



laetus in praesens

Alternative view of segmented documents via Kairos

19 June 2017 | Draft

Refining the Value of Sustainable Development Goals

In quest of the systemic coherence of global attractors

-- / --

Introduction

Order in psychosocial space -- and strategic design implications

Values: Cannon-balls? Wealth symbols? Ball-games? Strange attractors?

Use of distinctive geometries as mapping surfaces for value-goals

Polyhedral mapping reconciling value-goals and their antitheses in the light of ball-games

Global mapping of 17 value-goals alone

Global mapping of 17 value-goals interacting with their 17 problematic opponents

Unusually memorable mapping possibilities of a tetrahedral geodesic spheres

Interplay of value-goals -- integrating opposing "hemispheres of the global brain"

Global mapping in 4D of interactions of competing value-goals?

Integrative comprehension of disparate global value-goals through sphere-packing

Requisite 12-fold organization implied by the 17-fold articulation of value goals -- as its "stellations"?

Unexplored cognitive implications of 17 Sustainable Development Goals -- through "magic squares"?

References

Introduction

In a period of global crises a frame of reference is offered by the 17 [Sustainable Development Goals](#) articulated by the United Nations, superseding the earlier formulation of the 8 [Millennium Development Goals](#). The new set of goals, as with the earlier set, is variously held to be beyond useful criticism -- being effectively "set in stone", as with the Babylonian [Code of Hammurabi](#). Any reference as to the reasons by which the previous set has faded into history is carefully avoided -- irrespective of whether this might guide reflection on the possible early fate of the new set.

At the same time much is made of the values which are shared by various alliances, especially those held to be fundamental to any special relationship between certain countries. Obvious examples include the frequent reference to such values in the case of the relationship between the USA and the UK. The sharing of values is cited in the case of the European Community, other regional associations of nations, the Commonwealth of Nations, and OECD. Irrespective of their subtle distinctions, it is articulated in declarations of human rights: Universal Declaration of Human Rights, the European Convention on Human Rights, the Arab Charter on Human Rights, American Declaration of the Rights and Duties of Man. Much is also made of the shared values characteristic of a given nation and the collective identity of its peoples-- especially when challenged by the consequences of a massive influx of migrants and refugees.

The concern here is with the nature and memorability of "values". What is a "value" -- other than as is assumed to be "defined" by the focus of lengthy speeches and voluminous theses? Perhaps appropriately challenged by a play on words, if values are indeed the finest of things -- the essence of "fine" -- are they essentially denatured by any effort at their "de-finition"? Do the words purportedly indicative of values, prominently featuring in the declarations of leaders, enhance the attractive power of values? Or do they detract from it in ways which could be recognized as an abuse of any more fundamental insight?

With respect to the UK, the point has been succinctly made by Rowan Williams in response to recent speeches by Theresa May as leader of a country seeking to negotiate its dissociation from the European Community. As recently reported, the former Archbishop of Canterbury appeared unimpressed with Theresa May's repeated talk of "Christian values" and warned of dangers of disillusion with political process and of 'messianic leadership' -- in the light of the process leading to World War II:

It's a phrase that's flung around constantly. The heart of Christian values has something to do with mutuality - a real commitment to and investment in the wellbeing of your neighbour, and the confidence that they are invested in your wellbeing. Not everyone shares these values. (*Rowan Williams: Britons are peering into the abyss after Brexit vote*, *The Guardian*, 21 May 2017)

Citing the Brexit process, Williams suggested that it was "taking our eyes off the ball in some other areas" and called for as broad a consensus as possible on tackling long-term systemic issues. He notably criticized the "innate short-termism in our political language". The argument is valid for other leaders and the short-termism they cultivate in response to more fundamental issues of society. Hence the potential value of the Sustainable Development Goals. But how can such value goals be meaningfully "shared"?

The challenge is that those 17 Goals are apparently an asystemic "hodge-podge" of disparate preoccupations whose interrelationships and mutual dependencies are unmemorable -- to the extent that there is any effort to articulate them in systemic terms. Can they be appropriately caricatured as a "laundry list" of what needs to be "cleaned" in a planetary society perceived to be increasingly "dirty"?

This is consistent with the pattern established with [Agenda 21](#) articulated at the UN Earth Summit of 1992, and a precursor of the Millennium Development Goals. To the extent that fundamental values and goals are intimately related, any set of values to which reference is variously made could also be recognized as a "hodge-podge" of questionable memorability.

Given the criticism by Rowan Williams, what indeed are "values" -- and how indeed do they contrast with the values of cultures such as Islam in a period where there is a quest for "universal values" as the basis for any "broad consensus" -- unless some are to be deliberately and righteously excluded therefrom? If the conventional process of "de-finition" has obscured their nature and empowering modality, could the same be said of "de-velopment" -- given the crises to which it has seemingly given rise.

Is it possible that the key to the "sustainability" of the "goals" may lie in "veloping", as speculatively argued (*Veloping: the Art of Sustaining Significance*, 1997). In a similar vein, could values be better understood dynamically and as "strange attractors" in a complex psychosocial system (*Freedom, Democracy, Justice: Isolated Nouns or Interwoven Verbs? Illusory quest for qualities and principles dynamically disguised*, 2011; *Human Values as Strange Attractors*, 1993). Rather than "definition" of values and goals, is there then a case for their "refinition" -- however that might come to be understood?

The concern here is how a complex nexus of value-imbued goals can be better represented to reflect its coherence as an empowering modality -- challenging any dangerously oversimplistic understandings of consensus, typically insensitive to the subtleties of diversity, as previously argued (*The Consensus Delusion: mysterious attractor undermining global civilization as currently imagined*, 2011). Fundamental to the quest is the comprehensibility and memorability of any means of encompassing disparate concerns. This can be framed as a quest for [mnemonic catalysts for comprehension of complex psychosocial dynamics](#) (*Imagining the Real Challenge and Realizing the Imaginal Pathway of Sustainable Transformation* (2007).

How indeed are people expected to "get their heads around" the set of 17 Sustainable Development Goals?

Order in psychosocial space -- and strategic design implications

There is much concern with the problematic socio-political agendas associated with any [New World Order](#). The title "order in psychosocial space" is inspired by the seminal study by [Keith Critchlow](#) (*Order in Space: a design source book*, 1969). However the point to be stressed is that the concern here is with the wider comprehensibility of any recognizable order -- with whatever cognitive constraints this may imply, as previously argued (*Comprehension of Numbers Challenging Global Civilization*, 2014).

The set of 17 Sustainable Development Goals is seemingly framed in defiance of both systemic insight into their interconnectivity and any sense of pattern memorability. Few would have mnemonic clues enabling them to name the goals, whatever the arguments to the contrary (Andrew Norton and Elizabeth Stuart, *SDGs: why 17 goals and 169 targets might not be such a bad thing*, *The Guardian*, 26 November 2014). The latter summarizes the case made by researchers arguing that though more unwieldy, the comprehensive sustainable development goals are a better springboard for change. However the remarkable analysis cited makes no reference to "comprehension" and with only passing references to communication of any systemic insight (May Miller-Dawkins, *Global Goals and International Agreements: lessons for the design of the Sustainable Development Goals*. ODI Working Paper 402, November 2014).

The asystemic nature of any conventional set of values elaborated by political systems can indeed be considered unwieldy, whatever the rationalizations offered for their viability. Who needs to comprehend the set as a whole in systemic terms? Clearly there would be preference for a limited number of value-goals to facilitate the task -- consistent with the remarkable conclusions of the most cited academic paper in psychology (George A. Miller, *The Magical Number Seven, Plus or Minus Two: some limits on our capacity for processing information*, *Psychological Review*. 63, 1956, 2, pp 81-97). The 8 Millennium Development Goals conformed to that constraint. Its predecessor, [Agenda 21](#), did not. It is a 350-page document divided into 40 chapters that have been grouped into 4 sections. There has been little effort to interlink the contents of the chapters, or to perceive the value in doing so.

Consistent with the Miller constraint was the observation of [Jeffrey Sachs](#), Director of The Earth Institute, interviewed with respect to an early draft of the 17 Goals:

I think they're on a very good track. I am very happy with the zero draft, though it's going to be important to narrow the number of goals down significantly. I personally hope for ten or under, but what's here now is strong. All the major themes of sustainable development are here -- economic, social, environmental, governance and implementation aspects -- and they are not in a list of dozens, but a list of 17 headlines. (*Q&A: Jeffrey Sachs on why the SDGs are big on science*, *SciDevNet*, 4 July 2014)

Why 10 or less? Seemingly no case is made in scientific terms for "10 or less". Issues of relevance have been discussed elsewhere (*Representation, Comprehension and Communication of Sets: the role of number*, 1978; *Examples of Integrated, Multi-set Concept Schemes*, 1984). Alternatively, a cynical argument from a political perspective could be that the larger the number of value-goals in the set, the less the capacity and the motivation to configure them systematically in ways that might highlight embarrassing dysfunctions in their interconnectivity. Awkward questions are thereby avoided under a guise of adequacy -- as neatly caricatured in cybernetic terms

by the so-called [Belgian Compromise](#) (*Principia Cybernetica*).

Who is required to have a global understanding of the 17 SDGs -- whether in an international institution or any national counterpart? How do they facilitate their capacity for systemic understanding and comprehensibility -- of "[joined-up thinking](#)"? How does this challenge relate to that of ensuring systemic oversight -- now highlighted as consequence of extensive surveillance in defence of national values and law and order?

In the light of Crichtlow's presentation, the challenge can be framed metaphorically in terms of the much studied constraints of [sphere packing](#). Given their global implications, values or goals could then be appropriately imagined as "balls" of a kind. The question is how any set can be "packed" together in a manner consistent with engendering a sense of coherence of the whole. Accepting that more than 7 (or 9) value-goals are appropriate to a sense of the whole, a more coherent set could be based on 12 -- given the manner in which this figures so widely in psychosocial organization (*Checklist of 12-fold Principles, Plans, Symbols and Concepts: web resources*, 2011). This was the basis for an earlier argument (*Eliciting a 12-fold Pattern of Generic Operational Insights: recognition of memory constraints on collective strategic comprehension*, 2011).

Curiously, in contrast, 15 is the number of players per side in [rugby union](#), whereas it is 13 per side in [rugby league](#) football, and 11 per side in [association football](#), as played worldwide. Arguably there are characteristics to embodiment of such numbers in a game (with a corresponding number of opponents) which offer coherence to the whole -- one which is clearly far more attractive to many than an essentially arid political articulation of goal-values. Given the concern with "goal" in ball games, there is obviously a very strange irony to the use of "goal" with respect to sustainable development -- with a "goal" being of the highest value in the dynamics of such a game.

In contrast again is the manner in which goal-values are embodied by religion into patterns of 12, most notably in the pantheon of classical Greece (the *Dodekathemon*) and that of Rome thereafter (*Dii Consentes*). In each case the 12 engender a pattern of worship and supplication in temples constructed for this purpose. This has notably been echoed in the Christian tradition with its pattern of 12 Apostles, and a degree of architectural and institutional focus on each of them.

Profoundly curious is the absence of any sense of the pattern of discourse between the Gods or between the Apostles -- despite their contrasting embodiments of the value of the whole. They have "nothing" of consequence to say to each other. This is of course characteristic of the religious orders and priesthoods associated with each. Any memorable discourse is conflictual or tokenistic at best. In contrast in the case of the gods of the classical period, their relationships were articulated in the form of an extensive set of memorable stories which continue to be recounted to this day.

It could be usefully imagined that each value or "religion" invites and engenders a particular mode of engaging with the whole -- a particular mode of comprehension. This possibility is of course a challenge to any broader systemic understanding. Thus the international institutions (notably the Specialized Agencies of the United Nations) -- as secular echoes of the temples of yore -- each cultivate a particular mode of discourse which does not recognize or encourage any need for substantive discourse with the others. The pattern is echoed between academic disciplines where any form of interdisciplinarity has been "systematically" deprecated more frequently than not. There is however the unexplained tendency for both agencies and disciplines to name their indicatives after classical deities considered to be the embodiment of particular values.

Given that understanding, the argument here then depends on one particular mode which can only imply, provocatively, the possibility of a pattern relationships between a variety of modes. The mode is exemplified by that of [Buckminster Fuller](#) (*Synergetics: Explorations in the Geometry of Thinking*, 1975; and *Synergetics 2: Explorations in the Geometry of Thinking*, 1979). However the promised cognitive dimension is only implicit there, if not absent, as separately argued (*Geometry of Thinking for Sustainable Global Governance: cognitive implication of synergetics*, 2009). Implication rather than definitive articulation may be consistent with the image of mutual mirroring imagined with respect to [Indra's Net](#) of Hinduism -- an inspiration for the mathematician [Felix Klein](#) (David Mumford, et al., *Indra's Pearls: the vision of Felix Klein*, 2002).

