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1 June 2018 | Draft

Visualization Enabling Integrative Conference Comprehension

Global articulation of future-oriented 3D technology

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Introduction

Much is made of the future role of technology and artificial intelligence, especially in their relation to the evolution of the internet. Far less is made of their role in the organization of knowledge and, more particularly, in enabling higher degrees of comprehension -- whether "globally" in the sense of world-wide, or "globally" in a more integrative sense, as distinguished separately (*Future Generation through Global Conversation in quest of collective well-being through conversation in the present moment*, 1997).

The question here is how the envisaged developments in visualization technology might be relevant to integrative comprehension of a future-oriented conference with an emphasis on technology. More specifically this gives focus to the question of whether the thematic preoccupations of the conference are applied to any degree in the dynamics of the conference itself. In that sense there is a case for understanding the FTA conference title otherwise, namely as ***assessing the technology enabling the future within a conference***. This highlights the question as to whether presentations made are relevant to the enhancement of the dynamics of the event itself rather than hypothetically to those of wider society. However it is not a binary question of either/or but rather of both/and.

This question has been explored in a critical review of the programme of a conference similar to the FTA2018 event, namely the 1st International Conference on Internet Science (*Internyet Nescience? Self-referential upgrading of obsolete Internet conference processes inhibiting emergence of integrative knowledge*, 2013). This was held under the aegis of the European Commission, by the EINS project, the FP7 European Network of Excellence in Internet Science. The method of that review is applied here to the FTA2018 programme, prior to exploring new visualization possibilities.

The technologies of relevance to in-conference thematic visualization continue to evolve rapidly. Decision-making environments, notably of the European Commission, now tend to be internet enabled, with shared screens for plenary discussion and individual screens for participants (whether or not they use their own wifi-enabled devices). Interactive screen content may be disseminated to other locations. Preceding applications to in-conference visualization are discussed separately (*Polyhedral Conference Representation as a Catalyst for Innovation: polyhedral animation of IPRA 2008*, 2008; *Complementary Knowledge Analysis / Mapping Process*, 2006). The question of how themes may be appropriately "interwoven" is also discussed separately (*Interweaving Thematic Threads and Learning Pathways*, 2010).

Especially striking, despite such possibilities, is the marked tendency to portray conference programmes as nested checklists, or possibly a matrix of tracks, with little consideration of how this constrains and inhibits integrative comprehension -- despite the ease with which they can be printed. This is even more noteworthy in the light of the widespread interest in the Triple Helix thesis (as a focus of the

Triple Helix Research Group of Stanford University) regarding the potential for innovation and economic development in a knowledge society. This is framed by the Triple Helix Association in terms of a more prominent role for the university and in the hybridisation of elements from university, industry and government to generate new institutional and social formats for the production, transfer and application of knowledge. With its inherent 3D implications, it is of interest with respect to related FTA themes.

Arguments are now being made to extend the Triple Helix concept to Quadruple and Quintuples forms (*Systemic closure: fourth helix -- and beyond?* 2017; (Elias Carayannis and D. F. Campbell, *Triple Helix, Quadruple Helix and Quintuple Helix and how do knowledge, innovation and the environment relate to each other? International Journal of Social Ecology and Sustainable Development*, 1, 2010, 1, pp. 41-69). At the same time much is being made of augmented reality and virtual reality technology and its implications. There is therefore a strong case for exploring how 3D variants of thematic structures can be displayed and comprehended -- potentially with the use of virtual reality technology, as previously argued (*Cognitive Osmosis in a Knowledge-based Civilization*, 2017). Just as personal computer screens were held to be ridiculous in conferences a decade ago, an equivalent lag may come become evident with respect to augmented reality and virtual reality displays in a conference environment.

Such points are of some relevance in the light of the highly critical assessment by the media of the hearing process of the European Parliament with regard to Facebook, marked by the promises/apologies of Mark Zuckerberg at that time concerning the remedial future use of artificial intelligence (*30 Questions that Facebook has yet to Answer*, 2018). The review of that process included illustrative visualizations which might have been used (*Democratic intelligence vs Artificial intelligence*, 2018). A similar argument was developed in a critical review of the recent report to the Club of Rome (*Exhortation to We the Peoples from the Club of Rome*, 2018). Illustrative visualizations and animations were included in arguing *Towards a higher order of coherent global strategic organization* and *Towards a geometry of systemic thinking and its symbolism*.

The evident bias against such visualization contrasts with the early argument in 1968 of the political scientist Harold Lasswell (*The transition toward more sophisticated procedures*):.

> Why do we put so much emphasis on audio-visual means of portraying goal, trend, condition, projection, and alternative? Partly because so many valuable participants in decision-making have dramatizing imaginations...They are not enamoured of numbers or of analytic abstractions. They are at their best in deliberations that encourage contextuality by a varied repertory of means, and where an immediate sense of time, space, and figure is retained. (In: Davis B. Bobrow and J. L. Schinartz (Ed.). *Computers and the Policy-making Community; applications to international relations*. Prentice-Hall, 1968, p. 307-314)

Self-referential conference questions for FTA2018

As noted above, with respect to the methodology employed in analysis of the 1st International Conference on Internet Science (2013), the announced conference themes are presented here with questions regarding their applicability to a conference on future-oriented conference assessment (notably in the light of collective learning since the previous FTA event):

Plenary themes:

- *P1: Democracy and Inequality*: How might these concerns be applied to an FTA conference?
- *P1: The exponential development of technology*: What do these concerns suggest with respect to the implementation of technology in an FTA conference, currently and in the future? Have "upgrades" been implemented, notably with respect to "new features" and "bugs" (as detected in previous FTA conference processes)?
- *P1: The changing nature of work*: How is the "work" of the conference and its participants to be understood in the FTA2018 event? How is this expected to evolve further towards the future and subsequent FTA events?
- *P2: The role of Europe in the world*: What is the role of European thinking within the FTA2018 event in the light of the evolution of thinking elsewhere in the world? How does this relate to the lags in uptake of technologies employed elsewhere?
- *P2: Changing the paradigm to build a sustainable future*: Is there a paradigm to be changed with respect to the FTA2018 process in order to ensure the future sustainability of such processes? How might changing such a paradigm be undertaken within the FTA2018 event itself?
- *P2: Future shape of our societies:* What could be the future shape of FTA events as psychosocial systems in their own right?

Cluster A:

- *A1: Evaluation of Foresight Projects and Programmes for Impact*: How is foresight to be evaluated within the FTA2018 event to ensure its greater impact on those present at the event and elsewhere?
- *A2: Evolution and Transformation of Cities... & Communities*: How is the evolution of the various clusters at the FTA2018 to be recognized and appropriately transformed?
- *A3: System Dynamics, Modelling and Gaming*: How are the dynamics of the FTA2018 event to modelled systemically during the event, notably with the use of gaming techniques? How is the event to be understood as a game?
- *A4: Futures Proficiency for Society*: How is the futures proficiency of FTA to be explored during the event -- and in relation to future events?
- *A5: Scenario Design for Policymaking*: What scenarios can be designed to frame the future development of the FTA event?
- *A6: Preparing for Societal Challenges*: How is the FTA event preparing for societal challenges to its processes, from participants or otherwise?
- *A7: Navigating the Innovation Method Wilderness*: How are the methodological innovations presented at FTA2018 to be effectively navigated -- at the event and by others subsequently?
- *A8: Emerging Policy Issues: Out of Sight, Out of Mind?*: How to engage with the policy issues in relation to future-oriented

policy analysis which are "below the horizon", or "under the radar", of FT2018?

Cluster B:

- *B1: STI Priority Assessment Methodologies*: What priority assessment methodologies can be brought to bear on FTA2018 itself?
- *B2: Participation for Local, Regional & National Strategies*: What scope is there for local, regional and national participation in the FTA conference process?
- *B3: Algorithm-based Foresight Methods*: How could algorithm-based foresight methods be applied to the dynamics of FTA2018 and expressed in developments towards the next FTA event?
- *B4: Systems of Values and Foresight*: What systems of values and foresight can be usefully recognized and deployed in relation to FTA2018?
- *B5: Towards Innovative Approaches in Foresight*: What innovative approaches to foresight could be applied in relation to the evolving dynamics of FTA2018?
- *B6: Going Digital - Exploring OECD Scenarios*: How might the OECD scenarios be applied to the FTA2018 conference itself?
- *B7: Rapid Future Government Fabrication Workshop*: How could the methods of the workshop be applied to FTA2018?
- *B8: Foresight in Challenging Policy Environments (I)*: As a challenging policy environment in its own right, how could foresight be applied within the context of FTA2018?

