



laetus in praesens

Alternative view of segmented documents via Kairos

22 October 2018 | Draft

Requisite 20-fold Articulation of Operative Insights?

Checklist of web resources on 20 strategies, rules, methods and insights

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Introduction

Web resources

Toolkit for operacy?

Coherence, comprehensibility and credibility of a cognitive toolkit

Reconciling "positive" and "negative" operational insights

Cognitive operational sets recognized dynamically rather than statically

Operational insight sets as resonance hybrids?

Constraint of the 7-fold on comprehension of the 20-fold

Transformation of principles into "sides" through "truncation" of cognitive sets ?

Dynamics of force-directed layout of concept sets beyond truncation of rigid polyhedra

Twenty as "God's number"?

References

Produced on the occasion of the 50th Anniversary celebrations of the Club of Rome

Introduction

It is somewhat surprising to note the range of articulations of insights and methods specifically identified as numbering twenty. A loosely clustered checklist is provided below.

The interest follows from the presentation of a preceding exploration (*Checklist of 12-fold Principles, Plans, Symbols and Concepts: web resources*, 2011). This was produced as an annex to a separate discussion (*Eliciting a 12-fold Pattern of Generic Operational Insights: recognition of memory constraints on collective strategic comprehension*, 2011), presented in the following sections:

Constraints on comprehension and communication of sets of principles

Collective comprehension and communication of a 12-fold set
Sets of symbols adequate to the distinction of complementarity within a 12-fold set

Engaging with the symmetry of "bloodless categories"

Embodiment as key to effective understanding -- the role of musical harmony

Adapting psychosocial insights from learning/action cycles
Imagining a dynamic configuration of relevant "psychopter technologies"

Experimental clues to a memorable 12-fold systemic pattern (Annexes)

Interlocking cycles enabling psychopter operation

As noted in the first section, the argument here follows from earlier initiatives (*Representation, Comprehension and Communication of Sets: the Role of Number*, 1978). This had resulted in analysis of a wide range of examples (*Examples of Integrated, Multi-set Concept Schemes*, 1984; *Patterns of N-foldness: Comparison of integrated multi-set concept schemes as forms of presentation*, 1980). These initiatives were themselves presented within a set of related papers (*Patterns of Conceptual Integration*, 1984). This included an exercise in generalizing the qualitative distinctions between insights in sets of a given number -- in sets of size from 1 to 20 elements (*Distinguishing Levels of Declarations of Principles*, 1980).

A major consideration was the importance to be attached to the much-cited study of George Miller (*The Magical Number Seven, Plus or Minus Two*, *Psychological Review*, 1956) -- and subsequent research on human working memory capacity. A related concern was the challenge of the erosion of collective memory (*Societal Learning and the Erosion of Collective Memory: a critique of the Club of Rome Report: No Limits to Learning*, 1980; *Pointers to the Pathology of Collective Memory*, 1980). The argument was then developed in relation to new ways of articulating collective principles and the quest for mnemonic facilitation (*In Quest of Mnemonic Catalysts -- for comprehension of complex psychosocial dynamics*, 2007; *Structuring Mnemonic Encoding of Development Plans and Ethical Charters using Musical Leitmotivs*, 2001; *Structure of Declarations Challenging Traditional Patterns*, 1993).

The question here is then "why 20" -- in contrast to "why not 7" or "why not 12"? Is it purely a rhetorical convenience or a coincidence of no significance? However, given that 12 is already a stretch, when 7 (plus or minus 2) has proven to be so convenient, why the greater challenge to memory of 20? On the other hand is there any significant difference from 21 ("plus or minus 2"), as might be by the articulation of [Yuval Noah Harari \(21 Lessons for the 21st Century, 2018\)](#).

Or is the choice of 20 simply a convenient doubling of the many uses of 10 -- most notably the *10 Commandments*, as perhaps the ultimate articulation of human operacy? This is suggested by debate regarding *20 Commandments* (Troy Lacey, [Are There 20 Commandments? Answers in Genesis, 2 March 2015](#); [The Other Ten Commandments, h2g2, 18 March 2008](#); Wallace Wenn, [The Other Ten Commandments](#)).

More intriguing is the possibility that 20 constitutes a subtle recognition of a form of completeness -- as with the coherence implied by [20 Questions](#). The number 20 has particular properties which may contribute to this sense of completeness, notably with respect to the integrative pattern offered by the dodecahedron (20 vertices) and its dual the icosahedron (20 faces). It is also the number of [proteinogenic amino acids](#) that are encoded by the standard genetic code.

Potentially more intriguing still is its relationship to the [vigesimal number systems](#). In many European languages, 20 is used as a base, at least with respect to the linguistic structure of the names of certain numbers. Vigesimal systems are common in Africa; twenty was a base in the Maya and Aztec number systems.

The question of why 20 could be asked otherwise by assuming there is a strange attraction to particular patterns -- in the light of the argument of [Jeremy Lent \(The Patterning Instinct: a cultural history of humanity's search for meaning, 2017\)](#). A set of values could then be understood as a pattern of strange attractors ([Human Values as Strange Attractors, 1993](#)). As discussed here, this could be consistent with a perspective of cognitive psychology ([George Lakoff and Rafael E. Nunez, Where Mathematics Comes From: how the embodied mind brings mathematics into being, 2000](#)).