Values: Cannon-balls? Wealth symbols? Ball-games? Strange attractors?

Values are upheld as fundamental to strategic initiatives and appeals for political solidarity and consensus, as evident in the case of the US Republican party:

Emphasizing values, closely associated in GOP dogma with preserving the traditional family and conservative mores, has been integral to the party's identity and success for decades. (*Bush strategy puts high value on values*, CNN, 28 August 2004)

Although mentioned with the greatest frequency, it is seemingly unclear how values are most fruitfully to be understood. This is despite the fact that it is increasingly seen as essential that students should receive an education in civic values -- as the modern secular variant of the focus on values by religions in the recent past. In the USA these are the values citizens learn to respect, as set forth in the Declaration of Independence and the Preamble to the Constitution (Donald W. Harward (Ed.), *Civic Values, Civic Practices*, 2013).

There is of course the difficulty of the nature of fundamental values, the evident diversity of interpretations of them, and the violence to which these typically give rise -- even when "peace" may be upheld as a fundamental value to which all aspire, for example. The obvious ambiguities of such interpretation, and the elusive nature of many values, were a primary inspiration for the [Human Values Project](#) which offered a discussion of [value confusion](#) in practice in relation to [value definition](#). This provided a context for a methodology to explore the [classification of values](#) -- very broadly understood -- most notably in terms of the dynamic associated with [value polarities](#).

Cannon-balls? Given the clarity implied by any definition, any value can be conceived as identified with a definitional "ball" as a cognitive container for the ideal or principle to which reference can be made. Drawn as a circle, this would be a typical way of indicating

a value in any presentation -- as distinct from other values, similarly encircled and labelled. Given the clash of values implied by the clash of cultures and the [clash of civilizations](#), these definitional balls can be readily caricatured as reminiscent of the cannon-balls used in the defence of values and in the process of imposing the unquestionably "right values" on those upholding the unquestionably "wrong values".

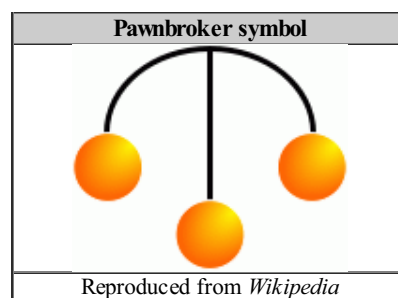
The cannon-ball caricature is consistent with the sense in which the fundamental values of a culture may be upheld as "non-negotiable" -- as variously framed in terms of the [American Way of Life](#) (*U.S. Lifestyle Is Not Up for Negotiation*, *Inter-Press Service*, 1 May 2012). As noted with respect to the declaration of George Bush with respect to US foreign policy:

.. this policy would be steered by a clear set of values: "non-negotiable demands", no less, of human dignity. American presidents often talk about values. What is important here, though, is how the talk could bite. Many of America's allies do not meet his list of values, let alone its enemies. (*George Bush and the axis of evil*, *The Economist*, 31 January 2002)

Unfortunately the cannon-ball caricature engenders both a response in such terms through suicide bombing and the deployment of IDEs - and ripostes in the same mode. There is a curious existential relationship acquiescence to foreign values and the notorious threats of "bombardment back to the Stone Age" (Nick Cullather, *Bomb them Back to the Stone Age: An Etymology*, *History News Network*, 10 May 2006).

There is thus an ironic sense in which common appeals for "solidarity", so closely associated with the challenge of diversity in a psychosocial system, may well translate into the "solidity" of cannon-balls as historically understood. Worse still, they may even reinforce any tendency to a form of "thick-headedness" and the lock-step thinking with which that is associated. Promotion of "solidarity" could be seen as associated with "freezing" of the [adaptive cyce of resilience](#) as being beyond collective comprehension.

Wealth symbols? There is an appropriate irony to the ambiguity of use of the [pawnbroker symbol](#) of three spheres as a point of reference for the impoverished -- given its historical association with the wealth of banks and moneylenders, acting as lenders of last resort. Throughout the Middle Ages, [coats of arms](#) bore three balls, orbs, plates, discs, coins and more as symbols of monetary success.



How is this ambiguous relationship between wealth and its lack to be understood -- especially given that "No poverty" is the first of the 17 Sustainable Development Goals? The question is pertinent given the primary value of poverty to the monastic life -- with the further irony of the preoccupation with the Trinity in the case of the Christian tradition.

Strange attractors? As an alternative, the subtlety of values associated with the highest aspirations could be understood as calling for an articulation which honours that subtlety and its fundamental nature. Values could then be caricatured as attractors -- possibly to be usefully informed in a complex society by understanding of the dynamics of the "strange attractors" of the [complexity sciences](#), as previously argued (*Human Values as Strange Attractors*, 1993).

The sense of a fundamental value-based global attractor can be explored speculatively otherwise (*El-Attractor -- Timeless Complex Dynamic: Health, Wealth, Stealth / Youth, Couth, Truth*, 2007).

Ball-games? As discussed below, potentially more immediately fruitful is exploration of the ball metaphor for values -- but otherwise, in terms of the focal role of balls in games. These have the advantage of being widely comprehended and intimately related to the high value of scoring goals. Understandably, those whose values are non-negotiable are obliged to prove themselves in those terms -- as in the focus provided by the Olympic Games as collectively appreciated. In a sense they cannot afford to be seen to lose -- especially when related to the need "to be great again", and be seen to be so.

The 17 Sustainable Development Goals then merit exploration as a ball-game "played" with value-goals. The game can be compared with other ball-games played by teams with varying numbers of players per side. A first point of consideration is: *Why 17?* How is this pattern to be distinguished from the coherence offered by the 8 [Millennium Development Goals](#) (MDGs) for the year 2015 that had been established following the Millennium Summit of the United Nations in 2000, following the [United Nations Millennium Declaration](#)? *Why 8?*

What coherence does the pattern of 17 offer as a systemic pattern through which any larger whole is expressed?

The Millennium Development Goals was associated with 21 targets. The Sustainable Development Goals has been associated with 169. Why 21? Why 169?

With respect to the 17 value-goals and their associated global strategies, it is then the set of 17 problems by which they are held to be opposed which is a concern -- a vision of the global problematique. As argued separately, the set of strategies may be understood as the "resolutique", with game-playing itself understood as the "irresolutique" -- exploiting the terminological neologisms of the Club of Rome, as discussed separately (*Imagining the Real Challenge and Realizing the Imaginal Pathway of Sustainable Transformation*, 2007).

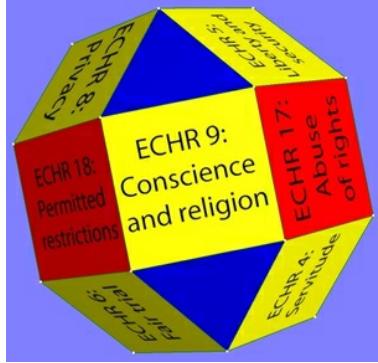
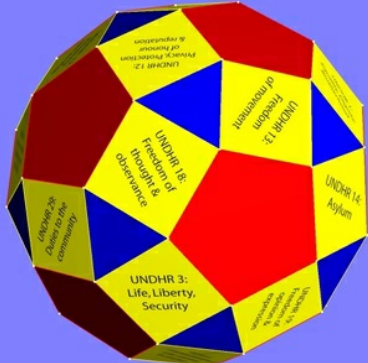

The possibility of reframing game-playing more fruitfully in relation to value-goals has notably been explored by [James P Carse](#) (*Finite*

and *Infinite Games: a vision of life as play and possibility*, 1986) and to higher order questions (*Engaging with Questions of Higher Order: cognitive vigilance required for higher degrees of twistedness*, 2004). ****

Use of distinctive geometries as mapping surfaces for value-goals

In the quest for cognitive order in psychosocial space, any pattern of order relying to a degree on geometry is provocatively challenged by the investigation of cognitive psychologists (George Lakoff and Rafael Nuñez, *Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2001). From that perspective there is every possibility that that order may be as much "within" as "without" -- however that distinction is "de-fined", as can be variously argued (*World Introversion through Paracycling: global potential for living sustainably "outside-inside"*, 2013).

Distinctive polyhedral forms can be used to map distinctive articulations of values as shown below, and presented separately with other variants (*Dynamic Exploration of Value Configurations: polyhedral animation of conventional value frameworks*, 2008; *Topology of Valuing: dynamics of collective engagement with polyhedral value configurations*, 2008).

Polyhedral representation of value configurations: a challenge to integrative imagination screen shots of stages in the transformation of the geometry of sets of values [PDF version] using indicative features of the <i>Stella Polyhedron Navigator</i> software package		
<i>European Convention on Human Rights</i>	<i>Universal Declaration of Human Rights</i>	<i>Arab Charter on Human Rights</i>
		
18 Articles displayed on 2 face-types of a rhombicuboctahedron	30 Articles displayed on 1 face-type of a rhombicosidodecahedron	53 Articles displayed on 2 face-types of a rhombicosidodecahedron

It is unclear whether the *Declaration Toward a Global Ethic*, as promoted by the *Parliament of the World's Religions*, lends itself to such treatment or could benefit from it.

In contrast with the preoccupation with the geography of the globe and its resources of Buckminster Fuller, of potential relevance is whether the *Dymaxion Map* he invented could be of value to preoccupation with value-goals. It is a projection of a world map onto the 3D surface of an icosahedron, which can be unfolded and flattened to 2D. The question merits exploration in the light of his preoccupation with global resource management and his proposed *World Resources Simulation Center* -- now operational. Missing however is any concern with cognitive resources and their sustainable organization.

Polyhedral mapping reconciling value-goals and their antitheses in the light of ball-games

Taking 17 as a point of departure on which a form of ("non-negotiable") global consensus has been achieved, how might the coherence of the set be comprehended -- beyond the conventional use of an inherently unmemorable checklist of bullet-points? The approach taken here is to seek ways of mapping the 17 value-goals onto polyhedra with varying degrees of symmetry, offering varying degrees of memorability (partially according to that symmetry). The numbers characteristic of the polyhedra (vertices, faces, edges) can then be placed in juxtaposition with the number of players in various well-known ball games.

The argument here assumes that the 17 value-goals might indeed be associated with particular polyhedra. However the psychosocial reality of interest is the manner in which they are challenged by their antitheses -- the value-goals with which they are in game-like competition, namely those of their opponents, perceived as "deadly".

In sport, it is not the values upheld by the "home team" which are of sustainable interest -- unless they are challenged by opponents who can be successfully defeated as an exemplification of the superiority of the values which the "home team" defends. The game derives its interest (as a "strange attractor") from its dynamics, not from any static juxtaposition of the opposing teams.

The existence of the globally agreed set of 17 value-goals is taken as the necessary point of departure for this exercise. For this reason polyhedra onto which they might be mapped are presented at the top of the table below -- whether the choice is made to map onto vertices, faces or edges. In each case however, accepting that the set acquires its interest and meaning from its dynamics with an opposing set, there is a need to consider what polyhedra the two "teams" of 17 might be mapped to provide a sense of the larger coherence of psychosocial dynamics. The shaded rows in the table therefore offer indications of suitable polyhedra with regard to both "teams", in contrast to the unshaded row for the singular set of value-goals alone. It is then in the shaded row that various ball-games can be identified (on the right), according to the number of players on each side.

It is appropriate to recall that the perspectives opposing any set of values are themselves typically associated with a contrasting set of values -- rather than being inherently meaningless in any absolute sense (whatever claims are made in this respect by the opponents). Like it or not, however "non-negotiable" the world view with which each is associated, it is within the game that "negotiation" takes place, whatever the conflictual dynamics involved.

Links have been provided in the table to depictions of some polyhedra, whether in terms of their interest (in relation to the set of 17), or because of their recognition in terms of regularity or semi-regularity. Such regularity is understood as an approximation to the global whole (implied by the relation of the polyhedra to their **circumspheres**). For any given case, there may be multiple polyhedral candidates, in which case the number is indicated (in parentheses in the table), but only the more common or "interesting" are listed. Many indicated are obscure, little known, or highly irregular.

Given the particularly unusual value attached to the set of 17 as exemplifying a global preoccupation, the associated polyhedra are presented visually beneath the table -- whether for the 17 alone, or for the game of 2x17 in which they necessarily compete strategically.