Cluster C:

- *C1: Stakeholder Engagement to a Deeper Level?* How could the FTA2018 stakeholders engage at a deeper level in the event?
- *C2: Horizon Scanning & Beyond*: What are the FTA2018 horizons, how can they be scanned, and what lies beyond?
- *C3: Shaping Research Policy for Europe via Foresight*: How can the evolving research policy of FTA2018 as an event be shaped in the course of the event with the aid of foresight?
  :
- *B8: Foresight in Challenging Policy Environments (II)*: As a challenging policy environment in its own right, how could foresight be applied within the context of FTA2018? :
- *C5: Developing Forward-looking Strategies*: How are forward-looking strategies for FTA to be developed within the FTA2018 event itself?
- *C6: Modelling Outside of the Comfort Zone*: What is the comfort zone of FTA2018 and how can modelling be used outside of that zone -- at the event?
- *C7: STI Priority Assessment Methodologies*: What priority assessment methodologies can be brought to bear on FTA2018?
- *C8: Addressing Urban Complexity Through the Resilience Lens*: How is the collective complexity of FTA2018 to be addressed through the resilience lens?

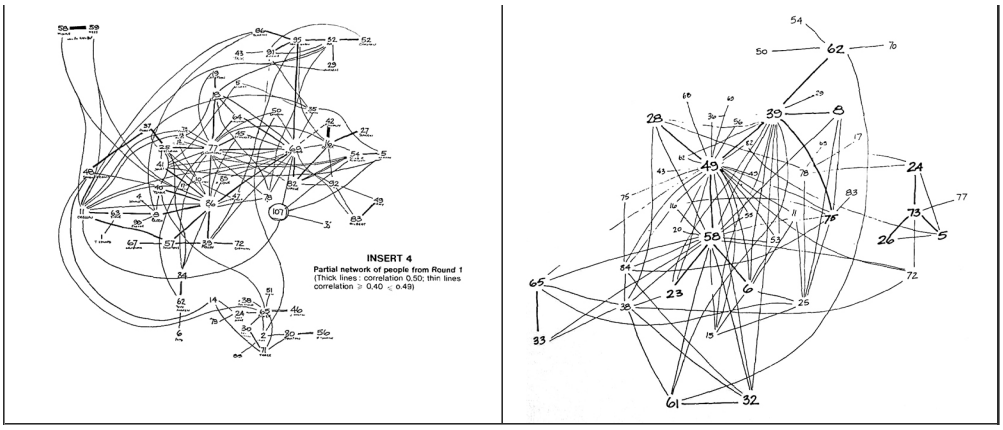
Methodological possibilities for refocusing conferences self-reflexively

Relevance of conference disciplines to functioning of the conference: The review of the Internet science conference noted that discipline announced as being primarily relevant to an Internet science conference could also be presented with questions regarding insights from their application to the event. Of greater interest is how those disciplines (computer science, sociology, art, mathematics, physics, complex systems analysis, psychology, economics, law, political science, epistemology) are variously relevant to emergence of knowledge in relation to the above questions. What disciplinary approaches are missing and why? Which disciplines might prove of relevance to the emergence of integrative of knowledge -- especially with respect to the potential of a semantic web?

Collectively "putting a conference to the question"? It is strangely tragic to note that some European governments, and their allies, make active current use in secret of an ancient mode of investigative research technology developed in Europe -- namely waterboarding. Otherwise known as "putting to the question", there is a case for asking whether conference organization should itself now be "put to the question". Framed otherwise, is their a "deadly question" which can be fruitfully asked of a conference -- of relevance to eliciting appropriate change and innovation? (*In quest of the most deadly question*, 2013). This possibility has been articulated in relation to another future-oriented event (*World Futures Conference as Catastrophic Question: from performance to morphogenesis and transformation*, 2013).

The matter has been addressed in a pioneering experiment by Stafford Beer (from the perspective of management cybernetics) and by Gordon Pask (from the perspective of conversation theory) within the context of the silver jubilee conference of the Society for General Systems Research (London, 1979). The process is described separately (*Metaconferencing: discovering people / viewpoint networks in conferences*, 1980). They used as their point of departure an iterative procedure inviting each participants to formulate a binary question which they believed would divide other participants 50/50. This enabled them to match the "proximity" of issues and participants on various maps. **What "deadly question" might each FTA participant be enabled to formulate as a means of challenging the conference as a whole?**

Indicative mapping from successive iterations among conference participants Society of General Systems Research (1979)	
Partial network of people from Round 1 (Thick lines: correlation 0.50; thin lines correlation = 0.40 = 0.49)	Partial network of people from Round 2 (Thick lines: correlation = 0.75; thin lines: correlation = 0.6 = 0.74)



Given the considerable evolution of technology since then, how is the reluctance to record and visualize the points and links made during the conference process to be understood -- constituting as it does an emerging template potentially enabling fruitful evolution of that process? There is little interest in why one person is (or is not) in communication with another, or why one theme is held to be related (or not) to another -- except perhaps as a question of "intelligence" and "security" concerns.

Tensegrity and syntegration: The 1979 event, and the consideration of tensegrity structures it evoked, can be understood as having engendered the subsequent invention of syntegration processes by Stafford Beer (*Beyond Dispute: The Invention of Team Syntegrity*, 1994) in the light of explorations of tensegrity (*From Networking to Tensegrity Organization*, 1984), as discussed below.

It also stimulated other approaches to communication between participants (*Participant Interaction Messaging: improving the conference process*, 1980; *Case studies*, 1979-1995).

Venue architecture versus Thematic architecture? It is curious to note the unquestioned tendency for the thematic organization of an event to be determined or constrained by the architectural constraints of the conference venue -- specifically the number and size of the meeting rooms available. The time constraints on a verbal presentation have similar consequences. This is now the case irrespective of the technology which would enable such constraints to be bypassed.

It is in this sense that the knowledge organization emerging from such a venue bears the detectable imprint of the architecture of the building. This may well be translated into the organization of the printed proceedings -- which have their own constraints in using space, visualization technology and active hyperlinks. The volume may however be perceived as providing the requisite integrative overview of the event as a whole -- through what has been caricatured by the splendid German term: *Buchbindersynthese*.

Intellectual property constraints: A major constraint implicit in conference organization relates to that of copyright. This may be a determining factor for the organizers due to contractual relations with publishers of the conference proceedings, most notably for financial reasons. Additionally, or separately, those making presentations may aspire to their publication in journals requiring similar constraints. This ensures restricted access, usefully to be caricatured as a form of knowledge incarceration (*Inhibition of creativity through incarceration of knowledge*, 2018). Given the editorial constraints imposed by publishers, these may inhibit to an even greater degree the use of images, colour, animations and presentations enhanced by hyperlinks.

The consequence in practice is that both organizers and participants are constrained in their ability to make papers available prior to the event, at the event, or subsequent to the event -- especially in electronic form online. All that is then free from constraint is any verbal presentation (not including any recording of it). This means that presenters and audience are obliged to spend a maximum amount of time presenting papers with minimum opportunity for discussion. Papers cannot be distributed to interested participants in other sessions, nor can they be subject to text analysis (as mentioned below).

Another constraint is evident in dialogue processes, possibly supported by software, when both may themselves be subject to intellectual property constraints -- possibly then to be used only under franchise by licensed consultants. Such constraints may well extend to metaphors, as discussed separately (*Future Coping Strategies: beyond the constraints of proprietary metaphors*, 1992).

Two-dimensional bias reinforcing binary thinking? The strange current dependence on two-dimensional knowledge architecture, as required by text-based articulation in conformity with print-based dissemination, raises the question as to what forms of knowledge architecture might necessitate 3D, 4D or more -- and how these articulations might need to be communicated. How does this relate to the "planning" of "global" organization, as can be speculative explored (*Adhering to God's Plan in a Global Society: serious problems framed by the Pope from a transfinite perspective*, 2014).