A related question has been raised with respect to the seemingly arbitrary articulation of a recent strategic report to the Club of Rome into 40 segments ([Ernst von Weizsaecker and Anders Wijkman, Come On! Capitalism, Short-termism, Population and the Destruction of the Planet, 2018](#)), as separately reviewed ([Exhortation to We the Peoples from the Club of Rome, 2018](#)). The latter includes a range of images and animations to emphasize the need for more complex articulations of strategic approaches -- especially those of global relevance. Why 40? Is there some unexplored sense in which a 20-fold understanding of operational insights is reflected in that 40-fold strategic proposal?

Web resources

The following checklist is based on simple search engine queries of the web. No significance is implied in the selection. The question is what significance, if any, the collection may imply. Issues with respect to the simple clustering have not been resolved. Clearly some lists presented as "rules" could be understood as "guidelines" or "principles", for example.

Thinking / Problem solving

- Peter Cam: [Twenty Thinking Tools: collaborative inquiry for the classroom](#) (ACER Press, 2006)
- Jane Chen: [Twenty Problem Solving Skills](#) (CreateSpace Independent Publishing Platform, 2011)
- Robert H. Koenker: [Twenty Methods for Improving Problem Solving](#) (*The Arithmetic Teacher*, 5, 1958, 2, pp. 74-78)
- Meg Dowell: [20 Cognitive Biases That Largely Affect Your Everyday Decisions](#) (*LifeHack*)
- Jennifer M Wood: [20 Cognitive Biases That Affect Your Decisions](#) (*MentalFloss*, 17 September 2015)
- [Twenty Science Attitudes](#) (*Rational Enquirer*, 3, 1990, 3)
- Chris Helder: [20 useful beliefs that are better than positive thinking](#) (*EliteAgent*, 28 September 2018)
- Marshall Goldsmith: [Twenty ineffective habits of successful leaders](#) (*Peter Simoons*)
- Eric Booth: [\[20\] Habits of Mind of Creative Engagement](#)

Learning modalities:

- [The 20 Learning Modalities](#) (*Guerilla Educators*, 4 October 2007)
- James Seaman: [20 Learning Modalities](#) (*Surround Learning*, 30 April 2011)
- [20 Learning Modalities: survey results](#) (*Billings Career Center: 21st Century Learning in Action*, 10 October 2011)
- Andrianes Pinantoan: [20 Habits of Highly Effective Educators](#) (*InformEd*, 8 February 2013)

Lessons:

- Donald J. Wheeler: [Twenty Things You Need to Know](#) (SPC Press, 2008)
- Jason Konefal and Maki Hatanaka: [Twenty Lessons in the Sociology of Food and Agriculture](#) (Oxford University Press, 2018)
- Kenneth A. Gould and Tammy L. Lewis: [Twenty Lessons in Environmental Sociology](#) (Oxford University Press, 2014)
- Timothy Snyder: [On Tyranny: Twenty Lessons from the Twentieth Century](#) (2016)

Principles

- [The European Pillar of Social Rights in 20 principles](#) (European Commission)
- Nancy Fenton, [Using the 'Top 20 Principles'](#) (American Psychological Association, September 2015)
- [20 Principles You Should Live By To Guarantee You Get Everything You Want In Life!](#) (*Fearless Motivation*, 10 September 2018)
- Jen Groover: [20 Principles of Success Not Taught in School](#) (*Positively Positive*, 7 February 2012)
- John Sullivan: [The 20 Principles of Strategic Recruiting](#) (*ERE*, 7 July 2008)

- Linda Buzzell and Craig Chalquist: *20 Principles of Ecoresilient Community* (Chalquist.com, 2007)
- Jonti Mayer: *20 Principles Promise Success* (Spice4Life)
- David Aaker: *Aaker on Branding: 20 Principles That Drive Success* (Morgan James Publishing, 2014)
- *20 Principles for Creating Change* (Times Square, 2012)
- Jennifer Valcke: *20 Principles Behind Good Lecturing*
- *20 Principles of Questioning: a guide to the cross-examination of vulnerable witnesses* (The Inns of Court College of Advocacy, 2018)
- *20 Principles of Customer Care* (UniCare)
- *20 Principles of Dialogue* (TeamLabs)
- Rena F. Subotnik: *The Top 20 Principles from Psychology for Teaching Gifted and Creative Children in Schools*
- *The 20 Principles of the Alexander Discipline* (Benco Product)

Rules

- Gina Barreca: *20 Rules That Everyone Can Live By* (Psychology Today, 29 March 2016)
- Stephen King: *20 Rules for Writers in Writing* (Open Culture, 12 October 2018)
- *20 Rules of Knowledge Formulation* (SuperMemo)
- Piotr Wozniak: *Effective learning: Twenty rules of formulating knowledge* (SuperMemo, February 1999) [overview]
- *Native Americans Left A Code Of 20 Rules For Mankind To Live By* (LifeCoachCode, 22 August 2017)
- Hayley Anderton: *20 Rules of Life A Japanese Samurai Wrote Almost 400 Years Ago That Will Change You* (PeaceQuarters, 2017)
- *Miyamoto Musashi's 20 rules for a good life* (Medium)
- Kai Sato: *20 "Rules of the Road," Jerry Perenchio's Unfading Wisdom* (Inc)
- Ethan Hawke: *20 Rules for a Knight: A Timeless Guide from 1483* (Knopf, 2015)
- *The 420 Code: guide to the high life*
- *20 rules of parliamentary procedure* (Oregon State College)
- *The Dalai Lama's 20 Rules For Living That Will Force You to Get Your Sh*t Together* (Limitless Minds, 20 August 2018)
- Catherine Adenle: *20 Rules for Change Management in Organizations* (SlideShare, 8 January 2015)
- Matthew Salesses: *20 Rules for Good (and Healthy) Internet Citizenship* (The Good Men Project, 2 December 2013)
- Deborah Gerner: *20 Rules of Thumb for Dealing with Extended Illness*
- Susan Clark and Woden Teachout: *The 20 Rules of Slow Democracy* (Chelsa Green, 2016)
- Peter Adamson: *20 "Rules for History of Philosophy"* (History of Philosophy, 21 December 2016)
- Kate Bailey: *The 20 Rules Of Being A Modern Gentleman* (Thought Catalog, 3 February 2014)
- Jim Burns: *20 Rules for Parenting Adolescents* (Home World, 1 August 2016)
- J. T. Kostman: *20 Rules for Effective Communication in a Crisis* (Disaster Recovery Journal, 22 November 2007)