Identification of polyhedra as possible mapping devices – in comparison with dynamics of ball-games of equivalent complexity (unshaded rows relate to 17; shaded rows relate to 34)					
Polyhedral mapping possibilities (data from the polyhedral library in <i>Stella Polyhedron Navigator</i>)				Team games	
	Vertices	Faces	Edges		
17	Stellation of rhombic triacontahedron (1)	Pentagonal rotunda (5) 2-Frequency octahedral geodesic hemisphere	Bi-augmented triangular prism (2) Square pentagonal mixed prism		
	Moon base (2) 4-Frequency tetrahedral geodesic sphere	Gyroelongated square bicipola (2) 898-Tuttip	Stewart Z4 (1)	34 (2x17) 17-a-side	
16	Heptagonal deltohedron (20) Octagonal prism	Heptagonal antiprism (20) Octagonal dipyrmaid	Square antiprism (5) Square deltohedron		
	Rhombic triacontahedron (30) Biaugmented truncated cube	Icosidodecahedron (33) Truncated icosahedron Truncated dodecahedron	Octagonal antiprism (7) Octagonal deltohedron	32 (2x16) 16-a-side	
15	Pentagonal cupola (9) Augmented truncated tetrahedron Bifunabirofunda	Elongated pentagonal dipyrmaid (5)	Pentagonal prism (9) Pentagonal dipyrmaid		
	Icosidodecahedron (32) Wings	Rhombic triacontahedron (24)	Dodecahedron (23) Icosahedron	30 (2x15) 15-a-side	rugby union hurling bandy
14	Rhombic dodecahedron (30) Tetrakisshexahedron	Cuboctahedron (35) Truncated octahedron Truncated cube	Gyrobifastigium (5)		
	Augmented truncated cube (6) Tetrated dodecahedron	Tetrated dodecahedron (5)	Heptagonal antiprism (20)	28 (2x14) 14-a-side	football cricket
13	Augmented hexagonal prism (5)	Gyroelongated square pyramid (5) Biaugmented pentagonal prism	Augmented triangular prism (1)		
	Strombic icositetrahedron (8)	Rhombicuboctahedron (35) Truncated cuboctahedron Great rhombicuboctahedron Great truncated cuboctahedron	Parabiaugmented hexagonal prism (4) Bifunabirofunda	26 (2x13) 13-a-side	rugby league
12	Icosahedron (37) Cuboctahedron Truncated tetrahedron Great dodecahedron Great icosahedron	Dodecahedron (35) Rhombic dodecahedron	Cube (8) Octahedron Tetrahemihexahedron Tetrahemihexacron		
	Truncated octahedron (40) Truncated cube Rhombicuboctahedron Small cubicuboctahedron Snub cube	Stella octangula (42) Strombic icositetrahedron Pentagonal icositetrahedron Augmented cube	Cuboctahedron (23) Rhombic dodecahedron Octagonal prism Octagonal dipyrmaid	24 (2x12) 12-a-side	shinty
11	Elongated pentagonal pyramid (8) Gyroelongated pentagonal prism Diminished icosahedron	Elongated pentagonal pyramid (9) Biaugmented triangular prism Augmented hexagonal prism	--		
	Great dodecahemicosacron (5)	Great dodecahemicosahedron (13)	Augmented hexagonal prism (2)	22 (2x11) 11-a-side	association football cricket bandy
10	Hexahemioctacron (8) Square deltohedron Pentagonal prism	Cubohemioctahedron (18) Square antiprism Pentagonal dipyrmaid	Pentagonal pyramid (3)		
	Dodecahedron (26)	Icosahedron (20) Great icosahedron Small cubicuboctahedron	Pentagonal antiprism (19)	20 (2x10) 10-a-side	rugby tens
9	Heptagonal dipyrmaid (9)	Heptagonal prism (6)	Triangular prism (3) Triangular dipyrmaid		
	Small rhombihexacron (13) Great rhombihexacron	Small rhombihexahedron (19) Great rhombihexahedron	Truncated tetrahedron (8) Hexagonal prism	18 (2x9) 9-a-side	baseball footy
	Cube (18)	Octahedron (13)			

8	Square antiprism Squashed cube Rhombic prism	Truncated tetrahedron Hexagonal prism Gyrobifastigium	Square pyramid (1)		
	Heptagonal deltohedron (20) Octagonal prism Octagonal antiprism Simplest torus	Heptagonal antiprism (20)	Square antiprism (5)	16 (2x8) 8-a-side	youth teams (cricket, football)
7	Tetrahemihexacron (8) Pentagonal dipyramid	Szilassi (5) Pentagonal prism	--		
	Rhombic dodecahedron (30) Heptagonal prism Heptagonal antiprism	Cuboctahedron (35) Truncated octahedron Truncated cube Csaszar	Gyrobifastigium (5)	14 (2x7) 7-a-side	paralympic football
6	Octahedron (5) Triangular prism Pentagonal pyramid	Cube (8) Triangular dipyramid Pentagonal pyramid Squashed cube	Tetrahedron (1)		
	Icosahedron (37) Truncated tetrahedron Cuboctahedron	Dodecahedron (35) Rhombic dodecahedron	Cube (8) Octahedron Squashed cube	12 (2x6) 6-a-side	volleball paralympic football ice hockey
5	Triangular dipyramid (4) Square pyramid Triangular dipyramid	Triangular prism (2) Square pyramid	--		
	Hexahemioctacron (8) Pentagonal prism	Cubohemioctahedron (8) Square antiprism Pentagonal dipyramid	Pentagonal pyramid (3)	10 (2x5) 5-a-side	football basketball paralympic football
4	Tetrahedron (1)	Tetrahedron (1)	--		
	Cube (18) Square antiprism Gyrobifastigium	Octahedron (13) Truncated tetrahedron Gyrobifastigium	Square pyramid (1)	8 (2x4) 4-a-side	short football
3	--	--	--		
	Octahedron (5) Pentagonal pyramid Triangular prism	Cube (8) Triangular dipyramid Pentagonal pyramid Squashed cube	Tetrahedron (1)	6 (2x3) 3-a-side	
2	--	--	--		
	Tetrahedron (1)	Tetrahedron (1)	--	4 (2x2) 2-a-side	doubles (tennis, etc) bridge
1	--	--	--		
				"2"	

In what sense could it be understood that particular ball-games, with a distinctive number of players, are giving expression (unconsciously) to the elusive experiential coherence of a pattern of invariance indicated by a particular polyhedron? Are the passing patterns of any such game an exemplification of constraints implied by the polyhedral configuration?

With respect to the pattern of 17 value-goals, it could be considered remarkable the the number is central to to one of the most esteemed ball-games, namely golf. The esteem is all the greater given the association of the game with the person recognized as the "most powerful man on the planet" and his ownership of the courses on which it takes place. Golf courses of distinction typically have from 17 to 19 "holes".

The challenges are usefully reframed by the work of management cybernetician [Stafford Beer](#) (*Beyond Dispute: the invention of team synergy*, 1994). Although no reference is made to the players of a rugby game, for example, his research focused on "problem jostling" between 12 active perspectives in a game. These interactions he associated with the 30 edges of an [icosahedron](#) between its 12 vertices. Given his understanding of the role of the edges in the icosahedron, it is these edges which may be of special interest in representation of the dynamics of any game. Other insights may arise from consideration of the vertices and faces for that purpose -- as with the sense of "facing off" or "marking" a player in the opposing team.

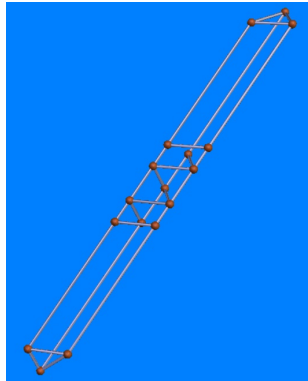
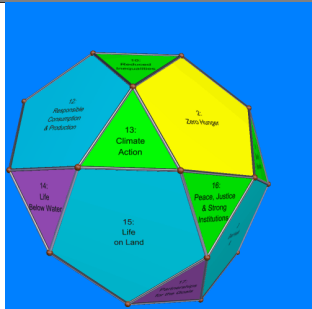
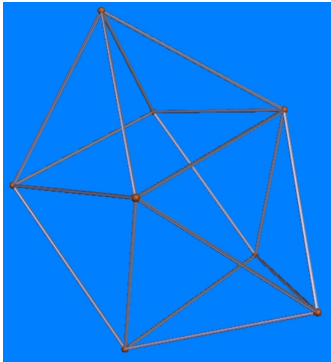
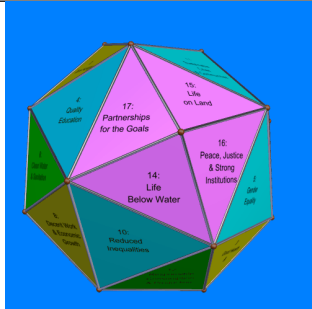
Similar approaches have been previously explored:

- preparations for the preceding Agenda 21 gave rise to an exercise (*Configuring Globally and Contending Locally: shaping the global network of local bargains by decoding and mapping Earth Summit inter-sectoral issues*, 1992). Here the opposition was between "global" and "local", each being "hidden" from the other -- but otherwise.
- the [15 global strategic challenges](#) identified by the [Millennium Project](#) were framed in terms of "wickidity" (rather than wickedness) to suggest the stimulus they constitute to innovation. They were presented as mirrored by 15 internal processes of a (futures research) conference (*Embodying Strategic Self-reference in a World Futures Conference: transcending the wicked problem engendered by projecting negativity elsewhere*, 2015) -- "external" and "internal" being respectively "hidden" from each other.

Global mapping of 17 value-goals alone

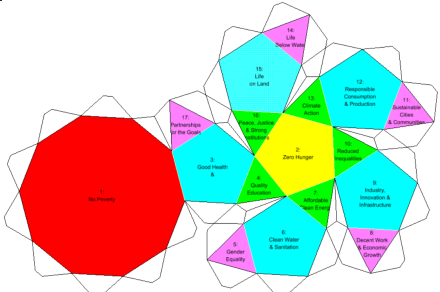
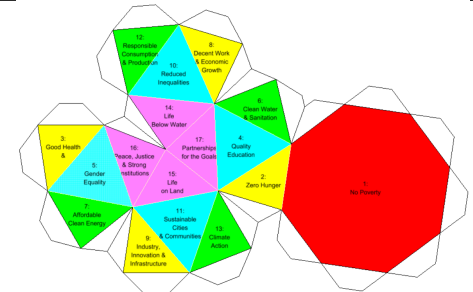
The initial challenge is to consider how the 17 value-goals could be mapped onto a polyhedron. As shown in the preceding table, there are remarkably few polyhedra of interest which lend themselves to this. Seemingly the sole possibility of mapping onto **vertices** gives rise to the form on the left -- readily to be characterized as an uninteresting distortion, although most closely reminiscent of a checklist of bullet-points. To a lesser degree, the same might be said of any mapping onto the **edges** of the polyhedron on the right. Potentially far more

interesting is the mapping onto the faces of the two distinct polyhedra presented in the centre below as animations. Their form as distinct types of rotunda is suggestive of interesting possibilities for their construction as described in the subsequent table.

Polyhedra offering 17 features onto which to map 17 value-goals (some faces transparent for great comprehensibility)		
Stellation of rhombic triacontahedron (17 vertices of 9 types; 28 edges of 14 types; 13 faces of 7 types)	Pentagonal rotunda (17 faces of 5 types; 35 edges of 7 types; 20 vertices of 4 types)	Biaugmented triangular prism (17 edges of 9 types; 11 faces of 6 types; 8 vertices of 4 types)
	 2-Frequency octahedral geodesic hemisphere (17 faces of 5 types; 28 edges of 7 types; 13 vertices of 4 types)	
		
Images generated with <i>Stella Polyhedron Navigator</i>		

Illustrative constructions: As noted, the polyhedra presented above as animations lend themselves readily to construction in ways which are of considerable merit to communicating the pattern of 17 value-goals. When unfolded from 3D into their respective 2D nets, they can be presented with "tabs" enabling their parts to be glued together when folded into a 3D configuration.

This offers the immediate possibility of creating miniature models (in paper or cardboard), duly labelled, for educational and communication purposes. Of potentially greater interest is their construction as domes or tents on a larger scale -- to enable people to walk through and around them, with all that that implies in psychological terms (as in the case of temples, cathedrals and other symbolic edifices).

Tabbed variants of polyhedra enabling model, dome and tent construction (labelled with the 17 value-goals, arbitrarily attributed to faces)	
Pentagonal rotunda (rotated above)	2-Frequency octahedral geodesic hemisphere (rotated above)
	
Images generated with <i>Stella Polyhedron Navigator</i>	

As "tents", they recall the argument made for "bigger tents" as discussed separately (*Global Brane Comprehension Enabling a Higher Dimensional Big Tent? Strategic implication in encompassing nothing and coming to naught*, 2011).

"Value bunkers": Arguably the configuration of 17 value-goals is reflective of a "bunker mentality" given the emphasis on the security they imply for adherents and the form of such rotunda -- reminiscent of "circling the wagons". This emphasizes the exclusion of any other sense of global reality -- and of others holding alternative visions.