Ironically the question could be raised in relation to the well-publicized International Flat Earth Conference recently held (Michael Marshall, *The universe is an egg and the moon isn't real: notes from a Flat Earth conference*, *The Guardian*, 2 May 2018; *Is the Earth flat? Meet the people questioning science*, *The Guardian*, 27 May 2018; Alan Burdick, *Looking for Life on a Flat Earth: what a burgeoning movement says about science, solace, and how a theory becomes truth*, *The New Yorker*, 30 May 2018).

The challenging question then to be asked of any conference like FTA2018 is to what extent it effectively reinforces what might be caricatured metaphorically as a "Flat Earth mentality" (*Irresponsible Dependence on a Flat Earth Mentality -- in response to global governance challenges*, 2008). The latter was produced in reaction to the implications of the prize winning work by Thomas L. Friedman (*The World Is Flat*, 2005) which received the first *Financial Times* and Goldman Sachs Business Book of the Year Award in 2005. The award recognizes one business book that provides *the most compelling and enjoyable insight into modern business issues, including management, finance and economics*.

Can a conference assessing the "future of technology" avoid addressing the question as to the "technology of the future" which might otherwise have been used to enhance the organization of the conference itself and the integrative coherence of its outcome?

Bias: focus on whole versus focus on the part: In the light of the argument above, what follows is necessarily biased in favour of **acquiring a sense of an event as a whole** rather than focusing on any particular part of it. The question raised is how this can be better achieved using emerging information technology -- and why there is a high degree of resistance to such exploration, biased as it is in favour of the focus on individual presentations and themes, irrespective of their context within the event and with respect to the wider world.

How are future approaches to gaining a sense of the whole to be imagined, as notably argued by the Global Sensemaking group? What catalysts are required to enable exploration of the future otherwise, as may be variously argued (*Imagining the Real Challenge and Realizing the Imaginal Pathway of Sustainable Transformation*, 2007).

Thematic visualization and representation possibilities

These possibilities were discussed in a section in relation to the review of the Internet Science conference. This did not include any illustrative visualizations -- namely the primary focus in what follows.

There is relatively little recognition of the large variety of polyhedra, with an amazing variety of symmetry properties facilitating comprehension. As yet unexplored is the possibility that -- as a means for providing coherent mappings -- they may have much to offer as triggers for the imagination. Clearly any such triggers are to be welcomed in a period of crisis -- especially when they offer unusual ways of imagining relationships beyond those favoured by convention.

So framed, the question is **which polyhedra are suggestive as offering unusual properties of value to strategic formulation and its wider memorability?** The following are exercises in that respect, whether the conference elements are to be mapped onto faces, vertices or edges -- and whether or not that segmentation is to be taken "seriously".

It is appropriate to stress that no particular polyhedron constitutes the most appropriate mapping. Indeed it is the process of exploring the variety of polyhedra that offers greater insight -- with the possibility that those selected as more interesting are better to be understood as a set of complementary perspectives -- of ways of seeing the coherence of the set of initiatives on which the mapping is based. The addition of the texts may render comprehension difficult in static images when rotation and other visual effects are beneficial.

Use of a spherically symmetrical polyhedron for such a mapping has previously been made with respect to the articles of various charters of human rights (*Dynamic Exploration of Value Configurations: polyhedral animation of conventional value frameworks*, 2008). In that case use was made of a rhombicuboctahedron and a rhombicosidodecahedron to indicate -- through the geometry -- a degree of complementarity between the identified values of the 30 articles of the *Universal Declaration of Human Rights*, the 18 articles of the *European Convention on Human Rights*, and the 53 articles of the *Arab Charter on Human Rights*.

Clearly the possibilities raise a variety of questions with respect to the process of determining coherence for systemic and communication purposes. Ideally the ordering of the themes of a conference report (**durings its elaboration**) might be fruitfully challenged by the one (or more) polyhedra onto which they might be mapped -- rather than engage in the questionable exercise of identifying polyhedra onto which themes could be mapped (**after the themes had been determined**). As previously emphasized, the question is how best the systemic integrity of the argument is to be recognized.

An interactive process could be envisaged in which the issue of whether certain themes should be collapsed or articulated would be desirable. Missing from this argument is the question of the systemic significance to be attributed or derived from the association of particular segments with particular portions of a polyhedron.

The pattern of edges forming a polyhedron then lends itself to interpretation both as polarities (thereby configured) and to pathways, as discussed in the following:

- *From Statics to Dynamics in Sustainable Community: navigating through chaos by playing on polarities as attitude correctors*, 1998)
- *Pathway "route maps" of potential psychosocial transformation?* 2015 (In: *Memetic Analogue to the 20 Amino Acids as vital to Psychosocial Life?* 2015)

Tensegrity and syntegration in eliciting strategic coherence

As noted above, the 1979 event of the Society for General Systems Research gave rise to invention of syntegrity by Stafford Beer (*Beyond Dispute: The Invention of Team Syntegrity*, 1994). "Syntegration" is a trademarked name of the proprietary methodology that delivers the syntegrity protocol in the context of complex organizational challenges (Gunter Nittbaur, *Stafford Beer's Syntegration as a Renascence of the Ancient Greek Agora in Present-day Organizations*, *Journal of Universal Knowledge Management*, 2005). This offers a cybernetic approach to knowledge management within large groups whether involving 30 people, groups or issues -- notably by their association with the edges of an icosahedron. Intellectual property constraints have effectively inhibited its wider uptake.

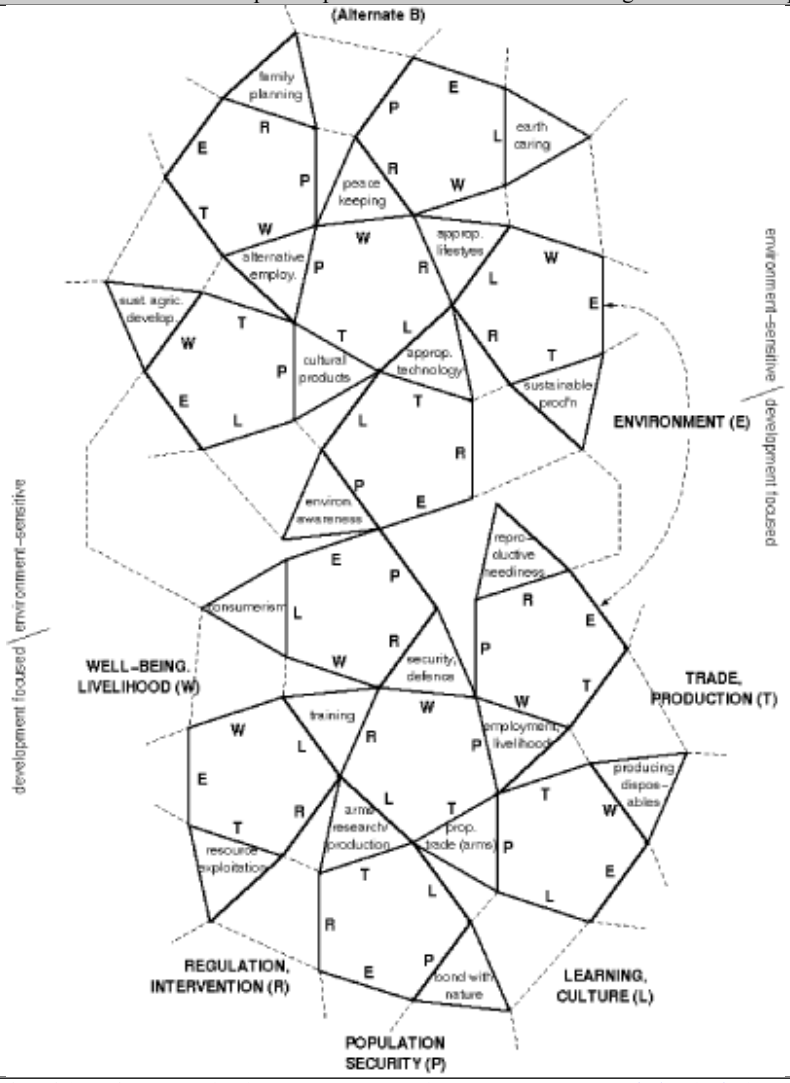
The understanding of syntegrity derives in part from understanding of tensegrity, whose organizational implications can be variously explored (*From Networking to Tensegrity Organization*, 1984; *Polyhedral Empowerment of Networks through Symmetry: psycho-social implications for organization and global governance*, 2008).

