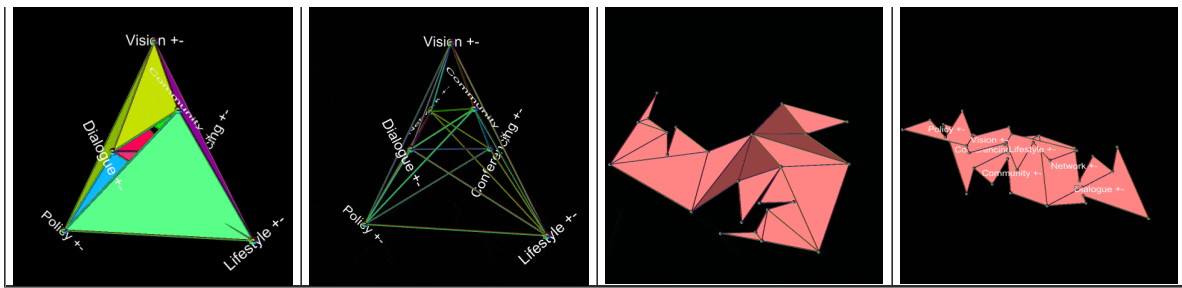
The challenge can be presented visually in terms of the exceptional Szilassi polyhedron which has seven sides. It is unique in that all of the sides have boundaries with each other, namely each face shares an edge with each other face. As a result, it requires seven colours to colour all adjacent faces. This serves to demonstrate that, on surfaces topologically equivalent to a torus, some subdivisions require seven colours, providing the lower bound for the seven colour theorem. The other half of the theorem states that all toroidal subdivisions can be colored with seven or fewer colours.

The polyhedron is appropriately difficult to visualize, especially when the sides are to be distinctively labelled. As shown in the animations below, the sense of "transcending" the polar extremes of each dimension is suggested by appending "+-" to each label. Labels are arbitrarily assigned to distinct faces -- evoking possibility of discussion regarding their most appropriate positions relevant to one another. Faces are successively rendered transparent to enable the structure to be better comprehended, and to facilitate reading of the labels (view enlarged in separate browser tab).



Whilst this is in its own right a challenge to the comprehension of its coherence, this is potentially all the greater in the case of its dual, namely the Császár polyhedron as presented below. This polyhedron has no diagonals; every pair of vertices is connected by an edge. The advantage is that labels can be more legibly associated with the 7 distinct vertices. Further understanding of the challenge of global strategic comprehension -- of "getting it together" and "connecting the dots" -- is suggested by the process of folding both the Szilassi and Császár polyhedra -- also as shown below right.

Animations of 7-vertexed Császár polyhedron as dual of 7-faced Szilassi polyhedron			
Császár polyhedron (labelled vertices)	Császár polyhedron (transparent faces)	Császár polyhedron (folding from 2D to 3D)	Szilassi polyhedron (folding from 2D to 3D)



The challenge of "resolving" the problem of global governance may be understood metaphorically as a knot, a riddle or a puzzle (*Mapping grossness: Gordian knot of governance as a Discordian mandala?* 2016; *Dynamics of N-fold Integration of Disparate Cognitive Modalities*, 2021; *Governance as an ongoing process of puzzle resolution*, 2017; *Recognition of Rubik's Cube as a relevant strategic development metaphor*, 2017). Ironically, at the time of writing, it may be contrasted with reduction of the world record for solving a 3x3 Rubik Cube -- and the media focus on the latter (*Speed-cubing world record broken: Max Park takes astonishing 3.13 seconds to solve 3x3x3 cube*, *The Guardian*, 16 June 2023).