The point is relevant in the light of the first major foreign policy address as president of Donald Trump -- speaking to an audience of leaders from Arab and Muslim-majority nations -- framed the fight against extremists as "a battle between good and evil" (*Trump: Anti-*

extremism is battle of good and evil, USA Today, 21 May 2017; *Trump: Good vs Evil*, The Canadian Press, 21 May 2017). The address also included repeated indication of the need to drive extremists out (*Trump's Riyadh Address on Islamist Extremism: "Drive them out"*, Legal Insurrection, 21 May 2017). The problem for a global civilization is the absence of "out" -- in the absence of [penal colonies](#) (as with Australia in centuries past).

Global mapping of 17 value-goals interacting with their 17 problematic opponents

As argued above, mapping of the value-goals alone does not explicitly introduce the challenge of the opposing perspective in each case, namely the problematic condition evoking an interesting dynamic through which each value-goal is exemplified. In framing the value-goals by what could be deprecated a "motherhood" phrases beyond criticism, it is questionable whether the implied problematic condition has been adequately identified and named -- except through its disparate facets articulated in the the 169 tasks. It is appropriate to note that strongly [explicit articulation of the problematic](#) has been a methodological criterion of problem profiles in the *Encyclopedia of World Problems and Human Potential* -- faced with the fuzzy value-loaded language of international strategic articulations. Lack of clarity effectively makes phantoms of the opposition -- the "Dark Force" with which battle itself becomes necessarily problematic, as highlighted by the US presidential election (*Democratic rehearsal of the final battle between the Forces of Light and Darkness*, 2016).

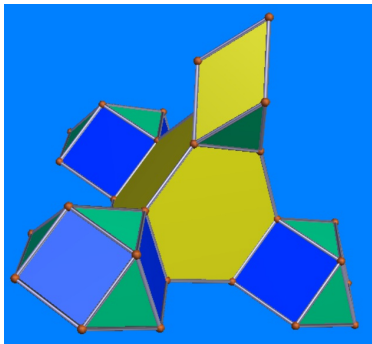
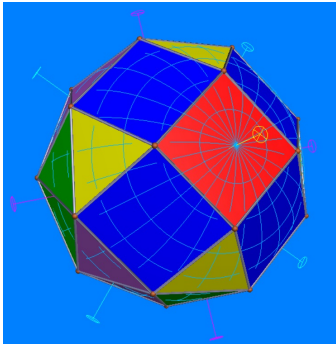
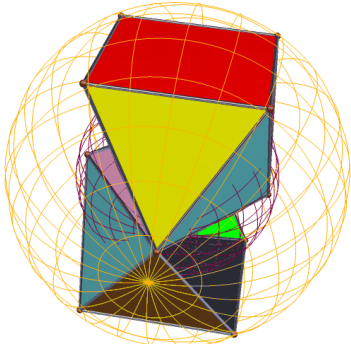
Understood as transactional games, the question is **onto the features of what memorable polyhedra engagement with the opposition might be mapped?** Again the number of candidates is relatively limited (as indicated by the earlier table).

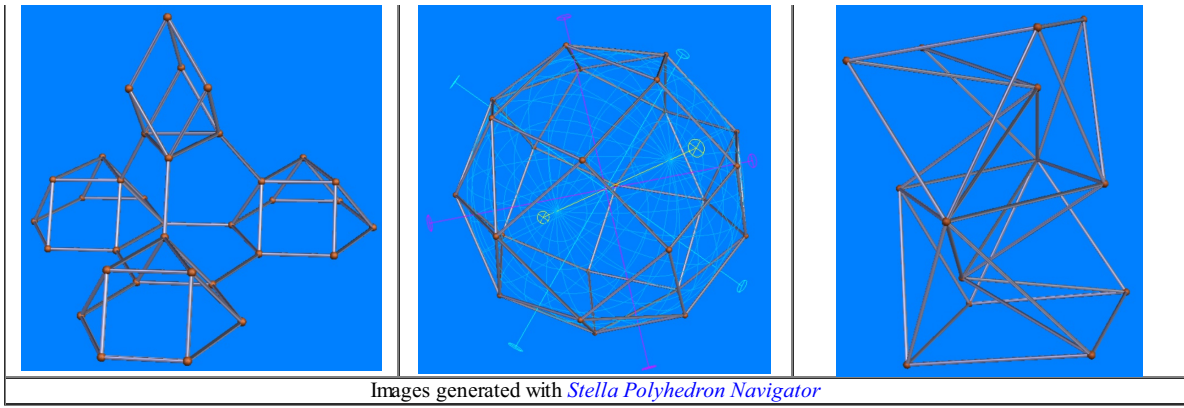
In the quest for useful candidates a concern is how a transactional game might be represented by:

- a vertex, where one vertex is effectively opposed by a counterpart in the structure -- typically not associated with an edge, but possibly with an axis of some kind
- a face, where one face is effectively opposed by a counterpart in the structure -- possibly opposite to it, however it may be rotated or oriented
- an edge, rising the question as to the corresponding number of vertices and with what these are associated.

In contrast with the polyhedra available for the 17 value-goals alone, those for the 2x17 are more strikingly memorable. Who could have predicted their possible association with a form recognizable as characteristic of space flight -- a "moon base", if not a "moon lander"? This helps to emphasize the need for more imaginative mapping possibilities consistent with what has become attractive to the imagination of many. Is the conventional articulation of value-goals inherently boring by comparison? If complex space-enabled structures are a legitimate focus for collective imagination, should the representation of value-goal complexes not be of a similar order of complexity? Metaphorically the argument can be taken further if the challenge is to ensure that such structures "take off", "fly" and reach "earth orbit"?

Given the mapping challenge, especially interesting is the unique occurrence of the 34-edged structure on the right (below): Stewart Z4. This is one example of a special category of toroidal polyhedra, known as [Stewart toroids](#), constructed exclusively by regular polygon faces, without crossings, and with a further restriction that adjacent faces may not lie in the same plane as each other (see [Simple Stewart Toroids](#)). With respect to this mapping exercise, it is particularly interesting because the edges are of 17 distinct types.

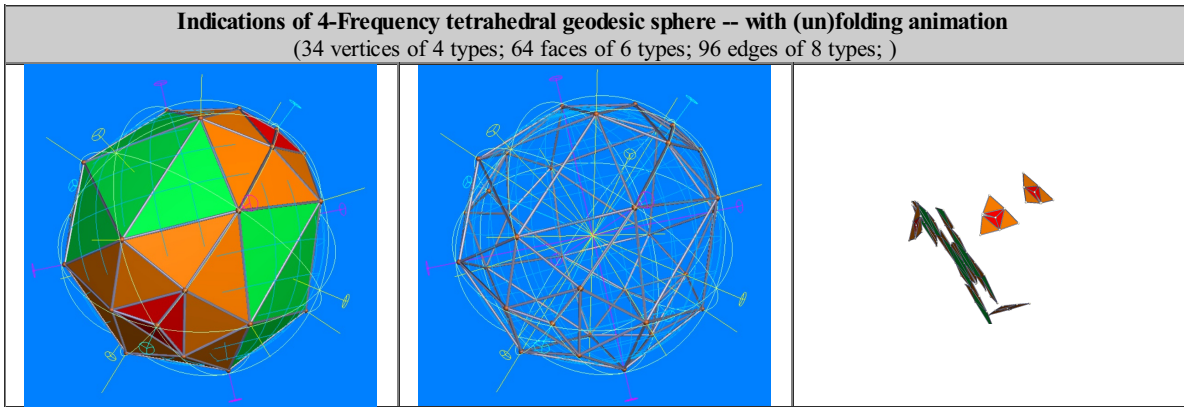
Polyhedra offering 34 features onto which to map opposing value-goals (some faces rendered transparent for great comprehensibility)		
<p>"Moon Base" (34 vertices of 12 types; 31 faces of 11 types; 63 edges of 21 types)</p>	<p>Gyroelongated square bicutipola (34 faces of 5 types; 56 edges of 8 types; 24 vertices of 3 types)</p>	<p>Stewart Z4 (34 edges of 17 types; 14 vertices of 8 types; 22 faces of 11 types)</p>
		
<p>"Moon base" (as above; but faces transparent)</p>	<p>Gyroelongated square bicutipola (as above; but faces transparent)</p>	<p>Stewart Z4 (as above; but faces transparent)</p>



Indication of these unusual forms helps to focus the question: **What makes a pattern interesting and memorable?** The question can be evoked more generally in relation to ball-games and human faces. Excessive regularity is essentially boring and unmemorable. Excessive irregularity is unmemorable because of its complexity -- whether or not it is momentarily interesting, rather than simply perceived and rejected as a "hodge-podge", "laundry list" or a "mess".

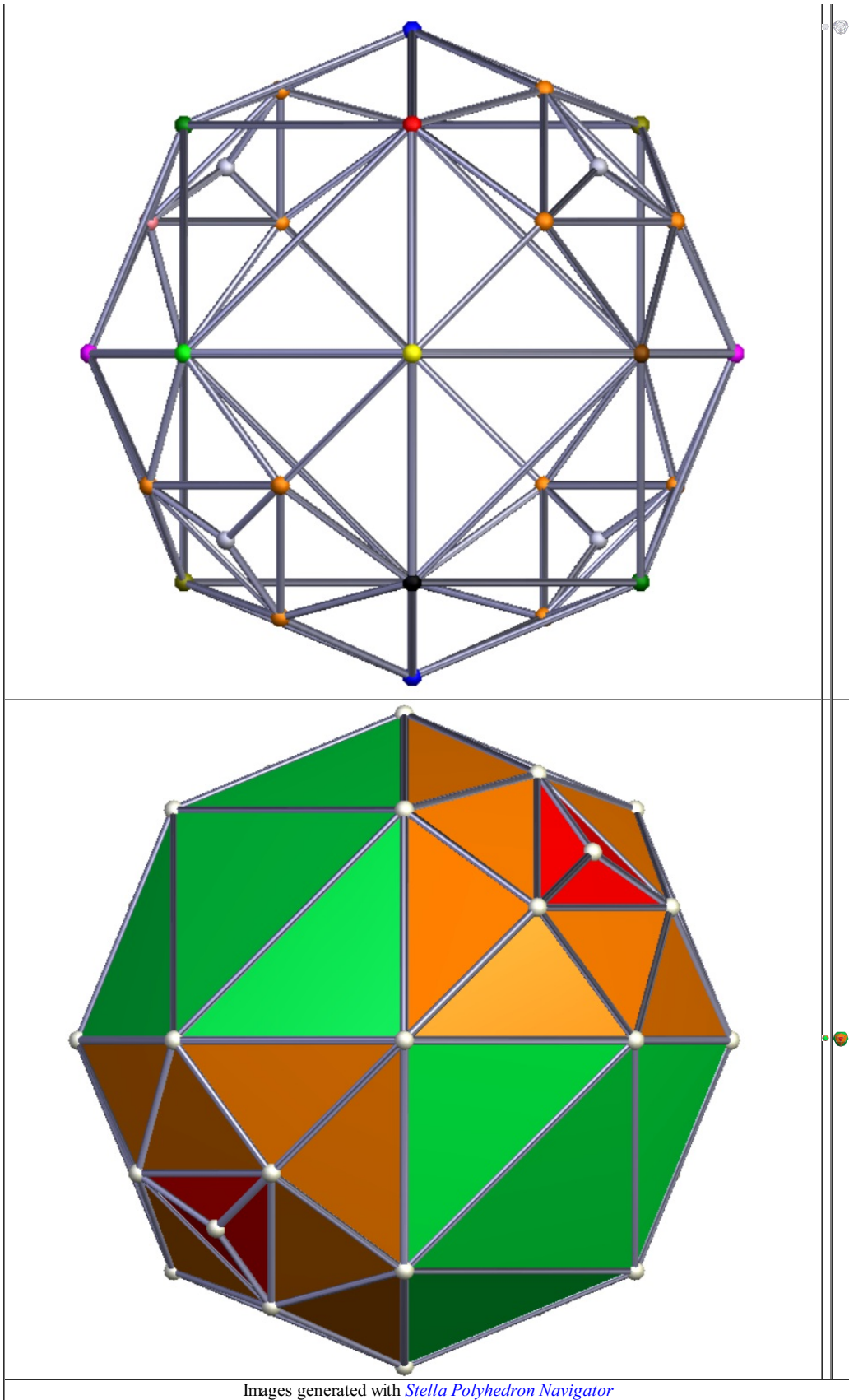
Unusually memorable mapping possibilities of a tetrahedral geodesic sphere

Another highly unexpected polyhedral form, cited with respect to its 34 **vertices** (in the table above), is especially unusual in this context in having 64 **faces**. The process of (un)folding between 2D and 3D offers insights in contrast to the rotunda form above (as illustrated on the right below).