On the occasion of the UN Earth Summit (Rio de Janeiro, 1992) an effort was made to configure its specified issues into a three-dimensional form, using an icosidodecahedral structure, as described separately (*Configuring Globally and Contending Locally: shaping the global network of local bargains by decoding and mapping Earth Summit inter-sectoral issues*, 1992). The tentative representation of

inter-sectoral dilemmas of sustainable development took the form of the following pattern (derived from based a detailed table, with commentary).

As a two-dimensional mapping this is helpful in suggesting the different negotiating arenas between combinations of "conflicting" strategic preoccupations -- in the form of polygons. Note one alternative variant in the left-hand image below. The challenge is how to configure the dialogue arenas together to form an integrative whole -- as suggested by folding the network into spherical form. This process is partly clarified in the right-hand panel below in which the "negotiating arenas" are distinctively coloured in the animation [produced with the Stella Polyhedron Navigator].

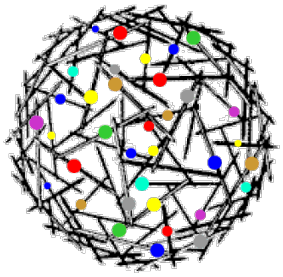
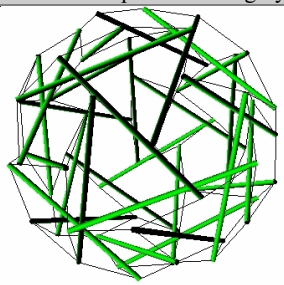
Configuration of inter-sectoral strategic dilemmas characteristic of Earth Summit debate
(based on dilemmas of sustainable development identified at the 1992 Earth Summit;
note the alternative variant of the pattern presented below -- and the folding of either into a spherical form

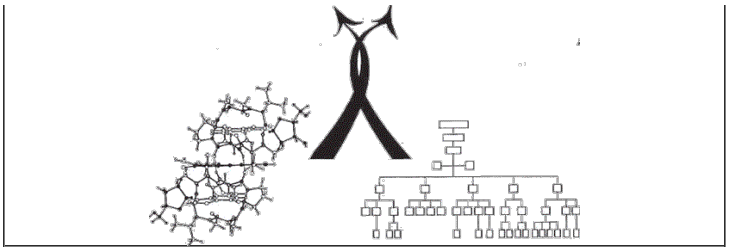


Reproduced from larger version in *Representation of Issue Arenas on Icosidodecahedral Net -Alternate B*)

A suggestive pointer in this direction is offered by the *Dymaxion Map* of R. Buckminster Fuller, author of *Operating Manual for Spaceship Earth* (1969), and a pioneer in the development of tensegrity structures -- as embodied in widely known geodesic domes. As explored by Beer, the question was how then to understand a conference process as a tensegrity -- as a designed dynamic combination of rigid non-compressible elements and flexible tension elements, as indicated in the animation below and discussed separately (*Nature of "global" dialogue*, 2013)

Spherical configuration of conference communication

Alternating positions on value polarities	Rotation of spherical tensegrity
	



Polyhedral conference representation as a catalyst for innovation

A video animation was made on the occasion of the conference of the International Peace Research Association (Leuven, 2008) -- *Building Sustainable Futures: Enacting Peace and Development*, as separately described (*Polyhedral Conference Representation as a Catalyst for Innovation: polyhedral animation of IPRA 2008*, 2008). That animation was developed from materials describing the IPRA 2008 conference programme on the web. It is currently available via YouTube: MP4 (75MB).

The animation was produced as part of an exploration for which arguments are developed in detail in a series of papers:

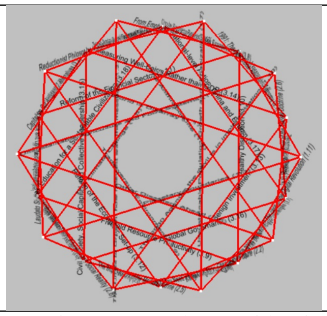
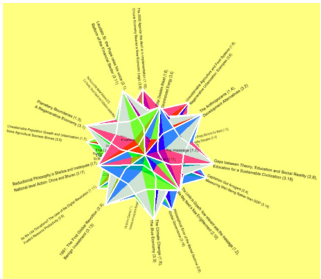
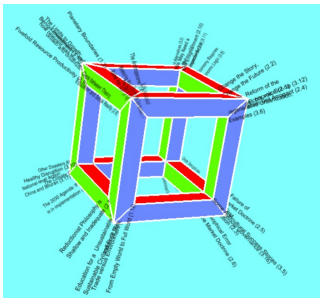
- *Towards Polyhedral Global Governance: complexifying oversimplistic strategic metaphors* (2008)
- *Polyhedral Pattern Language: software facilitation of emergence, representation and transformation of psycho-social organization* (2008)
- *Configuring Global Governance Groups: experimental visualization of possible integrative relationships* (2008)
- *Polyhedral Empowerment of Networks through Symmetry: psycho-social implications for organization and global governance* (2008)

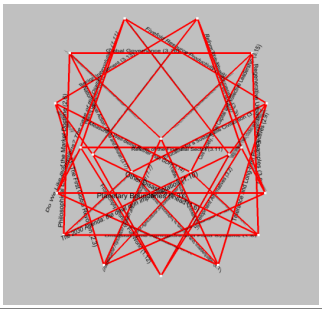
Use of polyhedra to imagine otherwise 40 Club of Rome proposals

A new "Report to the Club of Rome" has been prepared by Ernst von Weizsaecker and Anders Wijkman (*Come On! Capitalism, Short-termism, Population and the Destruction of the Planet*, 2018) as part of its 50th anniversary celebrations -- subsequent to its original foundation in Rome in 1968. Its declared mission is to promote understanding of the global challenges facing humanity and to propose solutions through scientific analysis, communication and advocacy. The report has been separately reviewed (*Exhortation to We the Peoples from the Club of Rome*, 2018)

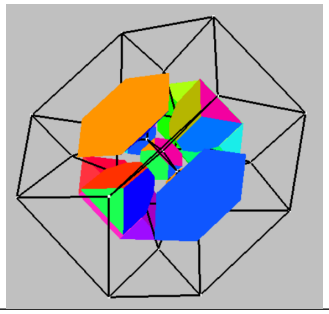
There are 40 segments to the report in the three sections (12, 10 and 18) -- excluding the elaboration of some into sub-segments. There is little evidence of effort to indicate systemic relationships between the issues with which each segment is associated. The review raised the question as to whether the coherence of the new report might be understood otherwise, most notably using polyhedral mappings and animations?

Alternative insights offered via coherence of polyhedral symmetries: The column on the left (below) offers the advantage of a singular image whose complexity is clarified in the animation. Especially intriguing is its the unusual memorability of symmetry of its dual, also clarified with an animation. The lower images in the central column explore the assumption that the coherence of the report may in fact be best understood in 4D, with the images presented being projections into 3D. The lower image illustrates the morphing between the truncated pentachoron (18-Tip) and its dual.