Supplementary insights from ChatGPT on mapping 64-elements onto 4D and 5D polytopes

Given the currently acclaimed merits of ChatGPT, and its contribution to the *Yi Jing* presentations indicated here (as mentioned above) the **following question** was submitted: *I want to use a polyhedron to map 64 elements to the nodes. I have explored the Truncated tesseract and the Rectified tesseract (namely 3D projections of polychora), together with 3 polyhedral compounds. Can you suggest any other approach -- possibly more symmetric 4D or 5D polytopes [Four-dimensional requisite for a time-bound global civilization? 2015; Comprehending the shapes of time through four-dimensional uniform polychora, 2015; Five-fold cognitive dynamics of relevance to governance? 2015]*

The **response from ChatGPT** was as follows:

If you're looking for alternative approaches to map 64 elements to nodes using polyhedra or polytopes, there are several other possibilities to consider. Here are a few suggestions:

- **Hypercube** (Tesseract): Instead of using the truncated or rectified versions, you can directly utilize the regular **tesseract** (4D analog of a cube). The tesseract has 16 vertices, 32 edges, 24 faces, and 8 cells, which can be used to map your 64 elements. [Total of edges, faces and cells is 64]
- **Hypersphere**: Another option is to use a hypersphere in four dimensions, also known as a 4-sphere. A **hypersphere** is a higher-dimensional analog of a sphere, and in 4D, it can be visualized as a collection of concentric spheres. You can map your 64 elements onto points on the surface of the hypersphere.
- **120-Cell** (Hyperdodecahedron): The **120-cell** is a highly symmetrical four-dimensional polytope composed of 120 dodecahedral cells [animation below]. It is one of the regular polytopes in four dimensions and exhibits a high degree of symmetry. You can map your 64 elements to the vertices or cells of the 120-cell. One possible mapping is to assign each element to a unique vertex of the 120-Cell. This would provide a one-to-one correspondence between the 64 elements and 64 of the 120 vertices.
 - Dodecaplex: This name emphasizes the 12-fold symmetry of the polytope, derived from the Greek prefix "dodeca-" meaning twelve, and "plex" meaning manifold or structure.
 - Tetracosahedroid: This name highlights the fact that the Hyperdodecahedron is the dual of the 600-Cell (Hexacosichoron).
- **Hexacosichoron**:
 - 600-Cell: This is the most commonly used name for the Hexacosichoron. The **600-cell** is another regular four-dimensional polytope composed of 600 tetrahedral cells. It is highly symmetric and has a rich structure. Mapping your 64 elements onto the vertices or cells of the 600-cell can provide a visually interesting and symmetric arrangement. The 600-Cell has 600 vertices. Similar to the 120-Cell, you can assign each element to a unique vertex of the 600-Cell, establishing a one-to-one correspondence between the 64 elements and 64 of the 600 vertices. Similarly, you can assign each element to a unique tetrahedral cell of the 600-Cell, resulting in a one-to-one correspondence between the 64 elements and 64 of the 600 cells.
 - Tetraplex: This name highlights the four-fold symmetry of the polytope, derived from the Greek prefix "tetra-" meaning four, and "plex" meaning manifold or structure.
 - Hexacosahedroid: This name emphasizes the fact that the Hexacosichoron is the dual of the Hyperdodecahedron (120-Cell).

These suggestions offer alternative approaches to map your 64 elements using polyhedra or polytopes in four-dimensional space. Each option comes with its own unique properties and symmetries, allowing you to explore different visualizations and arrangements.

A **further question** submitted was: *However this implies a selective mapping of some rather than an exhaustive mapping to all features of a type as in my tesseract examples. Related mapping issues I am considering are a pattern of 6 links between one node and another -- calling for polytopes with 384 edges. Can these be presented more symmetrically in 5D rather than 4D, as with the Cantitruncated tesseract or the Prism expanded rhombicosidodecahedron [illustrated above].*

The **response from ChatGPT** was:

If you're looking for a more symmetric arrangement with 6 links between each node, involving 384 edges, exploring five-dimensional polytopes could indeed offer interesting possibilities. Here are a couple of suggestions:

- **Penteract** (5D Hypercube): The **penteract**, also known as the 5D hypercube, is the five-dimensional analog of the regular cube. It consists of 32 vertices, 80 edges, 80 faces, 40 cells, and 10 four-dimensional hypercells. Each vertex in the penteract is connected to exactly six other vertices, resulting in a total of 192 edges (6 edges per vertex * 32 vertices). While it has more edges than the 384 you mentioned, the penteract still provides a highly symmetric and visually appealing structure.
- **5-Dimensional Hypersphere**: Similar to the suggestion in four dimensions, you can consider using a five-dimensional hypersphere (also known as a 5-sphere) to achieve a symmetric arrangement. In 5D, a hypersphere would consist of concentric hyperspheres, and you can map your 64 elements to points on the surface of the outer hypersphere. However, note that finding an exact number of edges that matches your requirement of 384 may not be possible in this case, as the number of edges in a hypersphere is not a simple multiple of the number of vertices.

These suggestions offer potential avenues for exploring more symmetric arrangements in five-dimensional space. The penteract and the 5D hypersphere provide alternative structures where each node can have a consistent pattern of six links, albeit with a different number of edges compared to your specific requirement of 384. Nonetheless, they can still serve as visually interesting and highly symmetric polytopes for your mapping purposes.

A further question was: *There are 64 convex uniform 4-polytopes. Is there any sense in which these may be self-consistently mapped onto properties of a polytope*

The **response from ChatGPT** was:

Yes, it is possible to map properties or characteristics of the 64 convex uniform 4-polytopes onto specific features or attributes of a polytope. By examining the properties of each 4-polytope individually, you can identify various aspects that can be mapped onto corresponding properties of a different polytope. Here are a few examples of properties that can be considered when mapping the 64 convex uniform 4-polytopes:

- **Symmetry**: Each 4-polytope exhibits its own unique symmetry properties, such as rotational symmetry, reflection symmetry, or combinations thereof. These symmetries can be mapped onto the symmetries of a different polytope, allowing you to create a visually appealing and symmetric arrangement.
- **Vertex Configuration**: The vertex configuration of a 4-polytope refers to the specific arrangement of edges meeting at each vertex. By mapping the vertex configurations of the 64 convex uniform 4-polytopes, you can establish corresponding vertex configurations in the target polytope.
- **Face Types**: Different 4-polytopes can have distinct face types, such as triangles, squares, pentagons, or higher-order polygons. By mapping the face types from the 64 convex uniform 4-polytopes, you can assign similar face types to the corresponding faces of the target polytope.
- **Connectivity**: The connectivity of a 4-polytope refers to the manner in which its vertices, edges, faces, and cells are connected to one another. You can examine the connectivity patterns of the 64 convex uniform 4-polytopes and find corresponding connectivity patterns in the target polytope.

By mapping these and other properties of the 64 convex uniform 4-polytopes onto the properties of a different polytope, you can establish a self-consistent relationship and create a unique mapping scheme. This mapping can help preserve specific characteristics and attributes while providing a novel arrangement or visualization of the target polytope.

A subsequent question was: *The hypercube and the rhombic dodecahedron are variously valued as a means of mapping logical connectives [using a 4-digit binary code]. How might one interpret the implications of other mappings in 4D and 5D -- one issue being the extension of logical connectives to include emotional connectives. [As noted above, the Yi Jing conditions are indicated by a 6-digit binary code, suggesting that the extra four conditions may well be what is missing from appropriate analysis recognizing "emotional connectives"].*

The **response from ChatGPT** was:

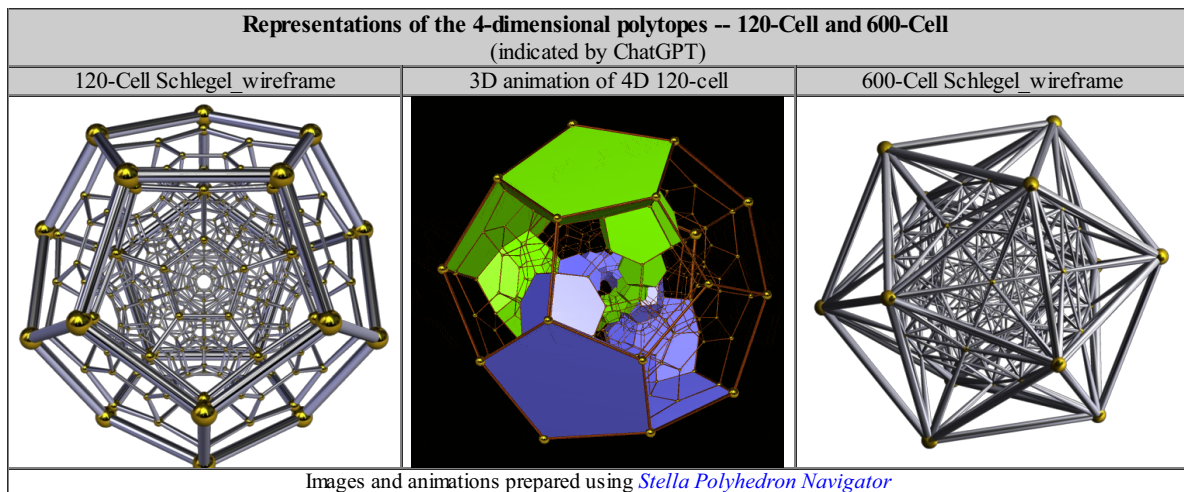
Extending the mappings of logical connectives to higher-dimensional polytopes, such as in 4D and 5D, can provide interesting interpretations and potentially open up new avenues of exploration. While the hypercube and the rhombic dodecahedron are commonly used for logical connectives due to their symmetries and relationships between vertices, you can explore alternative polytopes to map logical and even emotional connectives. Here are a few considerations:

- **4D Polytopes**:
 - **Tesseract** (4D Hypercube): The tesseract, being the 4D analog of the cube, can be used to extend logical connectives to four dimensions. Its symmetrical structure and well-defined vertex relationships make it suitable for representing logical operations in higher-dimensional contexts.
 - **120-Cell**: The 120-cell is a highly symmetrical and regular 4D polytope. Its intricate structure can be interpreted to represent complex logical or emotional connectives, as it offers a rich pattern of connectivity and relationships among its vertices, edges, faces, and cells.
 - **5D Polytopes**:
- **Penteract**
 - **5D Hypercube**: As mentioned earlier, the penteract is the 5D analog of the regular cube. Its higher-dimensional structure allows for more intricate mappings and interpretations of logical and emotional connectives in five dimensions.
 - **600-Cell**: The 600-cell, with its regular and symmetrical arrangement of tetrahedral cells, provides a unique structure to

explore logical and emotional connectives in a five-dimensional context.

When mapping emotional connectives onto these higher-dimensional polytopes, it is important to consider the specific aspects or characteristics you wish to represent. Emotional connectives can encompass a wide range of complex and subjective experiences, so it may require a more nuanced mapping scheme that accounts for the multidimensional nature of emotions.

Ultimately, the choice of polytope for mapping logical and emotional connectives in 4D or 5D depends on the specific properties, symmetries, and relationships you want to emphasize. By exploring different polytopes and their unique structures, you can develop novel interpretations and mappings that extend beyond traditional logical connectives and incorporate emotional aspects.



Aspects of the value of the 120-cell have been a focus of separate discussion (L. Dennis, Jytte Brender McNair, N. J. Woolf, L. H. Kauffman, *The Mereon 120/180: form informing function*, 2013; *Building on the Known: a QuintEssential Jitterbug*). A 60-fold pattern has been explored in terms of the psycho-social implications of fullerenes for coherence, integrity and identity of a higher order (*Sustainability through Global Patterns of 60-fold Organization*, 2022).

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