Rules (Investment)

- Patrick Bet-David: *20 Rules of Money*
- Alan Farley: *20 Rules Followed by Professional Traders* (Investopedia, 7 October 2018)
- Grant Cardone: *20 Rules of Closing For the Expert Closer* (2016)
- Eric Tyson: *20 Rules for Successful Investing Investing For Dummies* (Investing For Dummies Cheat Sheet)
- *20 Rules of Angel Investing* (Rikvin)
- Ben Carlson: *20 Rules of Personal Finance* (Wealth of Common Sense, 15 December 2016)
- Perry Safran: *20 Rules for Arbitrating Effectively Management* (Concrete Construction, 1 February 1999)
- *20 Golden Rules of Contract* (Theon)

Insights

- Edgar Schein: *20 Organizational Culture Change Insights* (Human Synergistics, 14 January 2016)
- *The Top 20 Reasons Startups Fail* (CBInsights, 2 February 2018)
- Julius Vergara: *20 Insights On Influencer Marketing For Your Next Campaign* (Workspace Digital, 2018)
- Dave Ulrich: *20 Insights on Organizations* (RBL Group)
- *Time Management* [20 insights] (Millersville University)
- Lucy A. Taylor: *Twenty things I wish I'd known when I started my PhD* (Nature, 6 November 2018)
- Kent Lewis: *Twenty Measurement Insights from a Career in Marketing* (Media, 19 June 2017)

Strategies:

- *20 Simple Assessment Strategies You Can Use Every Day* (TeachThought, 29 August 2018)
- William N Bender: *20 Strategies for Increasing Student Engagement* (Learning Sciences International, 2017)
- Kim Maertz: *Surviving A Relationship Break-Up: Top 20 Strategies* (Mental Health Centre, University of Alberta)
- Lydia Breiseth, Kristina Robertson, Susan Lafond: *20 Strategies for School Leaders* (Colorín Colorado, 2015)
- Steve Wunker: *20 Strategies For Innovating Lower-Cost Business* (Branding Strategy Insider, 28 August, 2018)
- Jane Clark Lindle: *20 Strategies for Collaborative School Leaders* (Routledge, 2013)
- *20 Strategies Startups Can Implement Today To Improve Teamwork* (FoundersGrid, 14 November 2014)
- Charlene Richard: *20 Quick Strategies to Help Patients and Clients Manage Stress* (Brush Education, 16 Nov 2015)
- Katrina Schwartz: *20 Strategies for Motivating Reluctant Learners* (MindShift, 3 March 2016)
- Otake Hideo: *Opening Theory Made Easy: Twenty Strategic Principles to Improve Your Opening Game* (Kiseido Publishing)

Company, 2002)

- L. Hills: *Managing the Chronically Overworked Team: Twenty Strategies* (*Journal of Medical Practice Management*, 30, 2015, 6, pp, 388-92).
- Lisa Cannon : *Life Beyond Aid: twenty strategies to help make NGO's sustainable* (Initiative for Participatory Development, 1999)
- Trevor T. Steinbach: *20 Strategies for Discipline that WORK!* (StudyLib)
- *Twenty Strategies to Increase Student Motivation* (*Information Capsule*, Volume 0907, 2010)
- Andy Carroll: *Twenty Ways to Make a Difference: Stories from Small Foundations* (*Philanthropy News Digest*, 16 January 2013)

Methods / Ways

- *20 Methods To Learn Optimism* (BetterHelp, 4 September 2018)
- *20 Methods to Increase Your Confidence* (Warrior Mind Coach, 20 June 2010)
- Thomas Quan: *Self Confidence: 20 Powerful Ways To Increase Self-Confidence, Boost Self-Esteem, And Feel Unstoppable!* (CreateSpace Independent Publishing Platform, 2015)
- Matthew Jones: *20 Things Leaders With Real Confidence Do Differently*
- *20 Ways To Provide Effective Feedback For Learning* (TeachThought, 25 October 2017)
- Carrie Steckl: *Twenty Ways to Promote Peace in Our World* (MentalHelp.net)
- *Senator Warner: 20 Ways to Tame Social Media* (Technomy, 30 July 2018)
- Luc Steels and John McDermott: *The Knowledge Level in Expert Systems: conversations and commentary* [20 methods] (Academic Press, 2014)

Guidelines

- Scott Geller: *20 guidelines for giving feedback*
- *Twenty Guidelines on Forced Return* (Council of Europe/UNHCR, 2005)
- *Forced Return: 20 Guidelines Adopted by the Committee of Ministers of the Council of Europe* (4 May 2005)
- Julie Posetti: *Here are 20 Guidelines for Working with Whistleblowers. What's Missing?* (*Global Investigative Journalism Network, European Journalism Observatory*, 15 May 2018)
- *20 Clinical Practice Guidelines That Medical Students Should Know* (SDN, 21 July 2017)
- *20 Guidelines for Effective Prayer* (Methodist Evangelicals Together)
- Jericho Walls: *20 Guidelines for Effective Prayer* (International Prayer Network)
- George Gorski: *20 Guidelines for the Individual Investor* (*Seeking Alpha*, 6 July 2008)
- *20 Guidelines to Govern Your Buying Habits* (*Credit.org News*, 15 June 2015)