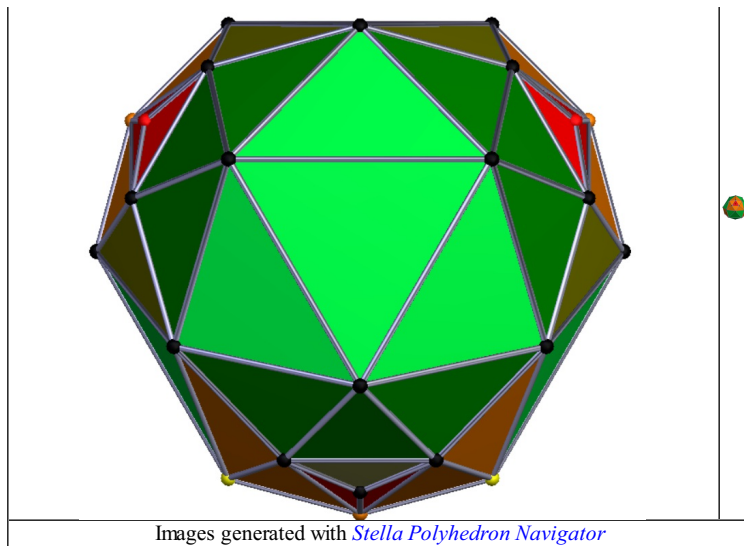
Contrasting views indicative of the complex symmetries of the 4-Frequency tetrahedral geodesic sphere





In the light of the assumption that the 17 value-goals necessarily exclude those by which they are opposed, the polyhedron may be explored as a globe of which only one half is strategically "visible". With the value-goals as vertices, 17 of these may be selectively coloured (black in the examples below) to suggest that "visible" domain -- as distinct from those which are "hidden" by the curvature of the globe, as understood cognitively. Associated faces may also be distinctively coloured. Associated faces can also be coloured (and labelled) as recognized zones, in contrast to those which are hidden.

Marking of 17 "visible" vertices with the implication of 17 "hidden vertices"	



The 64 faces invite a complementary mapping exercise of significance in terms of the classical insights of Chinese culture -- usefully recognized as having embodied a systematic understanding of sustainable development into the patterns of interaction encoded by the 64 hexagrams of the *I Ching* (*Transformation Metaphors derived experimentally from the Chinese Book of Changes (I Ching) for sustainable dialogue, vision, conferencing, policy, network, community and lifestyle*, 1997).

This complex pattern of interacting conditions can be mapped onto the faces of the polyhedron -- whether as the classical hexagram code or with the corresponding Chinese idiogram. The pattern of 64 is nearly unique within that polyhedral context. However one interesting candidate is the toroidal drilled truncated cube with 64 edges -- with which any set of 64 elements could be associated, as previously explored (*Proof of concept: use of drilled truncated cube as a mapping framework for 64 elements*, 2015). In that exercise the edges were labelled. The complementarity with the 34 value-goal dynamics merits further exploration.

Mapping of 64 conditions of <i>I Ching</i> onto 4-Frequency tetrahedral geodesic sphere (images attributed randomly, not meaningfully)	
Animation of hexagram mapping	Animation of idiogram mapping
Animations generated with <i>Stella Polyhedron Navigator</i>	

Interplay of value-goals -- integrating opposing "hemispheres of the global brain"

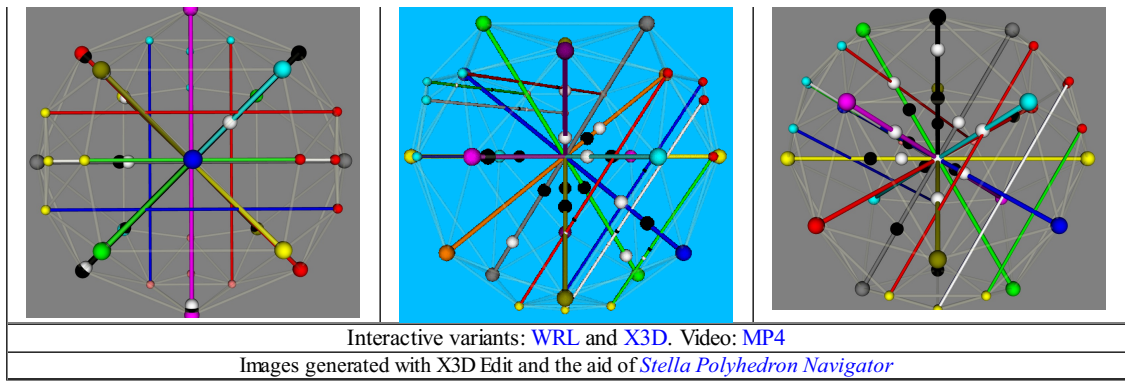
The vertices of the 4-frequency tetrahedral geodesic sphere (as discussed above) can be usefully paired through its patterns of symmetry in order to explore the interplay between the 17 value-goals and the 17 problematic conditions by which they are opposed -- irrespective of the polar position from which such opposition is perceived. However it is appropriate to recognize that the latter may be value-goals in their own right for other constituencies, however "misguided" or "evil" they may be readily framed to be. Such framing is of course mutual.

Although complex at first sight, the polyhedron can be described succinctly in terms of the set of 9 axes which pass through its centre to 18 vertices on the circumference -- complemented by a further 8 "axes" in two sets of 4, both of which do not pass through the centre, and with each set being orthogonal to the other.

Preliminary exercise: In the following exercise, the axis of interplay of each pair of value-goals across the polyhedron is coloured distinctively. The value-goals at each end are depicted with coloured spheres of the same colour. For the 9 axes passing through the centre, these are of the same colour. An exception is made for the 8 sets of axes which do not pass through the centre. As two groups of 4 axes, these are coloured red-green-blue and white, with the spheres coloured distinctively for each cluster.

This framework then allows black and white spheres to travel along each axis between the extremes as an indication of the "positive" implementation of the associated strategy in response to the "negative" nature of the problematic opposing condition. However the animation leaves ambiguous from which pole the white or black sphere is engendered.

Animations suggestive of integration of hemispheres of the global brain Screen shots and animation of contrasting views of the 4-Frequency tetrahedral geodesic sphere (variously indicative of movement of black and white spheres along its 17 axes between 34 vertices)		



With respect to such visual renderings and their symmetries, it is noteworthy that complex views preclude recognition of simplicity -- but simpler views preclude recognition of complexity.

Framework for a variety of governance "stories": The text file from which the animation is generated is relatively simple. This means that a variety of "stories" can be associated with simple modifications to the animation, especially since greater insight can be gained from such interaction with the animation in exploring various alternative preferences and "ways of seeing". Possibilities include:

- changing colours of axes and polar spheres according to a preferred convention
- distinguishing colours (and/or diameters) of spheres at each end of an axis to reinforce assumptions about the "positive" or "negative" nature of each
- modifying the diameter of selected axes as an indication of the relative strategic or budgetary importance of each (note that the 9 passing through the centre are already of larger diameter than the 8 which do not)
- modifying the radius of the polar spheres as an indication of their relative importance (note that those associated with the 9 axes passing through the centre are already of larger diameter than those of the 8 which do not)
- changing the relative rate of movement of the black/white spheres along the axes (as an indication of the "pace" of evolution of a problem, the application of strategic resources to it, or the frequency with which feedback is received)
- addition of text or other labels to spheres or axes
- (de)emphasizing the circumferential framework provided by the edges of the 4-frequency tetrahedral geodesic sphere, possibly to be understood as a network of communication (and feedback channels) between the value-goals. A circumsphere can be readily emphasized to highly the sense of globality
- ensuring that the polar spheres change radius dynamically, notably when the black/or white spheres are closest to them along the axis

The framework is curiously reminiscent of the abacus (or even pinball) -- but with a focus on qualitative systemic functions rather than on the quantitative. As a framework for 17 distinctive games, there is the possibility that it could be adapted to allow competing players to control some movements in an (educational) game-playing mode.

Integrating hemispheres of the global brain: In highlighting the contrast between the visible value-goals and those which are hidden or deprecated, the argument can be understood in terms of integrating cognitive hemispheres -- effectively of the so-called [global brain](#). Clearly a United Nations summit articulation of a set of value-goals is unquestionably one approximation to such a notion -- even if only one "hemisphere" (of those claiming to represent the "good") is effectively recognized, with the other only implicitly recognized by the opposition it constitutes. Given use of the metaphor, as with the [lateralization of brain function](#), there is a concern with what functions are associated with one hemisphere rather than the other -- and what might be the implications globally, as discussed separately ([Engendering Viable Global Futures through Hemispheric Integration: a radical challenge to individual imagination](#), 2014).

The animations (above) along axes of the 4-frequency tetrahedral geodesic sphere are then suggestive of a preliminary insight into the "wiring" of one understanding of the "global brain". As with the human brain, it is then of interest to understand the locus of integrative connectivity between the hemispheres -- conventionally associated with the [corpus callosum](#). Arguably any analogous insight is absent in the conventional insight into the UN's 17 Sustainable Development Goals -- effectively a "one-hemisphere" articulation, with all that such a limitation implies in terms of any global sense of perspective ([Corpus Callosum of the Global Brain? Locating the integrative function within the world wide web](#), 2014). Provocatively, the mapping of the *I Ching* hexagrams onto the same form offers a richer transcendence of any singular hemispheric understanding.

Complementary values of development goals?	
Sustainable Development Goals	Opposing value-goals?
1 No Poverty (wealth? sufficiency?)	Selective increase in impoverishment?
2 Zero Hunger (food security)	Hunger?
3 Good Health and Well-being	Illness
4 Quality Education	Dumbing down? Ignorance?
5 Gender Equality	Gender discrimination? Disempowerment of women?
6 Clean Water and Sanitation	Water shortage? Unhygienic water use? Pollution?
7 Affordable and Clean Energy	Unsustainable use of energy resources? Pollution?
8 Decent Work and Economic Growth	Undignified work? Zero growth?
9 Industry, Innovation and Infrastructure	Progressive dehumanisation?
10 Reduced Inequalities	Increasing inequality?
11 Sustainable Cities and Communities	Unconstrained urban sprawl?
12 Responsible Consumption and Production	Unrestrained consumption and production?

13	Climate Action	Climate change denial and <i>laissez faire</i> ?
14	Life Below Water	Unconstrained depredation of marine resources?
15	Life on Land	Unconstrained depredation of land resources?
16	Peace, Justice and Strong Institutions	Selfishly framed to "make us great again"?
17	Partnerships for the Goals	Unfair competition in value-goal achievement?

There is considerable degree of naivety on the part of some in ignoring the extent to which value-goals in opposition to those of sustainable development are a primary vested interest for some constituencies -- even of some nations as a whole (with the ambition to "be great again"). This may take the form of vigorously promoting alternative interpretations in their own interest. They may consider their own security, survival and well-being to be dependent on them. In that sense the value-goals promoted by the UN are strangely reminiscent of the famous tale by [Hans Christian Andersen](#), as discussed separately ([Entangled Tales of Memetic Disaster: mutual implication of the Emperor and the Little Boy](#), 2009).

** phantom opponents

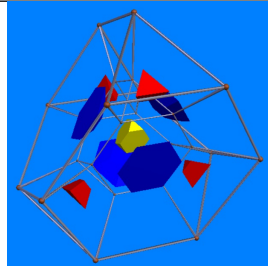
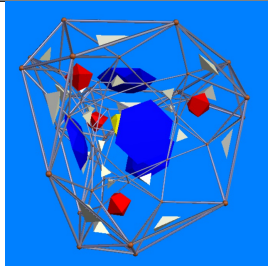
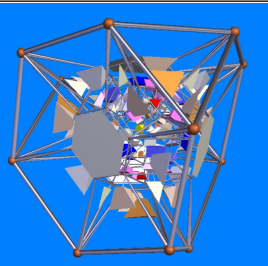
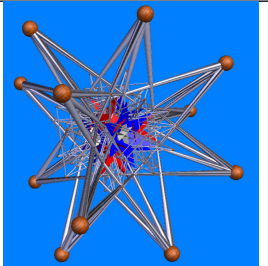
Global mapping in 4D of interactions of competing value-goals?

One of the polyhedra that emerged as a candidate is a necessarily "mysterious" 4D structure 898-Tuttip. This raises the question as to whether the most fruitful representation of the dynamics of value-goals in a psychosocial system is best understood in 4D rather than 3D. Given the implication of the time dimension in the "game" between the value-goals and their opponents, a 3D representation could be deprecated as an unfortunate distortion of a more complex reality -- one celebrated in the very dynamics of the game. The 4D analogues of polyhedra are termed [polychora](#) (or 4-polytopes).