40 segments of the Club of Rome report *Come On!* -- as variously mapped onto polyhedra (Images and animations prepared using *Stella Polyhedron Navigator*, and selected from its library of polyhedra)		
40 Edges	40 Faces	40 Vertices
Crossed Pentagrammic Cupolaic Blend 40 edges, 22 faces, 20 vertices	Bruckner 24,1 (8.6) 40 faces, 40 vertices, 60 edges	Leonardo cube 40 vertices, 48 faces, 96 edges,
		
Crossed Pentagrammic Cupolaic Blend (animation of above)	298-Deca (4D projection into 3D) 40 faces, 30 vertices, 60 edges,	Irregular dodecahedral compound 40 vertices, 24 faces, 60 edges

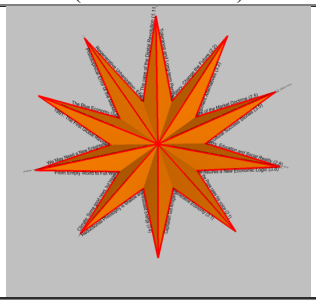


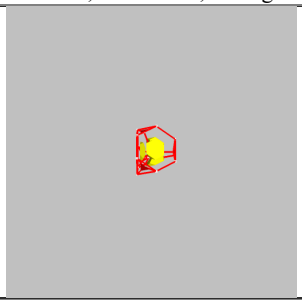
Dual of Crossed Pentagrammic Cupolaic Blend
40 edges, 20 faces, 22 vertices
(animation of dual)

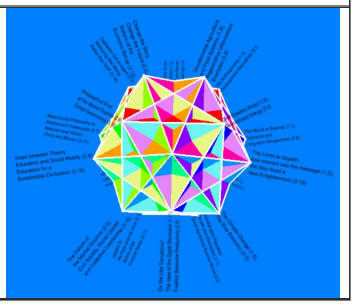


18-Tip and dual (4D projection into 3D)
40 faces, 10 vertices, 30 edges
30 faces, 20 vertices, 40 edges

Compound of 5 cubes
40 vertices, 30 faces, 60 edges







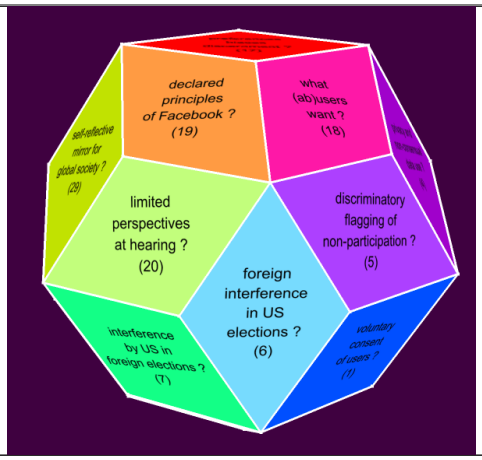
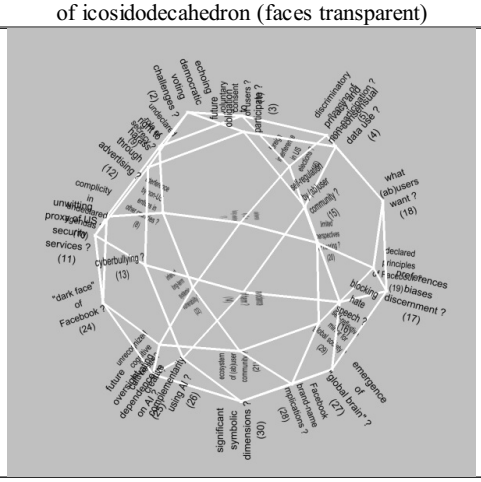
Use of polyhedra to imagine otherwise 30 challenges of Facebook

Questions have been recently asked of Facebook at a Joint Hearing of the US Commerce, Science and Transportation Committee with the Senate Judiciary Committee entitled "Facebook, Social Media privacy, and the Use and Abuse of Data" (Washington DC, 10 April 2018). followed by a hearing before the House Energy and Commerce Committee. Subsequently Mark Zuckerberg was subject to hearings at the European Parliament (22 May 2018).

An effort was made separately to identify the questions that had yet to be answered (*30 Questions that Facebook has yet to Answer*, 2018). This included use of mapping of 30 questions onto polyhedra and indication of a mapping technique using Decision Explorer (see illustrative: screenshots, case studies, cognitive mapping guidelines, users, learning videos; use in support of group decision-making support through Decision Explorer Connect).

Mapping the whole in movement: This argument justifies the following experimental mapping of the 30 questions onto the 30 faces of a polyhedron -- a rhombic triacontahedron, for example -- with spherically symmetrical properties suggesting its integrative nature. Such a form can best be understood through rotational movement.

The mapping is necessarily arbitrary, for purposes of illustration, but suggests the possibility of refinement (with the aid of AI, currently upheld as a vital strategic focus of Facebook) to augment its integrative systemic significance -- and its comprehensibility through symmetry and other effects.

Animation of mappings of Facebook questions onto a polyhedron and its dual	
Mapping of questions onto 30 faces of rhombic triacontahedron	Mapping of questions onto 30 vertices of icosidodecahedron (faces transparent)
	
Animations prepared using *Stella Polyhedron Navigator*	

Curiously the global representation (above left) clarifies the extent to which any such configuration of faces necessarily has a "hidden" hemisphere from any given perspective -- a set of faces only revealed by rotation. The image on the right suggests a form of transparency in this regard -- however this may be interpreted.

Another approach to visualization can be taken through unfolding the polyhedron into a flat presentation as shown below. For purposes

of illustration and education, the 2D variant can then be cut out and folded back to form the 3D version -- as might be done for future hearings.

Screen shots of stages in unfolding the mapping of 30 Facebook questions onto a rhombic triacontahedron -- from 3D to 2D

Animated version. Tabbed 2D version (cut-out and fold).
Prepared using *Stella Polyhedron Navigator*.

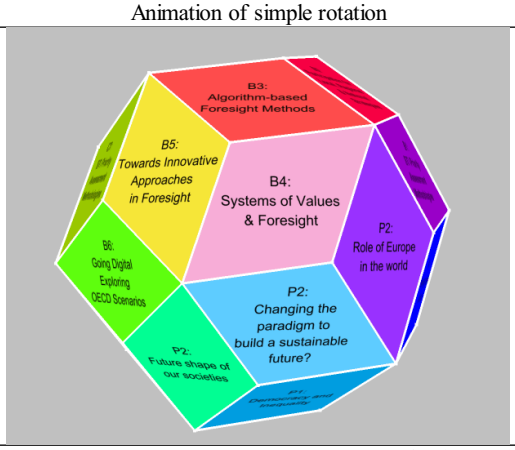
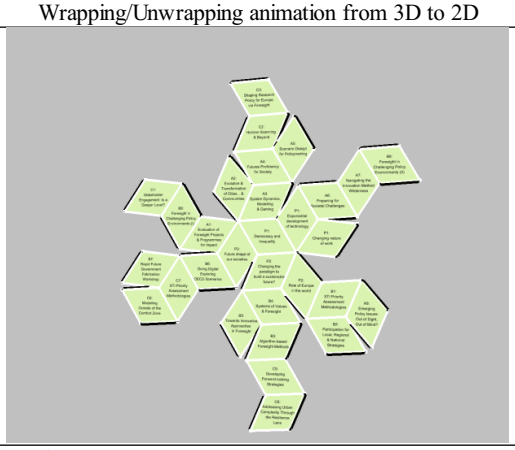
Experimental polyhedral mapping of 30 European FTA issues

The purpose here is to present contrasting ways of comprehending the conference as a whole -- of "seeing it whole". The question is what systemic insights visualization technology might elicit from the possibilities of configuring the elements of the conference otherwise -- whether for participants, for the European Commission, or for wider society. There is obvious relevance to the modelling, simulation and gaming preoccupations of the FTA event.

Session theme mapping: The titles of the 30 FTA2018 program sessions (noted above) can be mapped experimentally onto the **faces** of a suitable polyhedron -- notably the rhombic triacontahedron -- as shown below. Such a mapping could also be made onto the **vertices** of its geometric dual, namely the icosidodecahedron. It could be argued that the approach calls for learning a new "language" -- facilitated by the mnemonic advantages of iconographic reinforcement.

In this exercise, no effort was made to explore whether significant juxtapositions of the themes could be made in that mapping -- nor ways of deriving insights from other features of the spherical geometry (great circles, symmetry, clusters of faces, etc). Clearly greater use of colour coding could be made.