Proposals

- Gian Paolo Manzella: *Building a 'Creative' Lazio: 20 Proposals for a Regional Economy of Creativity* (4 June 2014)
- Michel Bauwens: *20 Proposals to get beyond the crash* (P2P Foundation, 12 November 2008)
- *Engineers present 20 proposals for development* (ERT NewMedia)
- Rhett Jones: *Senate Democrat Floats [20] First Serious Proposals For Regulating Big Tech* (Gizmodo, 30 July 2018)

Arguments / Reasons

- Peter Kreeft: *Twenty Arguments For The Existence Of God* (2013)
- Peter Kreeft: *Twenty Arguments for Atheism* (2013)
- Peter Wardlaw: *Twenty Arguments against the doctrine of Universal Atonement* (Q. Dalrymple, 1845)
- Greg Gibson: *Rare and common variants: twenty arguments* (*Nature Reviews Genetics*, 2012)
- Peter Saunders: *Twenty good arguments for Christianity* (*Christian Medical Comment*, 13 January 2013)
- G. Gibbs: (*Twenty terrible reasons for lecturing* (SCED Occasional Paper, No. 8, 1981).
- Alan Robock: *20 Reasons Why Geoengineering May Be a Bad Idea* (*Bulletin of the Atomic Scientists*, 1 May 2008)
- *Do UFO's and Aliens Exist? 20 Reasons to be Skeptical* (*Relatively Interesting*, 7 August 2018)
- Oluwatoyin Dare Kolawole: *Twenty reasons why local knowledge will remain relevant to development* (*Development in Practice*, 25, 2015, 8)
- Paul Mason: *Twenty reasons why uprisings are kicking off everywhere* (BBC News, 5 February 2011)
- Melissa Mackenzi: *Twenty Reasons Mass Killings Happen* (*The American Spectator*, 23 February 2018)
- A. L. Weber and S. L. Miller: *Reasons for the occurrence of the twenty coded protein amino acids.* (*Journal of Molecular Evolution*, 17, 1981, 5, pp. 273-284).

Miscellaneous

- Shahida Arabi: *20 Diversion Tactics Highly Manipulative Narcissists, Sociopaths And Psychopaths Use To Silence You* (*ThoughtCatalog*, 5 October 2018)
- *20 Observable Characteristics Of Effective Teaching* (TeachThought, 17 September 2018)
- Wayne Grudem and Elliot Grudem: *Christian Beliefs: Twenty Basics Every Christian Should Know* (Zondervan, 2005)
- Sherrie Eldridge: *Twenty Things Adopted Kids Wish Their Adoptive Parents Knew* (Delta, 1999)
- G. Lee Bowie and Meredith W. Michaels: *Twenty Questions: An Introduction to Philosophy* (Cengage Learning, 2010)
- Noor Inayat Khan: *Twenty Jataka Tales* (Pilgrims Publishing, 2005)
- Gene Getz and James Lloyd: *Measure of a Man: Twenty Attributes of a Godly Man* (christianaudio.com, 2009)
- *Charter of Human Rights and Responsibilities: list of 20 rights that assist all people to live with freedom, respect, equality and dignity* (Victorian Government Solicitor's Office, 2017)

- [Hilbert's 20 axioms of the Euclidean geometry](#) (*Physics Forums*)
- Gaël Giraud et Cécile Renouard: [20 Propositions pour Réformer le Capitalisme](#) (Flammarion, 2009)
- [20 Axioms of Natural Attraction Ecology](#) (*Wikiversity*)
- [Significance of the Twenty Pieces of Silver for Joseph and Thirty Pieces for Christ](#) (*Is Was and Will Be*, 30 September 2013)
- Buddhism: [Upakleshas](#) -- 20 secondary hindrances binding people to illusion (*Chinese Buddhist Encyclopedia*)
- Robert Bringhurst: [Everywhere Being Is Dancing: Twenty Pieces of Thinking](#) (Counterpoint, 2009)
- Alfred Caldecott: [The Caldecott Aesop: Twenty Fables: A Facsimile Of The 1883](#)
- H. D. Traill: [Number Twenty: fables and fantasies](#) (Henry, 1892)
- B. J. Fogg: [Mobile Persuasion: 20 Perspectives on the Future of Behavior Change](#) (Stanford Captology, 2007)
- Wayne Grudem and Elliot Grudem: [Christian Beliefs: Twenty Basics Every Christian Should Know](#) (Zondervan, 2005)
- Gordon Tredgold: [20 Habits of Highly Successful and Effective Leaders](#) (*Inc*)

Commentary: A more systematic approach would of course use the key words (principles, rules, strategies, etc) in searches for lists based on other numbers (18, 19, 21, 22, etc) to determine whether the proportion numbering 20 is statistically significant. The results are of course biased through the focus on English alone. It was however noted that French makes extensive use of "20 propositions" -- not evident in English.

If the inference that a 20-fold ordering is relevant to some form of operacy, this could be said to be subtly supported by the proportion of references relating to education, thinking, learning, and skill acquisition.