Arguably people have an intuitive understanding of the pattern of many such 4D forms without being able to visualize them -- although such visual representations exist. Separately it has been argued that this understanding is reflected to some degree in the widespread understanding of familiar weather dynamics ([Enhancing Strategic Discourse Systematically using Climate Metaphors: widespread comprehension of system dynamics in weather patterns as a resource](#), 2015). The latter paper notably discussed the following:

- Visual representations of globality of requisite variety for global governance
- Four-dimensional requisite for a time-bound global civilization?
- Comprehending the shapes of time through four-dimensional uniform polychora
- Five-fold ordering of strategic engagement with time
- Interplay of cognitive patterns in discourse on systemic change

The image on the left below offers 34 faces for the representation of the dynamics of 2x17 value-goals. Of further interest is the various ways in which such a form can be transformed as depicted in the associated images.

898-Tuttip (4D model)			
<p>Base 4D model (34 faces of 4 types; 48 edges of 2 types; 24 vertices of 1 types; 10 cells of 3 types)</p>	<p>"Rectified" (130 faces of 7 types; 144 edges of 4 types; 48 vertices of 3 types; 34 cells of 4 types)</p>	<p>"Expanded/Runcinated" (308 faces of 17 types; 288 edges of 10 types; 96 vertices of 3 types; 116 cells of 11 types)</p>	<p>"Truncated (retrograde)" (130 faces of 7 types; 192 edges of 7 types; 96 vertices of 3 types; 34 cells of 4 types)</p>
			
Images generated with <i>Stella Polyhedron Navigator</i>			

Is it not probable that curious activists of the younger generation -- inspired by science fiction and space exploration -- are more than likely to be inspired by 4D and the unusual nature of such configurations? The early possibilities of their exploration in virtual reality merit consideration. The point has been argued with respect to NATO ([Comprehension of NATO as a four-dimensional dynamic entity?](#), 2017).

What indeed might be the implications for strategic articulation and debate of such processes as "rectified", "expanded/runcinated" and "truncated"?

There is also the curious possibility that insight into 4D may be evident otherwise in the style of thinking associated with various practices of divination -- throwing bones and casting stones and runes, as discussed separately ([Engaging with the Future with Insights of the Past: consulting the dead, sacrifice, bone-cracking and divination](#), 2010)

Integrative comprehension of disparate global value-goals through sphere-packing

It could be more appropriately assumed that the set of 17 SDGs might have been more appropriately and memorably configured as a set of 12. From that perspective, the following exploration is of relevance -- even as an indication of a method which could be applied to 15

or 17 value-goals. Rather than mapping value-goals on the features of a single polyhedron, the approach is to configure distinctive polyhedra -- each considered representative of a distinctive value-goal, perhaps understood as a distinctive style of global cognitive closure. However the argument makes apparent that **12-fold psychosocial organization may be a requisite implication of the articulation of the 17 value-goals** -- as discussed in the subsequent section.

Static configuration of set of value-goals in 2D: Keith Critchlow presents the following configuration of 12 distinctive geometrical forms, each characterized by **semi-regularity as polyhedra** in their differing approximations to a spherical whole. Consistent with this argument, the configuration is framed by one of them. Transformative relationships between each of them are inherent in the geometry. As such it constitutes the kind of systemic framework for which there is little quest in the case of value-goals, and most notably the Sustainable Development Goals. Are 5 of the 17 effectively implicit in a set of 12 or in some way excessive? The concern relates to the degree of questionable closure achieved in the "de-finition" of each -- with little attention to what may have been excluded for political and other reasons

A potentially valuable means of understanding and configuring 12 such modalities is through the **Archimedean polyhedra**, as envisaged elsewhere (*Union of Intelligible Associations: remembering dynamic identity through a dodecameral mind*, 2005). In an earlier exploration of *Patterns of Conceptual Integration (Annex 18: Polygons and polyhedra*, 1984), the 13 distinct Archimedean polyhedra were described as similar arrangements of regular, convex polygons of two or more different kinds meeting at each vertex of the polyhedron [which can itself be circumscribed by a tetrahedron, with 4 common faces]. Such semi-regular polyhedra are defined by the fact that all their vertices lie on a circumscribing sphere.

Keith Critchlow (*Order in Space*, 1969) configures 12 of them, within their circumscribing spheres, in a closest packing configuration around the circumscribing sphere of the 13th -- a truncated tetrahedron -- as shown below. The truncated tetrahedron is the only semi-regular solid with 12 independent axes passing through its vertices from its centre. Removal of the central sphere allows the 12 other spheres to close into a more compact icosahedral configuration.

In his description of *Omnidirectional Closest Packing*, R Buckminster Fuller (*Synergetics: Explorations in the geometry of thinking*, 1975) notes:

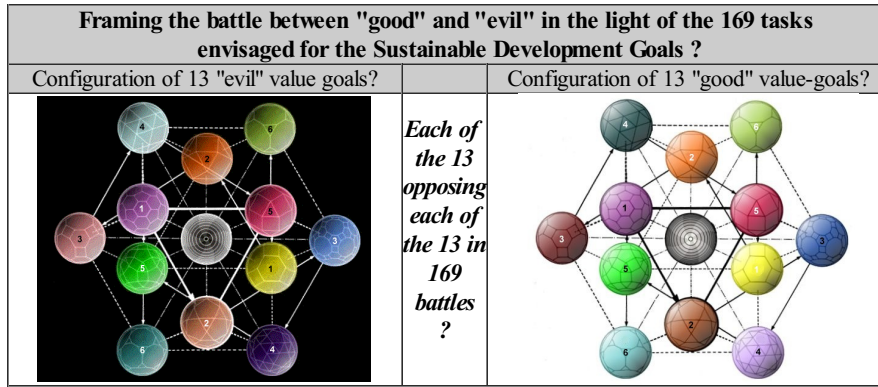
In omnidirectional closest packing of equiradius spheres around a nuclear sphere, **12 spheres will always symmetrically and intertangentially surround one sphere with each sphere tangent to its immediate neighbors.** We may then close-pack another symmetrical layer of identical spheres surrounding the original 13. The spheres of this outer layer are also tangent to all of their immediate neighbors. This second layer totals 42 spheres. If we apply a third layer of equiradius spheres, we find that they, too, compact symmetrically and tangentially. The number of spheres in the third layer is 92.

(reproduced from *Psychosocial Implication in Polyhedral Animations in 3D Patterns of change suggested by nesting, packing, and transforming symmetrical polyhedra*, 2015; *Towards Polyhedral Global Governance: complexifying oversimplistic strategic metaphors*, 2008, and from *Union of Intelligible Associations: remembering dynamic identity through a dodecameral mind*, 2005)

Sphere-packing of Archimedean polyhedra	
Successive truncations of octahedron 2, 3, 4-fold symmetry	Successive truncations of icosahedron 2, 3, 5-fold symmetry
1. truncated octahedron (14 polygons: 4 / 6 sided) 2. cuboctahedron / vector equilibrium (14: 3 / 4) 3. truncated cuboctahedron (26: 4 / 6 / 8) 4. snub cube (38: 3 / 4) 5. rhombicuboctahedron (26: 3 / 4) 6. truncated cube / hexahedron (14: 3 / 8)	1. truncated icosahedron (32 polygons: 5 / 6 sided) 2. icosidodecahedron (32: 3 / 5) 3. truncated icosidodecahedron (62: 4 / 6 / 10) 4. snub dodecahedron (92: 3 / 5) 5. rhombicosidodecahedron (62: 3 / 4 / 5) 6. truncated dodecahedron (32: 3 / 10)
truncated tetrahedron (8 polygons: 3 / 6 sided)	
Arrangement of the 12 Archimedean polyhedra in their most regular pattern, a cuboctahedron, around a truncated tetrahedron	

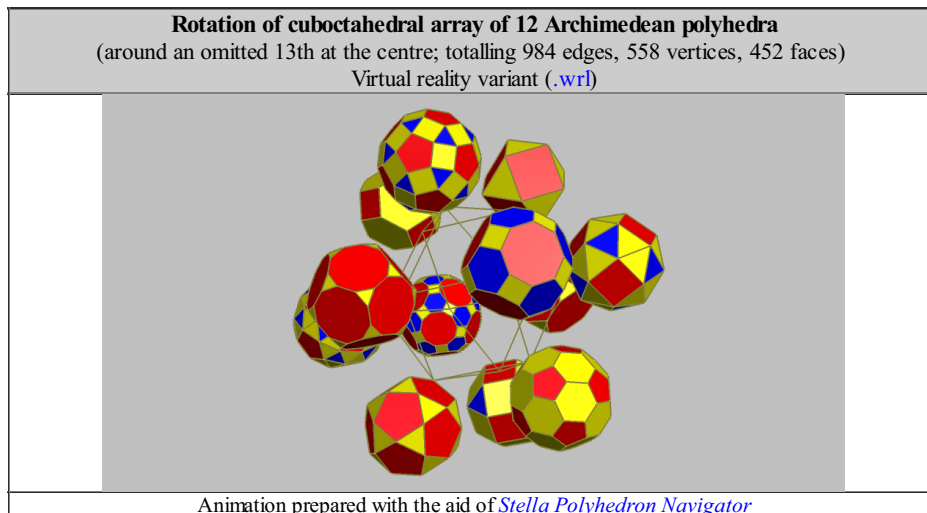
How might value-goals be suggestively associated with such a configuration? As of August 2015, 169 targets were proposed for the 17

Sustainable Development Goals, and 304 proposed indicators to show compliance. The figure of 169 is significant, especially in the light of any relevance of a configuration of 13 "positive" value-goals such as that above. Speculatively the challenge might then be framed as below.



Static configuration rotating in 3D: Rather than the inhibiting cognitive constraints of 2D for the imagination, the distinctive geometrical forms can be presented together in 3D in rotation as follows -- in order to increase memorability and interest.

In such a case each of the 12 distinctive value-goals can be associated with such a form, using their faces, vertices or edges to hold the distinctions made within each -- notably for institutional programmatic and project purposes. As distinctive "worlds" -- reference framework -- clicking on any one of them could enable the world to be "visited" to explore such detail and benefit from hyperlinks to other resources.



Dynamic configuration -- "jitterbug": Considerable emphasis is placed on the manner in which the static configuration presented above is but a phase in a transformative process of packing and unpacking. This notably features in the articulation of Buckminster Fuller who caricatured that dynamic under the name jitterbug -- variously illustrated in accessible videos. This striking "pumping" action can be rendered more interesting using emerging 3D technology and virtual reality

This cuboctahedral configuration is especially significant given the importance associated with it by Buckminster Fuller (*Synergetics: explorations in the geometry of thinking*, 1975/1979). He variously renamed it vector equilibrium and **dymaxion**, associating the expansion and contraction of the configuration with a fundamental jitterbug movement. This is comprehensively summarized by Fuller (*Jitterbug: Symmetrical Contraction of Vector Equilibrium*). [see videos: [Vector Equilibrium: R. Buckminster Fuller](#); [Buckminster Fuller's Jitterbug](#); [Bucky's "Jitterbug": Vector Equilibrium](#)].

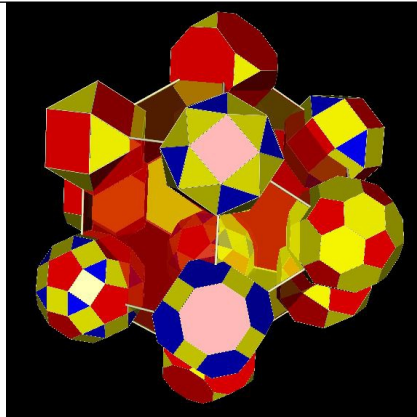
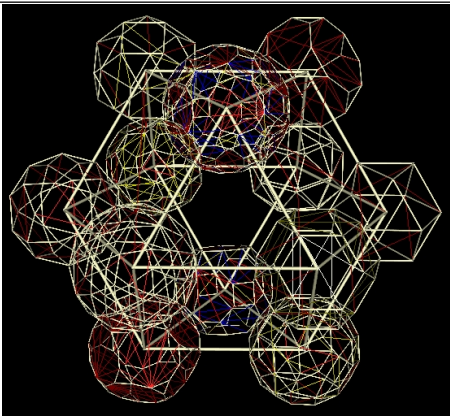
The most comprehensive video is that presented to the American Mathematical Society by [Joseph Clinton](#) (*R. Buckminster Fuller's Jitterbug: its fascination and some challenges*, Synergetics Collaborative, 2006). A summary of the associated movements is provided by Robert W. Gray (*The "Jitterbug" And Its Motion*, 2001; *The Jitterbug Motion*, 2002). An earlier exercise discussed the transformations in some detail, with a mapping of many of them (*Vector Equilibrium and its Transformation Pathways*, 1980):

The cuboctahedron is the polyhedron obtained by bisecting the 12 edges and truncating the eight corners of the cube. It can also be developed, however, from the omnidirectional closest packing of spheres around one nuclear sphere. The centres of 12 such spheres define the 12 nodes of the cuboctahedron. As all spheres are the same size it can be seen that the length of the cuboctahedron's edges equal the distance from its centre to its 12 nodes. Thus the form can be considered to be a system of equal vectors which are in equilibrium -- a vector equilibrium -- where the outward radial thrust of the vectors from the centre is balanced by the circumferentially restraining chordal vectors. The explosive forces perfectly balance the implosive forces.