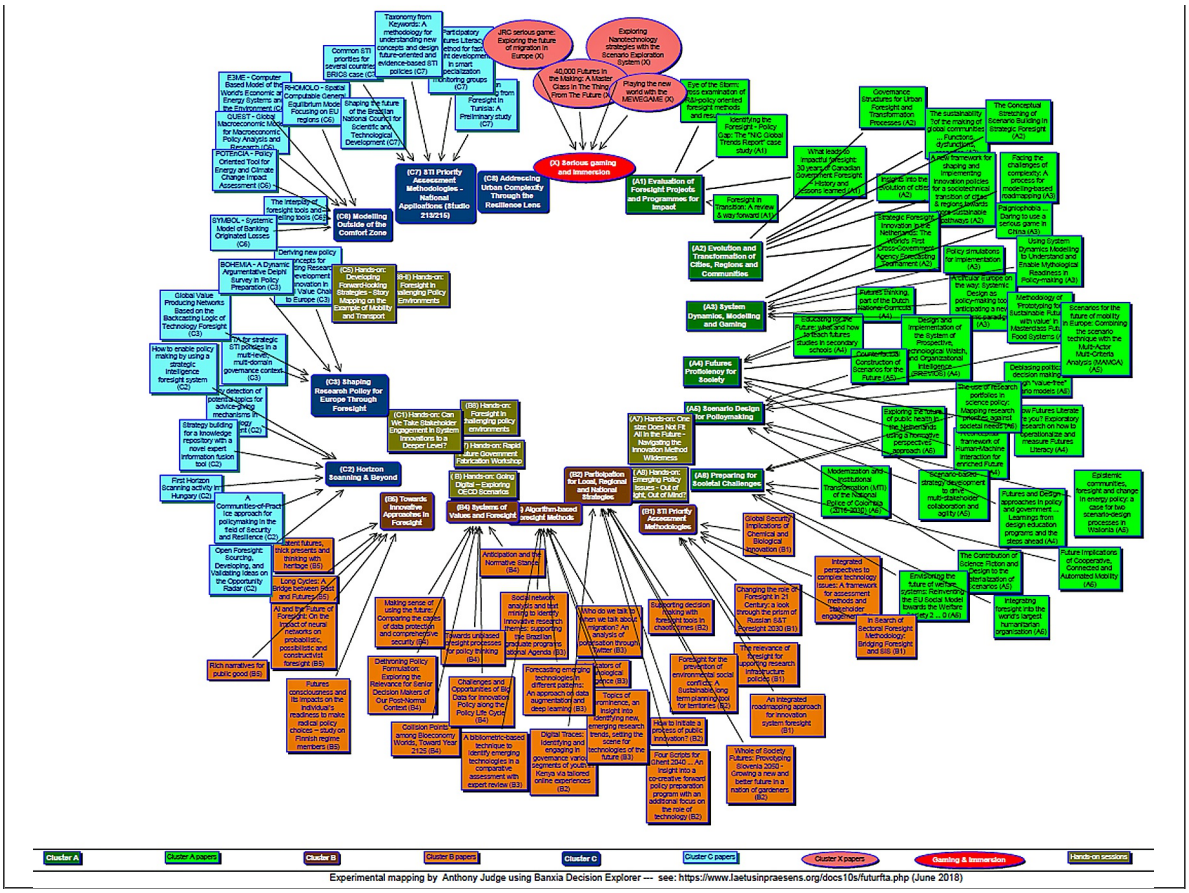
Mapping of FTA themes onto 30 faces of rhombic triacontahedron

Animation of simple rotation	Wrapping/Unwrapping animation from 3D to 2D
	

Prepared using *Stella Polyhedron Navigator*.

Mapping themes and papers: Use can be made of Decision Explorer, as indicated above, to map experimentally the themes and papers of the FTA2018 event -- as indicated below. These elements are presented within shapes, coloured according to theme, with session papers of a lighter tone. Links between theme and paper can be introduced. Other configurations could of course be derived by moving the elements -- as the application permits. The information included could be extended or reduced using memo cards and other devices -- especially in the online collective mode with Decision Explorer Connect. A larger version of the image is accessible to inspect detail.

Mapping of Themes and Papers on Future-oriented Technology Analysis (FTA2018)
(PDF version suitable for A3 printing)



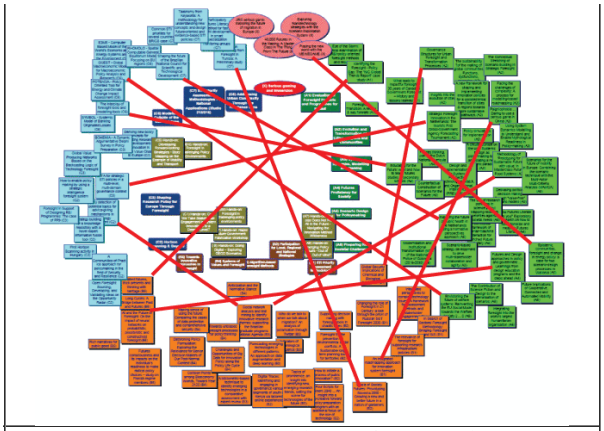
Conference system dynamics? Use of the above map can be taken further by introducing other kinds of links between papers/presenters. These might be derived and included from the following, whether at the present time or as envisaged for future events:

- citation analysis links between the indicated papers (authors), whether prior to their presentation (in the light of the previous work of other participants) or after the event (citing the papers presented by others on that occasion). This would give a sense of the coherence of the thematic content and its appreciation by participants. What reference is made to papers presented at the previous FTA event, for example? What is therefore the probability of future citation by participants of papers presented at the FTA2018 event?
- session attendance of participants, notably in the light of indications of attendance intentions (as requested in a survey of FTA participants prior to the event)
- topic correspondence between the variety of papers, possibly derived from simple keyword analysis of paper titles, or based on text analysis by using an application like Leximancer to generate a map of connectivity in the content presented at the event. Appropriately the slogan of that application is: **text in -- insight out**. This raises the question as to how it is intended to derive insight from the multiplicity of papers presented, whether in isolation, by theme, or for the event as a whole. How are such patterns of insight to be presented?
- an approach based on that explored by Beer and Pask through "divisive questioning" (as noted above), to derive clusters of participants and topics -- beyond the nested programmatic structure imposed by the organizers
- meta-data analysis of email/Twitter/Facebook traffic between participants at the event, in the light of available technology that has been recently so widely publicized. Google's capacity to track movement of smartphone users could be used to that end.
- potential use of CCTV and facial recognition technology -- to the extent that security cameras become the norm in conference rooms and hallways. This would give a (questionable) sense of the engagement of a participant in different sessions -- and therefore a sense of the thematic integration between disparate sessions.

An appropriate question is why conference organizers have proven to be so resistant to exploring ways to represent their event as a whole -- other than through participant photo opportunities. Curiously it is appropriate to note the very extensive use of online dating technology in comparison with the extremely limited use of such techniques to detect and enable communication between conference participants with matching interests.

For purpose of illustration, the following animation is used to suggest a means of deriving insight into the dynamics of the event in terms of distinctive patterns of linkage between disparate papers. The colours of links might be assumed to correspond to the following, for example: innovation, etc; technology, etc; foresight, etc; policy, etc; systems, etc; gaming, etc. The animation includes a frame without links and one with the programmatic links (from above).

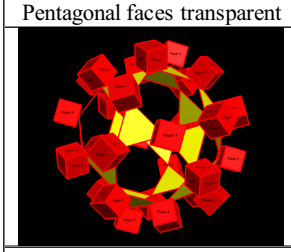
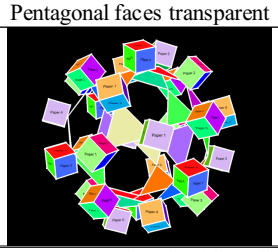
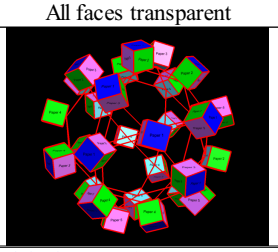
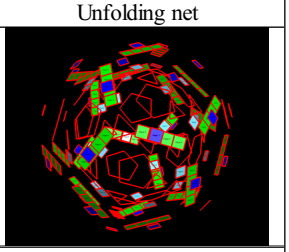
Indicative animation of dynamics between thematic content (for illustrative purposes only)



Adaptation of a Decision Explorer mapping

Comprehensive polyhedral mappings: As implied above, further possibilities can be explored as triggers to imaginative reflection on the interventions configured in the event as a whole. The following assume that each of the 30 sections had 6 presentations (valid in most cases due to time constraints). The six "papers" per session are then configured on a cube (without endeavouring to add the distinctive text details indicated above). The 30 cubes are positioned on the 30 vertices of an icosidodecahedron (of which the rhombic triacontahedron used above is the dual). In the 2 left-hand images the pentagonal faces are rendered transparent to enable a particular sense of the whole. In the third image the triangular faces are also rendered transparent. Different colouring conventions are used. The right-hand image shows the pattern as a whole in different (un)folding net configurations.