Somewhat unexpected is the large number of references to the 20 methods of Eastern martial arts, of which a sample is included:

- [20 Methods - Basic Level Shaolin - China Hand Kung Fu](#)
- Nicolas Manuele: [Shaolin Twenty Methods](#) (YouTube, 2008)
- Gichin Funakoshi: [The Twenty Guiding Principles of Karate: the spiritual legacy of the Master](#) (Kodansha International, 2013)
- [The 20 Principles of Shotokan Karate](#) (*Black Belt Wiki*)
- [The 20 Principles of Karate](#) (Niju Kun)
- [20 Precepts of Karate](#) (Shotokan Karate)

It is perhaps most surprising to note the even larger number of references to the 20 methods for the improvement of websites, of which only a sample are included here:

- [20 Vital Techniques and Best Practices For Effective Web Design](#) (2009)
- [20 Strategies to Make Your Webpage Trustworthy To Your Visitors](#) (2018)
- [20 Rules of Smart and Successful Web Development](#) (2006)
- [20 Quick Ways to Improve Your Site](#) (2018)
- Mirjam Seckler: [Empirical evaluation of 20 web form optimization guidelines](#) (*Human Factors in Computing Systems*, April 2013)

Martial arts could indeed be understood as a fundamental form of operacy. Somewhat amusing is the sense in which websites are effectively considered to be the systemic counterpart to the fortresses of centuries past, or the bunkers of the present day and recent past. Websites are now the fortresses of cyberspace, to be recognized as cyber-fortresses, appropriately calling for operational insights.

Toolkit for operacy?

An initial impulse for this exploration arose from an earlier study ([Memetic Analogue to the 20 Amino Acids as vital to Psychosocial Life?](#) 2015). This derived from the recognition, mentioned above, that 20 is the number of [proteinogenic amino acids](#) that are encoded by the standard genetic code -- perhaps the most fundamental exemplification of "operacy".

As notably promoted in the many writings of [Edward de Bono](#), operacy is the ability of an individual person to grow, to self-regulate and to lead other people to become successful. It includes the skills needed to become successful by doing whatever needs to be done correctly and consistently (Edward de Bono. [Judgment, recognition and operacy](#), *Extensor*). Operacy carries with it the concepts of empowerment, safe and fruitful completion, and efficiency in action.

Having coined the term operacy, it is therefore an appropriate coincidence that of the [56 books](#) written by Edward de Bono, 20 of those emerge from the selection offered (at the time of writing) -- sorted by "[thinking tools](#)". Of particular and unusual mnemonic value, de Bono provides a distinctive iconic image for all 56 books, and therefore for the 20 considered to be thinking tools.

In an effort to augment the sense of a coherent toolkit, the 20 icons indicative of the 20 tools lend themselves to a display in three dimensions, rather than in the two-dimensional form on the [De Bono website](#). As indicated above, the display could be based either on the dodecahedron (20 vertices) or the icosahedron (20 faces), namely its [dual](#).

It is immediately apparent that the 20 books do not represent distinctive skills. It is more appropriate to focus on the work as a whole of Edward de Bono over decades, especially his unusual interest in diagrammatic representation of skills, notably as featured in a book which does not feature in the list of 20 ([Atlas of Management Thinking](#), 1981). Claimed to be the first book to be written deliberately for the right side of the reader's brain, the summary indicates:

Verbal descriptions of complex management situations are necessarily lodged in the left side of the brain. In order for us to use the right side of the brain we need a repertoire of non-verbal images. That is precisely what this book is to provide. The images provided by the drawings in this book enrich the perceptual map of the executive. The images allow him or her to add some right-brain thinking to his or her usual left-brain thinking. This makes it easier for the executive to recognize situations in a flash instead of having to build them up piecemeal. The book has been called an Atlas because it is a reference work of visual images.

Rather than focus on the 20 titles, it is therefore of interest to focus on the 20 icons as potentially indicative of distinctive styles of operacy as understood by Edward de Bono. The question is whether further insight is suggested by their configuration in three dimensions rather than in the two dimensions of the website or the *Atlas*.

Indicative mapping of thinking tool titles of Edward de Bono onto polyhedral animations		
Titles on dodecahedron 20 vertices	Titles on icosahedron 20 faces	Title icons on icosahedron (unfolding)
Animations prepared with Stella Polyhedron Navigator		

An indication of the approach might be better made using some other 20-fold set, given that the titles of the works of Edward de Bono are about his treatment of thinking and do not distinguish 20 thinking tools as such.

Coherence, comprehensibility and credibility of a cognitive toolkit

The argument here is that any toolkit is then necessarily best to be understood in systemic terms. Indeed the images in the original *Atlas of Management Thinking* merit some such treatment, as implied by the relation between the 2-dimensional maps in any atlas and the 3-D globe from which they are derived. Given their articulation, the argument applies to the other clusterings of thinking tools (*Twenty Thinking Tools*, 2006; *Twenty Problem Solving Skills*, 2011; *Twenty Methods for Improving Problem Solving*, 1958). Clearly these could be experimentally mapped onto polyhedra as indicated above or below -- and would as such be more indicative of the cognitive content of any toolkit.