As explained, variants of the jitterbug are also distributed as an educational toy. As indicated by the videos, models of it have been

presented as virtual reality animations, most notably by Bob Burkhardt (*Jitterbug*, 2008). The development of 3D animation now enables presentation of the dynamics of the jitterbug transformation of the cuboctahedral configuration of Archimedean polyhedra to be explored otherwise. This would offering a stimulus to the imagination which is otherwise constrained by the 2D representation (above) and access to physical models.

The configuration immediately suggests possibilities of animating the relationships between the polyhedra in the array, most notably by animating them in a "pumping" motion of contraction to the common centre and expansion from it, as is evident from the following. (*Psychosocial Implication in Polyhedral Animations in 3D: patterns of change suggested by nesting, packing, and transforming symmetrical polyhedra*, 2015)

Screen shots of animation of cuboctahedral array of 12 Archimedean polyhedra collapsing into centre (without indication of the 13th at the centre, namely the truncated tetrahedron)	
Contextual cuboctahedron rendered partially transparent Video (.mpg; .mov); virtual reality (.wrl; .x3d)	Wireframe version with all faces transparent Video (.mp4; .mov); virtual reality (.wrl; .x3d)
	
Animations prepared with the aid of Stella Polyhedron Navigator	

What does such transformation suggest about the dynamic relationship between value-goals? The question is especially relevant if, as with ball games, the significance of their strategic relationship can only be successfully embodied in a dynamic -- when faced with an "opposing team"? A line-up of team players, whether facing potential opponents or not, is essentially "boring" -- interesting only by implication of their potential prowess in a subsequent game.



Requisite 12-fold organization implied by the 17-fold articulation of value goals -- as its "stellations"?

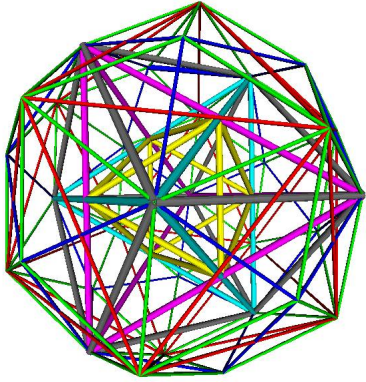
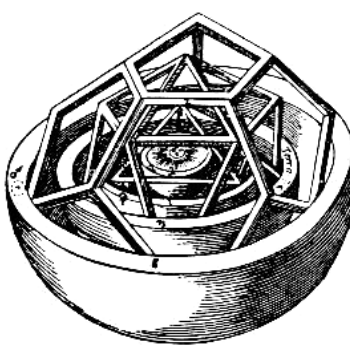
The previous section highlights the strange role of the cuboctahedron in providing a framework for the configuration of 12 semi-regular polyhedra. The framework is one which has an inherent dynamic through which it is transformed into configurations characteristic of the regular polyhedra. As noted, this transformation has been extensively studied and visualized. It is effectively a bridging transformation between the greater complexity of the semi-regular polyhedra and the regularity of the far more familiar polyhedra, most notably those in which the 12-fold pattern is exemplified (namely the cube, the icosahedron and the dodecahedron).

This process of transformative simplification can be usefully rendered more comprehensible with web-based graphics applications.

Dynamic reframing of Kepler's original configuration -- "pumping": Whilst Buckminster Fuller focused on the dynamics of the 12 semi-regular polyhedra, of related interest is the earlier imaginative configuration of Johannes Kepler -- and how it can only now be articulated visually. This focused on the 5 regular polyhedra as embodied in the following classical image -- encompassed by hemispherical suggestions of degrees of globality.

The following two images were presented together in the earlier document (*Relative movement of nested Platonic polyhedra: pumping and rotation*, 2015). This offered a means of drawing attention to the possibility of new insight into systemic relationships -- as proved so inspiring with the early image of [Johannes Kepler](#), and continues to do so. The pattern indicated by him is now recognized to be fundamentally incorrect from a variety of perspectives. The point to be made, however, is that there are few patterns of that degree of integrity -- of relevance to current global psychosocial organization. Considered as a transitional exercise, the question is whether analogues to Kepler's model could be usefully explored at this time. Arguably the image that has recently offered some degree of equivalent symbolic inspiration is that of the Earth, articulated geographically, as photographed from the Moon.

Nesting 5 Platonic polyhedra: octahedron, icosahedron, dodecahedron, tetrahedron, cube	
Screen shot of animation of dynamics within Rhombic triacontahedron as a nesting framework	Polyhedral model of solar system of Johannes Kepler in <i>Mysterium Cosmographicum</i> (1596)
	

	
<p>Interactive virtual reality variants <i>static</i>: .wrl or .x3d; <i>mutual rotation</i>: .wrl or .x3d; <i>"pumping"</i>: .wrl or .x3d Video (<i>"pumping"</i>): .mp4</p>	
<p>Developed with X3D Edit and <i>Stella Polyhedron Navigator</i></p>	<p>Reproduced from <i>Wikipedia</i> entry</p>

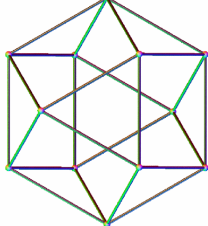
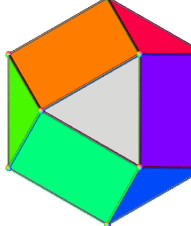
Value-goals understood as "stellations" of a cuboctahedral cognitive modality? The transformative direction of the above argument emphasizes the role of the cuboctahedron in ordering the complexity of the semi-regular polyhedra enabling its "packing" via the 12-fold into ever greater simplicity -- perhaps usefully understood as "implicit", given the arguments of [David Bohm](#) (*Wholeness and the Implicate Order*, 1980). Despite examples to the contrary, it would appear that the related modes of ordering do not adequately hold the variety with which global society now perceives a need to engage. Hence the use of 17 value-goals as attractors for consensus.

The geometry of the cuboctahedron, as a mode of order of questionable significance in practice (despite this role), has another aspect which merits particular attention now that global society has given such focus to 17 value-goals of sustainable development. The cuboctahedron has 17 stellations -- and only 17. This set might therefore be held to imply the underlying or cognitively implicit merit of the 12-fold role of the cuboctahedron.

Stellation is the process of extending a polygon (in 2D), or polyhedron in 3D, from a new figure. Starting with an original figure, the process extends specific elements such as its edges or face planes, usually in a symmetrical way, until they meet each other again to form the closed boundary of a new figure. The new figure is a stellation of the original. It was Kepler who defined the process and who stellated various regular polyhedra. He notably stellated the octahedron to form the *stella octangula* formed by two tetrahedra, and the focus of a previous discussion (*Framing Global Transformation through the Polyhedral Merkabah: neglected implicit cognitive cycles in viable complex systems*, 2017).

As illustrated there, insights from such a process with respect to an augmented tetrahedron were also suggested as a means of envisaging NATO otherwise (*Implications of stellation of the NATO star symbol?*, 2017). As presented, the set of stellations in that case offered a means of contrasting NATO as it imagines itself to be (or aspires to be) with NATO's perception of its enemies (and perception by its opponents).

How might the 17 value-goals be usefully associated with the stellations of the 12-fold cuboctahedral modality whose existence they could be held to imply?

17 Stellations of the cuboctahedron (equivalent animations)	
Faces transparent	Faces non-transparent
	
<p>Animations prepared with the aid of <i>Stella Polyhedron Navigator</i></p>	

NB: The above presentation is preliminary because although various sources assert definitively that there are 17 stellations of the cuboctahedron, illustrations of all of them are seemingly not available. Reservations are made that some may be included or excluded (including the source polyhedron), because they are (or are not) considered to be "stellations". However the remarkable software application enabling many of the illustrations of polyhedra used in this paper has a specific facility for generating such images according to the different criteria for [methods and rules of stellation](#). In the case of the cuboctahedron, this offers 5 "mainline" stellations, 9 "monoacral", 13 "fully supported", and 21 according to "[Miller's Rules](#)". Further commentary on stellation in general is provided by the developer of that application (Robert Webb, *Stella: Polyhedron Navigator, Symmetry: Culture and Science*, 11, 2000, 1-4). For the purpose of the above presentation, the first 17 stellations according to Miller's Rules have been (incorrectly) used in anticipation of the following clarification. The count of 21 includes the original core polyhedron as part of the series, and also stellations that do not make use of all the facial planes, meaning they would be better seen as stellations of a simpler core. So, for the cuboctahedron which has 21 stellations under Miller's rules, this includes 1 for the core (the cuboctahedron itself), 1 for the cube, 1 for the octahedron, and 1 for the stella octangula (only stellation of the octahedron). Removing those leaves 17 stellations.

Unexplored cognitive implications of 17 Sustainable Development Goals – through "magic squares"?

The collective global choice of 17 value-goals must necessarily be taken seriously. As noted by *Wikipedia*, the number 17 has wide significance in pure mathematics, as well as in applied sciences, law, music, religion, sports, and other cultural phenomena. It is potentially valuable to note the appreciation of 17 in mathematics, especially in the light of the insights offered by (George Lakoff and Rafael Nuñez, *Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2001).

Missing is any insight into how the collective decision-making process elicited 17, or why the number was perceived by some to constitute a coherent set. Other than as a fantasy of ball-game enthusiasts (as noted above), why does 17 "work"?

Pattern language? Insights into natural order have also been the focus of Christopher Alexander in a *magnum opus* (*The Nature of Order: an essay on the art of building and the nature of the universe*, 2003-4). This followed from his earlier seminal work on pattern language (*A Pattern Language: towns, buildings, construction*, 1977). This gave rise to his insights of potential relevance to further understanding of NATO (*Harmony-Seeking Computations: a science of non-classical dynamics based on the progressive evolution of the larger whole*, *International Journal for Unconventional Computing (IJUC)*, 2009).

The latter study identified 15 "transformations" whose implications for the psychosocial realm merit clarification, as discussed separately (*Comprehending Alexander's transformation principles within the psychosocial realm*, 2010; *Tentative adaptation of Alexander's 15 transformations to the psychosocial realm*, 2010). Those considerations framed the possibility of using a subset of the 17 "fully supported" stellations of the icosahedron as a guide to reflection on the *Geometrical configuration of Alexander's 15 transformations* (2010).

Characteristics of 17: What might be discovered to be the cognitive significance in a global psychosocial system of the following indications regarding 17 (as offered by *Wikipedia*):

- 17 is the sum of the first 4 prime numbers:
- Seventeen is the 7th [prime number](#). The next prime is nineteen, with which it forms a [twin prime](#).
- 17 is the third [Fermat prime](#), as it is of the form $2^{2^n} + 1$, specifically with $n = 2$. Since 17 is a Fermat prime, regular heptadecagons can be constructed with compass and unmarked ruler.
- There are exactly 17 two-dimensional space (plane symmetry) [groups](#). These are sometimes called [wallpaper groups](#), as they represent the seventeen possible symmetry types that can be used for wallpaper.
- Either 16 or 18 [unit squares](#) can be formed into rectangles with perimeter equal to the area; and there are no other [natural numbers](#) with this property. The Platonists regarded this as a sign of their peculiar propriety; and Plutarch notes it when writing that the Pythagoreans "utterly abominate" 17, which "bars them off from each other and disjoins them".
- 17 is the minimum possible number of givens for a [sudoku](#) puzzle with a unique solution.
- There are 17 orthogonal curvilinear coordinate systems (to within a conformal symmetry) in which the 3-variable [Laplace equation](#) can be solved using the separation of variables technique.
- 17 is the sixth [Mersenne prime](#) exponent, yielding 131071.
- 17 is the first number that can be written as the sum of a positive cube and a positive square in two different ways; that is, the smallest n such that $x^3 + y^2 = n$ has two different solutions for x and y positive integers. The next such number is 65.
- 17 is the minimum number of vertices on a graph such that, if the edges are coloured with 3 different colours, there is bound to be a monochromatic triangle.

Through the unusual properties of the 4-Frequency tetrahedral geodesic sphere (as noted above), a fruitful relationship between 17, 34 and 64 was noted.

Magic squares: Another relationship between 17 and 34 can be explored in terms of 4x4 magic squares as shown below, however the "magic" may be discovered to derive from characteristics such as those above.