Animations of 30 cubes (indicative of 6 papers per session) positioned on 30 vertices of an icosidodecahedron
(indicative paper titles only, not distinguished by cube)

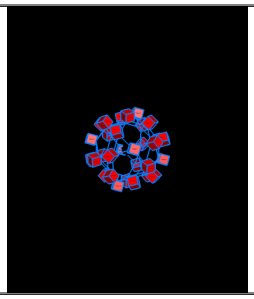
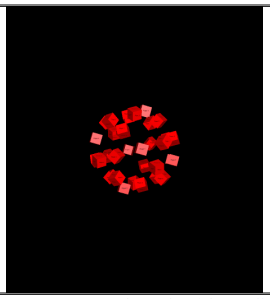
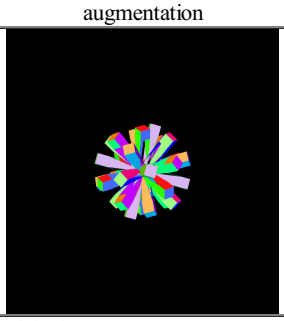
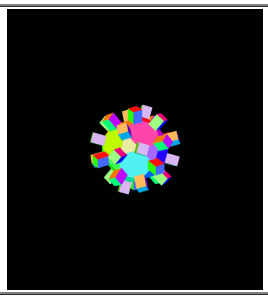
Pentagonal faces transparent	Pentagonal faces transparent	All faces transparent	Unfolding net
			

Produced with Stella Polyhedron Navigator

"Global" transformation as alternation between thematic configurations: As implied above, the geometric duality between the mapping surfaces can be used as a means of illustrating how comprehension of the conference system as a whole can be "smoothly" transformed between highly contrasting extremes -- between the rhomibic triacontahedral mapping and the icosidodecahedral.

This is suggestive of ways of thinking about analogous "global" transformations in society -- otherwise framed fuzzily as "change" or "paradigm shift", with little effort at articulation in terms of social structure and knowledge organization. In this respect of great potential interest are the distinctive approaches to morphing between such extremes (as described separately, morphing duals) and illustrated below. As stressed above, the challenge is how to "read" such transformation processes in psychosocial terms.

Illustrative morphing animations between dual mappings (rhombic triacontahedron -- icosidodecahedron)

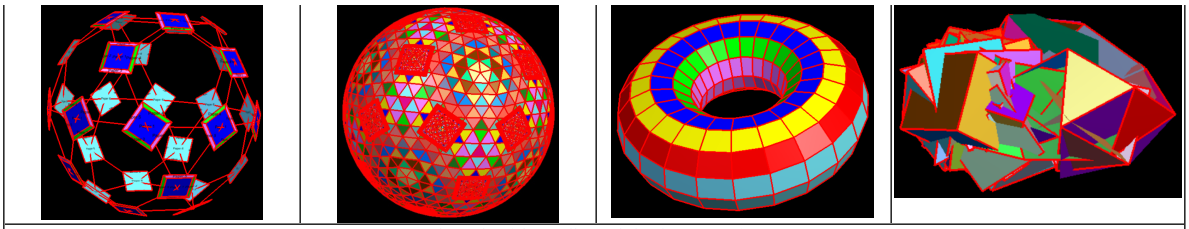
Morphing duals by sizing	Morphing duals by truncation	Morphing duals by augmentation	Morphing duals by tilt-rectiication
			

Produced with Stella Polyhedron Navigator

Conversion to other configurations: A further question is how any such configuration of session papers might be understood quite otherwise through standard transformations of its geometry. Some possibilities are indicated below. No indicative text is associated with the faces.

Transformation of the above model to other forms of presentation

Projection onto a sphere	Conversion to a 5-frequency geodesic sphere	Conversion to a torus	Conversion to a spring model

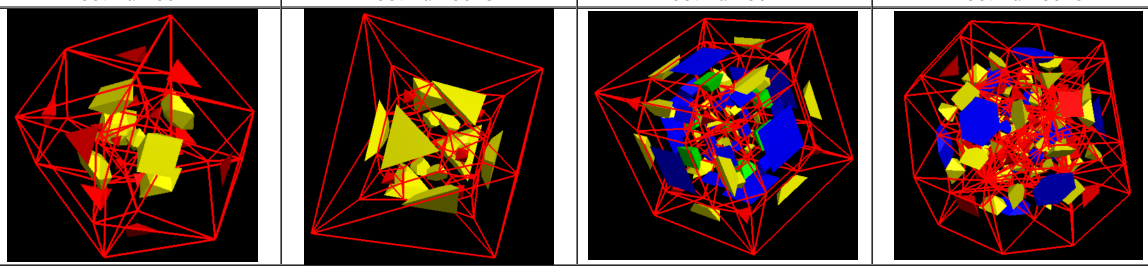


Produced with Stella Polyhedron Navigator

Four dimensional implications: Other than simple animations and conversions, there is the further possibility of how the time dimension might be embodied in the configuration -- namely by switching from a 3D polyhedral configuration to a 4D polytope, or polychoron (*Strategic Embodiment of Time: configuring questions fundamental to change*, 2010; *Comprehending the shapes of time through four-dimensional uniform polychora*, 2015). Clearly any such presentation does not lend itself to conventional depiction. It is however possible to make use of projections into 3D of the 4-dimensional structure derived from the model above. One approach follow from the conversion to Waterman 4D polytopes as indicated below.

Conversion to Waterman 4D polytopes

Root number 2	Root number 3	Root number 4	Root number 5



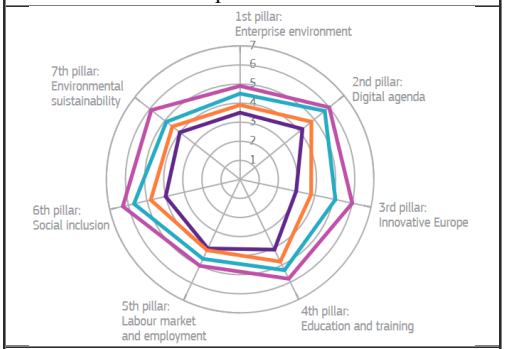
Produced with Stella Polyhedron Navigator

Comprehending otherwise the strategic pillars of Europe -- beyond a stone henge

Strategic pillars of Europe? It is curious to note the manner in which the values and principles of European institutions have been articulated in terms of strategic "pillars". Thus the Digital Agenda presented by the European Commission is indicated as forming one of the seven pillars of the Europe 2020 Strategy which sets objectives for the growth of the European Union (EU) by 2020. Information on the set of pillars is however very hard to locate and variously confused.

Europe 2020: Seven strategic pillars of Europe?

Reproduced from European Political Strategy Centre, 30 September 2015



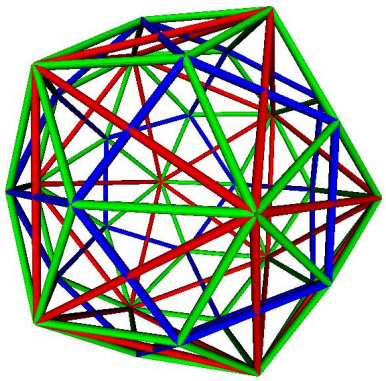
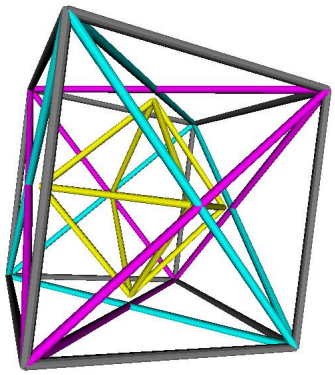
Source: World Economic Forum

Use of the pillar metaphor has however been discussed separately with respect to *Holders of value configurations -- and their "pillars"*, within an exercise in taking this understanding further (*Coherent Value Frameworks Pillar-ization, Polarization and Polyhedral frames of reference*, 2008; *Psychodynamics of Collective Engagement with Polyhedral Value Configurations*, 2008). Despite the widespread political and strategic current emphasis on values and principles, the manner in which their elusive nature is to be organized and comprehended remains as unclear as ever.