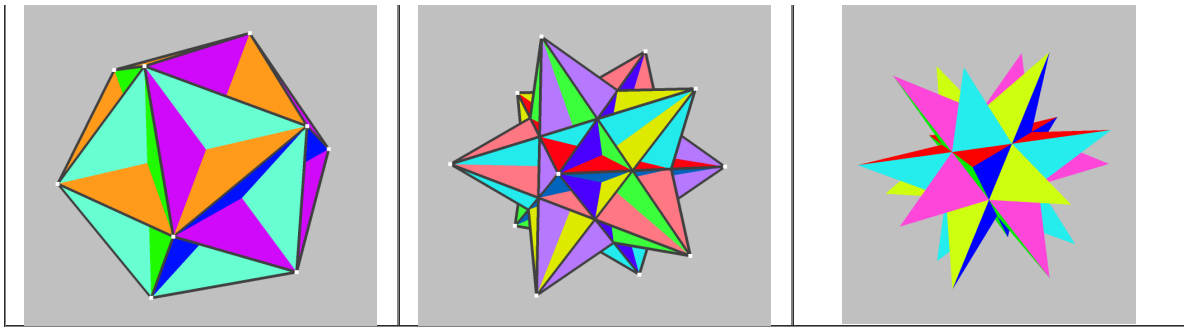
Sense of systemic coherence? Missing from the 20-fold articulations is any sense of how the operational insights function together systemically, with necessary feedback loops and learning cycles. As triggers for further reflection the 3D configurations above can be "enriched" internally to imply such connectivity, in the light of arguments developed separately (*Time for Provocative Mnemonic Aids to Systemic Connectivity?* 2018). One approach is to suggest that the subjective sense of coherence and completion is somehow associated with the [golden rectangles](#) integral to the dodecahedron and icosahedron as shown below.

This implies that a set of 20, for example, is somehow held to be coherent through aesthetic integrity -- much studied with respect to the golden rectangle. Many artists and architects have been fascinated by the presumption that the golden rectangle is considered aesthetically pleasing through its embodiment of the so-called [golden ratio](#), perhaps to be understood as just proportionality -- defined by the Greek letter *phi*.

Golden rectangles suggestive of internal coherence of a set of operational insights		
Dodecahedron (20 vertices)	Icosahedron (20 faces)	Icosahedron (15 golden rectangles)

Internal coherence of 20-fold set? The internal coherence can be explored further as implied by use of the [great dodecahedron](#) and the [great icosahedron](#) of 20 faces -- and a morphing process between the latter and its dual, the [great stellated dodecahedron](#) of 20 vertices (right below). Elements of the argument are discussed separately (*Representation of Creative Processes through Dynamics in Three Dimensions*, 2014; *From poster sessions to stellar futures via aesthetic visualizations*, 2015). The latter includes images of the succession of 18 fully 'supported stellations' of the icosahedron.

Great dodecahedron (12 vertices)	Great icosahedron (20 faces)	Great icosahedron to Great stellated dodecahedron



Functional distinctions? Of potentially greater interest is whether other items in the checklist above suggest more generic insights into the elements of a 20-fold pattern -- then necessarily more subtle and difficult to comprehend, or to label. What is the distinctive functional significance of each element of a 20-fold set -- if that is indeed an appropriate way in which to pose the question? The degree to which the martial arts use a 20-fold pattern (as noted above) suggests that such distinctions can indeed be made clear in operational terms.

As previously indicated, a related question is raised in the light of the seemingly arbitrary articulation of a recent strategic report to the Club of Rome into 40 initiatives (Ernst von Weizsaecker and Anders Wijkman, *Come On! Capitalism, Short-termism, Population and the Destruction of the Planet*, 2018), as separately reviewed (*Exhortation to We the Peoples from the Club of Rome*, 2018). This review includes a range of images and animations to emphasize the need for more complex articulations of strategic approaches -- especially those of global relevance.

Why 40 in the report to the Club of Rome? **Is there some unexplored sense in which a 20-fold understanding of operational insights is reflected in that 40-fold remedial global strategic proposal?**

Obstacles to effective strategic implementation? Given the recognized resistance to such global calls for action -- implied by "Come On!" in the title -- is there some relevance to the 20-fold pattern of *Upakleshas* of Buddhism, noted above, namely the 20 secondary "hindrances" binding people to illusion. These are:

20 Secondary hindrances according to Buddhism			
<ul style="list-style-type: none"> • belligerence • resentment • concealment • spite • jealousy 	<ul style="list-style-type: none"> • miserliness • deceit • dissimulation • haughtiness • harmfulness 	<ul style="list-style-type: none"> • non-shame • non-embarrassment • lethargy • excitement • non-faith 	<ul style="list-style-type: none"> • laziness • non-conscientiousness • forgetfulness • non-introspection • distraction
Reproduced from <i>Chinese Buddhist Encyclopedia</i>			

Also potentially relevant to any polyhedral mapping of psychological and behavioural "resistance" to 20-fold operacy, Buddhism distinguishes a 5-fold and a 10-fold list of hindrances (*Kleshas*):

- 5-fold: **ignorance, attachment, aversion, pride, jealousy**
- 10-fold: **greed, hate, delusion, conceit, wrong views, doubt, torpor, restlessness, shamelessness, recklessness**

There is a case for interpreting each of these hindrances for individuals in terms of their collective implications.

Reconciling a 20-fold and 6-fold pattern: Irrespective of the coincidental clustering by Edward de Bono of 20 "thinking tools", his main focus has been on a 6-fold articulation (*Six Frames: For Thinking About Information*, 2008). Curiously these make specific use of 6 mnemonic forms which are potentially related to coherent mappings in 3D (circle, triangle, square, diamond, rectangle, and heart). Some of the issues have been discussed in relation to the use of such forms on playing cards (*Radical Localization in a Global Systemic Context: distinguishing normality using playing card suits as a pattern language*, 2015).

To the extent that there is an intuitive recognition of coherence associated with regular polyhedra, it is therefore potentially interesting that Edward de Bono's long-term focus on 6 may be related to one of the patterns of **great circles** of which the spherical icosahedron has 6, 10 and 15 types, as detailed by *Wikipedia (31 great circles of the spherical icosahedron)*. It was this recognition that enabled **Buckminster Fuller** to construct **geodesic domes**. Arguably, in the desperate quest for global strategic coherence, there is a collective need for comprehensible construction of global psychosocial analogues.