4 x 4 magic square with magic constant 34 (with indication of portions of the square at the centre which total to 17)	
	<p>The number 34 also invites reflection in this context as the magic constant of a 4-by-4 normal magic square (namely with columns, rows and diagonals each adding to 34; as in the central square on the left).</p> <p>Encompassing all the numbers less than 17, the pattern includes the number of value-goals distinguished as 8 Millennium Development Goals, as well as the 15 global strategic challenges identified by the Millennium Project.</p> <p>That magic square is a notable feature of a much commented engraving by Albrecht Dürer (<i>Melencolia I</i>, 1514).</p> <p>According to <i>Wolfram Mathworld</i>, Dürer's magic square has the additional property that the sums in any of the four quadrants, as well as the sum of the middle four numbers, are all 34. It is thus a gnomon magic square. As indicated on the left,</p>

	<p>any pair of numbers symmetrically placed about the center of the square sums to 17, a property making the square even more magical.</p> <p>The number 17 figures variously in several magic squares held to be significant in other cultures, for example the Chautisa Yantra (India). That of Dürer is held to be very similar to Yang Hui's square, created in China some 250 years before Dürer's time.</p>
--	---

"Magic" of sustainability? The interest of Freemasonry in magic squares has been widely noted in relation to its purported role in constitutional development (notably in the USA), as well as in its particular interest in the Dürer magic square, as discussed separately (*Transformational pathways between 2D and 3D in the light of graph theory and "magic"*, 2016). On the assumption that the pattern of 17 value-goals was not fortuitous but was enabled by intelligence, whether conscious or unconscious, the first 16 can be distributed according to the above pattern -- if only as a mnemonic exercise. Potentially this would suggest an insightful pattern of particular relationships between the value-goals, as highlighted by those above totalling to 17. Appropriately, the 17th value-goal is *Partnerships for the Goals*

Highlighting potentially supportive relationships between 16 value-goals through their distribution (as numbered) according to the 4x4 magic square pattern above			

It is noteworthy that some use of a (2x2) "magic square" has been made in relation to sustainable development by Andreas Brunold (*Global Learning and Education for Sustainable Development, Higher Education in Europe*, 30, 2005, 3-4; *Civic Education for Sustainable Development and its Consequences for German Civic Education, Didactics and Curricula of Higher Education, Discourse and Communication for Sustainable Education*, 6, 2015). As a pattern, such usage follows a particular tradition in Germany (Sebastian Dullien, *A New "Magic Square" for Inclusive and Sustainable Economic Growth: a policy framework for Germany to move beyond GDP*, Friedrich-Ebert-Stiftung, 2017). Peter Bartelmus notes that:

Macroeconomic policies have traditionally focused on the achievement of overall objectives such as the "magic square" of economic growth, full employment, balanced foreign trade, and price stability (*Environment, Growth and Development: the concepts and strategies of sustainability*, 2002, p. 85)

The patterns of interaction of the numbers in relation to value-goals can be explored further following the recent importance speculatively attributed to the number 37, especially as the sum of 17 and 20 (*Memetic Analogue to the 20 Amino Acids as vital to Psychosocial Life? Number 37 as indicative of fruitful pathways of transformation?* 2015). Of particular relevance to the above argument is discussion there of *Global strategic significance of 20-fold configurations*, of *Indicative examples of the recognized significance of 20-fold patterning*, and *In quest of number 37 through the pattern of spherical polyhedra*.

The 17 value goals suggest that a higher degree of order is required than the fourfold magic square highlighted by economics, Metaphorical use of "magic" suggests that the quest for their requisite interplay may as usefully be associated with the ultimate nexus of values associated with the quest for the holy grail (*In Quest of Sustainability as Holy Grail of Global Governance*, 2011; *Interrelating Cognitive Catastrophes in a Grail-chalice Proto-model*, 2006).

Elusive requisite "magic"? How is the sense of coherence offered by the quest to be associated with "magic"? In an obvious sense it is readily recognized in the attraction offered to so many by completion of a puzzle, as in the case of [Rubik's Cube](#), [sudoku](#) or [crossword puzzles](#) -- all of which are a focus of worldwide fascination. The improbable balance elicited by their resolution is even evident in the recognition by nuclear physicists of a near [magic number](#) of protons and neutrons which would temporarily reverse the trend of decreasing stability in elements heavier than uranium, resulting in an ["island of stability"](#) -- one appropriate metaphor for global sustainability. Is it surprising that puzzle-solving and game-playing by the wider population, and the young, are now anticipating the quest for global strategic order by elites?

The quest for "magic" frames a desirable interplay of value-goals as potentially to be associated with **"islands of cognitive stability" through which sustainable global development might be comprehended as both credible and attractive.**

In the light of the above argument, there is a case for confronting the various cognitive constraints and possibilities highlighted by [George](#)

Miller's "*magical number seven, plus or minus two*" (1956) with the "*where mathematics comes from*" (2001) of George Lakoff and Rafael Nuñez. Do these variously frame the quest for "magic" in terms of 2x2 (as in macroeconomics), 3x3 (as in the Millennium Development Goals), or 4x4 (as with the Sustainable Development Goals)?

The first is suboptimally challenged by the quintessential (Betty Cornfeld and Owen Edwards, *Quintessence: the quality of having it*, 1983; Peter Senge, *The Fifth Discipline: the art and practice of the learning organization*, 1990). Are the 8 Millennium Development Goals to be considered as similarly suboptimal -- constrained by cognitive failure to embody the ninefold? Is the challenge of configuring the 17 Sustainable Development Goals an exercise in doing that -- especially given the pattern of 9-fold and 8-fold axes implied by the tetrahedral geodesic sphere as an exemplification of the global brain? Especially noteworthy is the role attributed to the ninefold by Freemasonry, as discussed separately with respect to the *nonagonal symbol* of its penultimate degree (*Speculation on Potential Symbolic Relevance of the Concordian Mandala*, 2016).

How is the fascinating attraction of Rubik's 3x3x3 cube -- acknowledged as the world's most popular puzzle game and toy -- to be compared with engagement with the SDGs? Why has the cognitive challenge so framed been extended to *Rubik's Revenge* (a 4x4x4 variant), the *Professor's Cube* (5x5x5), the *V-Cube 6* (6x6x6), the *V-Cube 7* (7x7x7) and the *V-Cube 8* (8x8x8)? Given the fascination with Dürer's magic square, it is appropriate to recognize the potential significance of its 3 dimensional variants (*Magic cube with Dürer's square*, 14 October 2009; *Dürer's square, Complex Projective 4-space*, 8 September 2012). Of related relevance, its fascination also extends to the polyhedron depicted in the *Melencolia I* engraving, especially the manner in which a portion of it is hidden -- rendering the structure and significance of the whole the subject of extensive commentary.

Little effort would be required to adapt the many existing virtual reality versions of Rubik's Cube or Rubik's Revenge with the addition of significant imagery (and/or numbers) to their mobile surfaces. Aspects of the integrative outcome of a similar "game" have been envisaged as a 7x7 Eco-Cube by Heiner Benking (*Visual Access Strategies for Multi-Dimensional Objects and Issues: a new world view, based on the hyperlink Eco-Cube, for better understanding and communication about multi-disciplines like ecology*, WFSF/FAW, 1993; *The Hyperlink ECO-CUBE: a central piece of a knowledge panorama for clearinghouse organisation and (environmental) education*, 1994).

The argument above was introduced with a discussion of "order in psychosocial space" -- and its implications for strategic design. This focus was the theme of an adaptation of Christopher Alexander's original study (*5-fold Pattern Language*, 1984). "Magic" could then be understood in terms of Alexander's quest as an environmental designer for the core attractor of a "place to be" -- then readily (and commonly) to be described as "magical". In the language of values, and of relevance to sustainable global development, governance, he framed this in terms of a "quality without a name":

There is a central quality which is the root criterion of life and spirit in a man, a town, a building, or a wilderness. This quality is objective and precise, but it cannot be named. The search, which we make for this quality, in our own lives, is the central search of any person, and the crux of any individual person's story. It is the search for those moments and situations when we are most alive (*The Timeless Way of Building*, 1979)

It is intriguing in relation to 17, that his study (as mentioned above) isolated only 15 "transformations" exemplified by the aesthetics of carpet design -- contrasting with other insights from architectural aesthetics. As argued separately, the quest for sustainable governance might indeed be framed in terms of the "magic carpet" metaphor (*Magic Carpets as Psychoactive Systems Diagrams*, 2010).

Architecture makes clear that any major construction of significance requires a preliminary design decision on proportion -- most notably in the case of cathedrals, temples and mosques. Such structures are an embodiment of patterns of numbers. Curiously, with respect to 17, the point is made by the Islamic architecture of the *Alhambra* in Granada as a focus for the mathematician Marcus du Sautoy as Oxford Professor for Public Understanding of Science. This features in his book on *Symmetry: a journey into the patterns of nature* (2008) and in a TED talk (*Symmetry, reality's riddle*, 29 October 2009). He highlights the 17 symmetries of its decorations, offering the insight that: *The language of group theory gives us the means to prove that 17 -- and no more -- different symmetry groups are possible on a two-dimensional wall*. Taking the Alhambra as an inspiration, together with the variations of Bach, he has offered (with colleagues) a performance of *17 movements, 17 rooms, 17 patterns*.

Could the patterns inherent in the 17 value-goals lend themselves to similar articulation through *sonification* -- as argued more generally (*A Singable Earth Charter, EU Constitution or Global Ethic?* 2006).

How indeed are people expected to "get their head's around" global complexity -- and then to engage in "sharing values" -- other than through such mnemonic clues?

Some possibilities described above have been developed further, with a variety of animations, in a subsequent document (*Interplay of Sustainable Development Goals through Rubik Cube Variations: engaging otherwise with what people find meaningful*, 2017).

References

Christopher Alexander:

- A Pattern Language: towns, buildings, construction. Oxford University Press, 1977 [summary]
- The Timeless Way of Building. Oxford University Press, 1977 [summary]
- The Nature of Order: an essay on the art of building and the nature of the universe. CES Publishing, 2003-2004 [summary]
- New Concepts in Complexity Theory: an overview of the four books of the Nature of Order with emphasis on the scientific

problems which are raised. 2003 [[text](#)]

- Harmony-Seeking Computations: a science of non-classical dynamics based on the progressive evolution of the larger whole. *International Journal for Unconventional Computing (IJUC)*, 5, 2009 [[text](#)]

•

Stafford Beer:

- Beyond dispute: the invention of team synteegrity. Wiley, 1994.
- Brain of the firm, Wiley, 1994.

David Bohm. Wholeness and the Implicate Order. Routledge, 1980 [[summary](#)]

James P Carse. Finite and Infinite Games: a vision of life as play and possibility, 1986 [[summary](#)]

Keith Critchlow:

- Order in Space: a design source book. Thames and Hudson, 1969
- Islamic Art and Architecture: system of geometric design. 1999
- The Hidden geometry of Flowers: living rhythms form and number, 2011

Marcus du Sautoy:

- Symmetry: a journey into the patterns of nature. Harper, 2008 [[review](#)]
- The Num8er My5teries: a mathematical odyssey through everyday life. Fourth Estate, 2010
- The Music of the Primes. Fourth Estate, 2003 [[summary](#)]

R. Buckminster Fuller with E. J. Applewhite:

- Synergetics: explorations in the geometry of thinking. Macmillan, 1975 [[text](#)]
- Synergetics 2: explorations in the geometry of thinking. Macmillan, 1979 [[text](#)]

Donald W. Harward (Ed.). Civic Values, Civic Practices. Bringing Tehory to Practice, 2013 [[text](#)]

George Lakoff and Rafael Nuñez. Where Mathematics Comes From: how the embodied mind brings mathematics into being. Basic Books, 2001

May Miller-Dawkins. Global Goals and International Agreements: lessons for the design of the Sustainable Development Goals. ODI Working Paper 402, November 2014 [[text](#)]

David Mumford, Caroline Series and David Wright. Indra's Pearls: the vision of Felix Klein. Cambridge University Press, 2002 [[summary](#)]

Gunter Nittbaur. Stafford Beer's Syntegration as a Renascence of the Ancient Greek Agora in Present-day Organizations. *Journal of Universal Knowledge Management*, 2005 [[abstract](#)]

Marc Pilisuk. Engaging the ISIS Threat: time for a method yet untried. *Transcend Media Service*, 12 June 2017 [[text](#)]

Marc Pilisuk, Melissa Anderson-Hinn and Gianina Pellegrini. Ethical Objectives and Values in Peace Psychology and Social Justice. *Transcend Media Service*, 12 June 2017 [[text](#)]

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



This work is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International License](#).

For further updates on this site, [subscribe here](#)