Clarification of the nesting of polyhedra then offers a sense of the fruitful connectivity between levels of discourse -- whatever this may imply with respect to comprehension of distinctive configurations of strategic pillars. The following then suggest a means of exploring the interplay of coherence between different levels. Use of the simplest polyhedra of greatest symmetry is assumed to be consistent with the sense in which the most fundamental configurations of strategic pillars implies a high degree of coherence -- however this is (mis)interpreted in practice.

Configurations in 3D of sets of pillars using interactive virtual reality displays

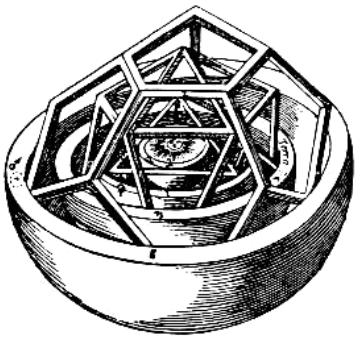
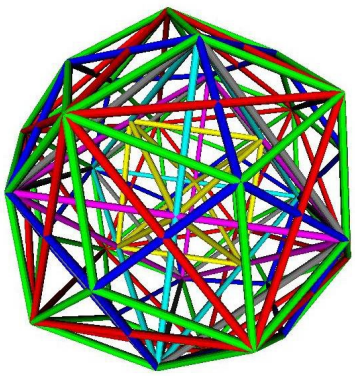
Dodecahedron (blue) and Icosahedron (red) nested within Rhombic triacontahedron (green)	Tetrahedron (cyan) and Tetrahedron (magenta), with Octahedron (yellow) nested within Cube (grey)

	
Accessible via virtual reality viewers/browser plugins -- VRML97 version or X3D version	Accessible in virtual reality viewers/browser plugins -- VRML97 version or X3D version

By combining the two structures above, the complete nesting configuration becomes evident -- perhaps ironically, a more consistently ordered modern version of Kepler's inspiring original image (below). The virtual reality viewers (including browser plugins) enable rotation and zooming into the structures.

The image on the right below is a virtual reality exercise in pulling together in an animation the arguments above relating to the ordering and nesting of fundamental categories of organization. It is usefully contrasted with the famous image on the left, given its significance in 1596 -- immediately prior to the Galileo affair in 1633. For many, in terms of its global significance, Facebook functions as a form of solar system in their daily lives. The question is whether Facebook is currently mistakenly understood by many in ways comparable to the misunderstanding by Kepler of the solar system at the time.

Of particular interest is the view from within the image on the left above or within that below. This recalls the work of Keith Critchlow both with respect to patterns in architecture and those in flowers, following his work on polyhedra (*The Hidden Geometry of Flowers: living rhythms, form and number*, 2011; *Islamic Patterns: an analytical and cosmological approach*, 1999; *Order in Space: a design source book*, 2000). It is of some interest that the flower metaphor -- in relation to polyhedra -- can be fruitfully associated with communication processes in the rise and fall of civilizations (*Flowering of Civilization -- Deflowering of Culture: flow as a necessarily complex experiential dynamic*, 2014)

Contrasting images of structural coherence	
Nested polyhedral model of solar system of Johannes Kepler (1596)	**Rhombic Triacontahedron (green) as a nesting framework** (combining the images above)
	
Reproduced from *Wikipedia* entry on *Mysterium Cosmographicum* (1596)	Virtual reality variants: *static*: vrml or x3d; *mutual rotation*: vrml or x3d; *"pumping"*: vrml or x3d; videos: "*pumping*" mp4; "*rotation*" mp4

Virtual reality representation: Given the technological commitment of Facebook to the revolution in augmented reality and virtual reality, experiments have been undertaken separately with polyhedral representation using virtual reality software (as noted above). Given the commitment of Facebook to the development of AI applications, a wide variety of experiments of this nature is to be expected in the years to come in order to enable content to be more meaningful and exciting to explore. Just as computer screens have finally come to be used by government representatives in committee and plenary sessions, it is to be expected that at some stage use will be made in such contexts of virtual reality and augmented reality technology.

Pillar articulation and dynamics: One unique online experiment in enabling understanding of how structures worked was Soda Constructor (now disabled) -- which attracted millions of users at all levels of society (*Animating the Representation of Europe: visualizing the coherence of international institutions using dynamic animal-like structures*, 2004). In that spirit, the animation on the right can be explored as a source of clues as to how a conference "works" in cycling through configurations of categories of more or less fundamental nature. The nested cycles potentially recall the dynamics of a pumping heart -- raising the provocative question as to whether the conference as a psychosocial organization can be considered to have a "heart".

A concern of that kind is not trivial in a European technology context given the periodic articulation of the concern as to whether Europe and its institutions are essentially "soulless" (*Challenge of "soullessness" -- beyond the "pillar-ization of Europe"*, 2004). The point continues to be variously made (Miguel Angel Moratinos, *A heartless and soulless Europe?* 14 September 2015; Stephen Baker, *Heartless U.S. vs. Soulless Europe*, *Bloomberg*, 5 April 2006; Sohrab Ahmari, *Europe's Soulless Liberalism*, *The Wall Street Journal*, 23 March 2017; *Why are most institutions of the EU based in Brussels, since it is such a soulless city in comparison to other European cities? Quora*).

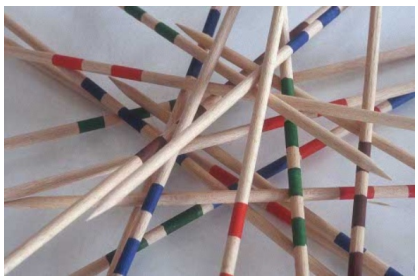
Unfortunately -- as with Soda Constructor -- it would seem that the pillar articulation of Europe has now lost the coherence with which it was originally conceived, even with respect to the three more fundamental EU pillars (*The pillars of the European Union still exist? European Constitutional Law Review*, 2014; *Four pillars of the EU are crumbling*, *The Sunday Times*, 2 August 2016; *Propping up the pillars of a fundamentally free Europe*, *European Parliament,* 25 October 2016; *Missing pillars and roadblocks on the path towards an integrated and decarbonised electricity system in Europe*, *FSR*, 2 May 2017).

Without it being clear as to how many "pillars" continue to be formally recognized, EU provision is however made for "pillar assessments" (*Terms of Reference for Pillar Assessments*, with an *Application form for pillar assessment*, 2015). On the other hand, seven new pillars have been informally proposed (Georgi Gotev, *Opinion leaders identify seven pillars for 'better' EU action*, *EURACTIV*, 20 March 2017). The animations of sets of nested pillar configurations above suggest that the confusion may derive from the distracting dynamics of one set of nested pillars with respect to another. Which configuration is most evident, and when -- and which is more fundamental and least evident, and when?

Pillar configurations as henges? The current confusion with respect to strategic values and how they might be configured as "pillars" merits a degree of comparison with the early configurations of stone pillars ("henges"). These are now the most visible crumbling remnants of the megalithic period in Europe -- notably Stonehenge and the Carnac stones. Given that ancient insights are assumed to have been "written in stone" by those megalithic monuments, should the manner in which modern configurations of principles and values be explored as also having been "written in stone", as is occasionally declared of sets of non-negotiable principles (*Transforming and Interweaving the Ways of Being Stoned: imagination, promise, rocks, memorials, petrification*, 2012)?

Provocatively it could also be asked whether the confusion and mystique in that regard are now evident in the engagement in international conferences -- as the modern equivalent of the gatherings at such henges millennia ago. Do the processes of modern conferences bear a degree of comparison with the "magical thinking" at those ritual gatherings, irrespective of how such thinking has since been deprecated from a formal scientific perspective? Can modern conference organizers be usefully compared to "arch-druids"?

Could the enthusiasm for the mysterious process of "networking" at conferences be understood in this light -- especially given the evident reluctance to use modern technology to enable its rational articulation into structures of higher degrees of order? Or could such participant engagement in conferences be better compared to highly selective engagement with "mini-pillars" -- perhaps to the game of pick-a-stick (otherwise known as Mikado)? Should the process by which participants pick a session or a theme be understood in such terms?

Provocative visual metaphors of current conference organization?	
Misty visibility of European strategic pillars?	Mikado Pick-a-stick?
	
Adaptation of image from *Wikimedia*	Reproduced from *Wikimedia*

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Ernst von Weizsaecker and Anders Wijkman. Come On! Capitalism, Short-termism, Population and the Destruction of the Planet. Springer, 2018