In the case of the icosahedron, the great circles are variously associated with its 12 vertices (6 circles), 20 faces (10 circles), and 30 edges (15 circles). It could be argued that **there is presumably a form of subtle aesthetic appreciation of such patterns which engenders the sense of coherence** giving rise to 12-fold, 20-fold and 30-fold sets.

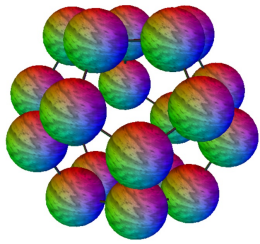
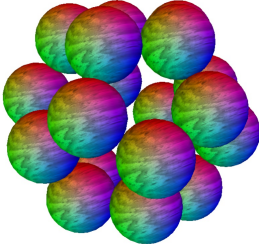
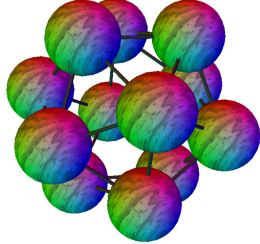
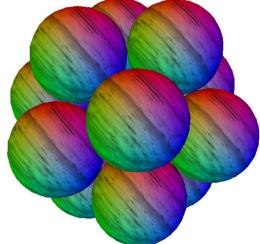
Coherent configurations of values: Is it a complete coincidence that the *Universal Declaration of Human Rights* (UNDHR) is articulated in 30 articles, or the European Commission's *European Pillar of Social Rights in 20 principles*? Given their acclaimed fundamental significance, especially the UNDHR, is the pattern as a whole of no particular significance in implying a degree of coherence, comprehensibility and credibility?

There is of course the possibility of mapping the UNDHR articles onto the 30 edges of the dodecahedron or of the icosahedron in quest of possibilities of eliciting greater coherence from the set. In an earlier exercise the 30 articles were mapped onto 30 faces of a **rhombicosidodecahedron**. The 18 articles of the *European Convention on Human Rights* were mapped onto faces of a

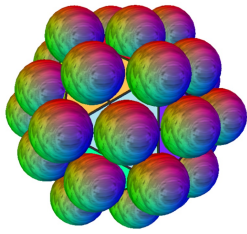
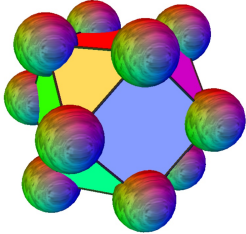
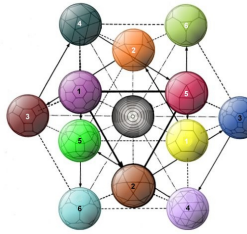
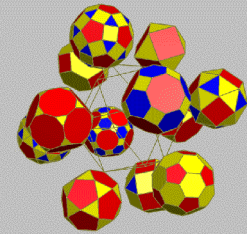
rhombicuboctahedron, and the 53 articles of the *Arab Charter on Human Rights* were mapped onto faces of a rhombicosidodecahedron (*Dynamic Exploration of Value Configurations: polyhedral animation of conventional value frameworks*, 2008).

Packing and morphing insights? Elaborating any set of insights could be said to call upon some sense of "packing" them together. It would be intriguing to explore any debate on extending a 20-fold set to 21, or reducing it to 19 -- or extending a 30-fold set to 31 or reducing it to 29. The issue has been evident in the case of the extension of the UN's *Millennium Development Goals* from 8 to the 16+1 of the *Sustainable Development Goals*. In the latter case the 17th Goal (*Partnerships for the goals*) is understood as coordination among the 16.

The issue of packing is the subject of special concern in terms of so-called **sphere packing**, namely an arrangement of non-overlapping spheres within a containing space. The question here is whether there is a cognitive equivalent that merits attention. What then is the "containing space" of any kind of toolkit?

Dodecahedron (20 vertices)		Icosahedron (12 vertices)	
Spheres "unpacked"	Spheres "packed" / touching	Spheres "unpacked"	Spheres "packed" / touching
			
Images prepared with Stella Polyhedron Navigator			

It has been established that the **cubeoctahedron** is especially significant to the process of sphere packing. It can be used to provide an array of 12 **Archimedean polyhedra** in their most regular array around a **truncated tetrahedron** (omitted from the animation on the right). This approach has the merit of distinguishing visually the elements of a 12-fold pattern, as is especially apparent from the animation on the right. The array is uniquely significant in terms of sphere packing in that the 12 are then all in contact with the 13th at the centre as extensively documented by [Keith Critchlow](#) (*Order in Space: a design source book*, 1969). Is there a corresponding need for "order in cognitive space" as reflected in 12-fold, 20-fold and 30-fold sets of insights?

Dodecahedron/Icosahedron compound (32 vertices)	Cubeoctahedron (12 vertices)	Cubeoctahedral array of 12 Archimedean polyhedra	Rotation of 12-fold array of Archimedean polyhedra
			

Of further relevance in the case of the cubeoctahedron is that it can be transformed dynamically through a much-studied "jitterbug" motion into other configurations, most notably the icosahedron (Robert W. Gray, *Jitterbug Defined Polyhedra: the shape and dynamics of space*, 2001; H. F. Verheyen, *The Complete Set of Jitterbug Transformers and the Analysis of their Motion, Computers and Mathematics with Applications*, 17, 1989, 1-3; Joe Clinton, *R. Buckminster Fuller's Jitterbug: its fascination and some challenges, Synergetics Collab*, 2011). Many videos of that movement have been produced (*Buckminster Fuller's Jitterbug*, 2007).

Such transformation are suggestive of a degree of cognitive continuity between various coherent N-fold patterns of insights, as discussed separately (*Time for Provocative Mnemonic Aids to Systemic Connectivity?* 2018).

Reconciling "positive" and "negative" operational insights

Essential elusiveness of insights: Many sets of insights tend to be framed either in terms of what to do or what not to do. This leaves unclear what the insight is, especially if it involves striking some kind of dynamic balance between both extremes -- a balance for which no singular label is adequate or particularly comprehensible. A further difficulty is that, as presented in checklists of insights, the terms use may be ambiguous or susceptible to various interpretations. This difficulty was addressed in the [Human Values Project](#) within the context of the *Encyclopedia of World Problems and Human Potential*.

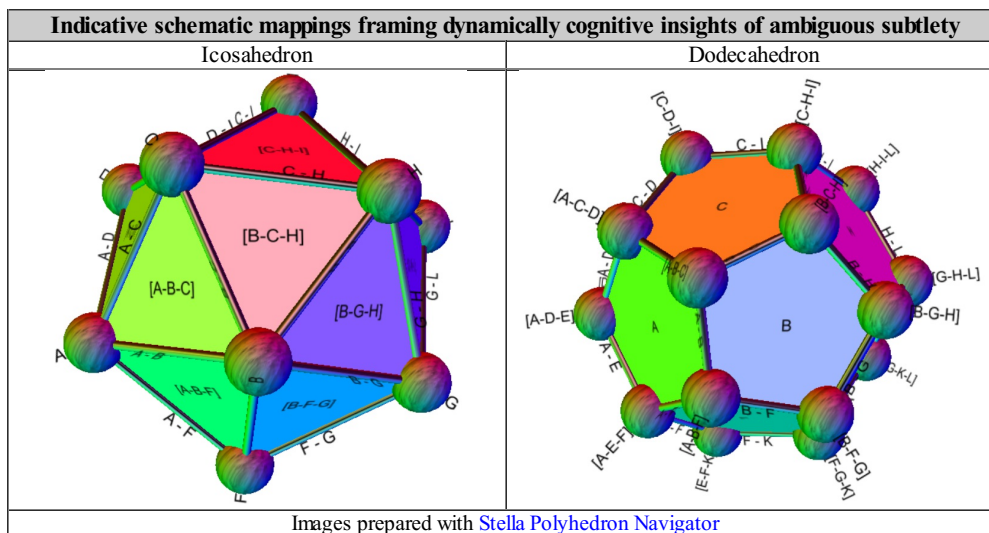
There use was made of synonyms and antonyms of value-charged words: 987 "constructive" and 1992 "destructive". These were then clustered in terms of 230 **value polarities**. The 20 Secondary hindrances according to Buddhism (as listed above) can be used as a point of departure in order to identify 20 implied cognitive attitudes or skills, given that the hindrances imply an attitude by which they can be transcended. The merit of that list is that it has a long tradition behind it and is relatively stable. The following is a very preliminary attempt to reconcile the Buddhist set with those value polarities, as was done with "destructive" concepts in the original project.

Buddhist secondary hindrances	Value polarities
belligerence	Accord-Disaccord / Friendship-Enmity / Congratulation-Envy

resentment	Congratulation-Envy / Contentment-Discontentment
concealment	Modesty-Vanity / Naturalness-Affectation
spite	Love-Hate / Friendship-Enmity / Kindness-Unkindness / Goodness-Badness
jealousy	Congratulation-Envy / Virtue-Vice / Contentment-Discontentment
miserliness	Economy-Prodigality / Temperance-Intemperance
deceit	Probity-Improbity / Skilfulness-Unskilfulness / Communicativeness-Uncommunicativeness
dissimulation	Modesty-Vanity / Naturalness-Affectation
haughtiness	Modesty-Vanity / Pride-Humility / Respect-Disrespect / Support-Opposition
harmfulness	Goodness-Badness / Kindness-Unkindness / Healthfulness-Unhealthfulness
non-shame	Virtue-Vice / Probity-Improbity / Modesty-Vanity / Rightness-Wrongness / Exultation-Lamentation / Naturalness-Affectation
non-embarrassment	Pride-Humility / Wealth-Poverty / Facility-Difficulty / Attention-Inattention / Certainty-Uncertainty
lethargy	Action-Inaction / Feeling-Unfeelingness / Intelligence-Unintelligence
excitement	Desire-Avoidance / Motivation-Dissuasion / Eloquence-Uneloquence / Attention-Inattention / Excitement-Inexcitability / Feeling-Unfeelingness
non-faith	Virtue-Vice / Belief-Unbelief / Probity-Improbity / Certainty-Uncertainty / Piety-Impity / Desire-Avoidance / Hope-Hopelessness / Obedience-Disobedience
laziness	Action-Inaction / Carefulness-Neglect / Timeliness-Untimeliness
non-conscientiousness	Taste-Vulgarity / Probity-Improbity / Dueness-Undueness / Carefulness-Neglect
forgetfulness	Kindness-Unkindness / Carefulness-Neglect / Remembrance-Forgetfulness
non-introspection	
distraction	Sanity-Insanity / Attention-Inattention

Framing ambiguity: The above exercise raised a variety of issues calling for further investigation. However it served to further highlight the underlying problem of the ambiguity of any terms with which a 20-fold set of thinking tools is distinguished. It suggested the further possibility of variously framing that ambiguity in order to indicate the nature of a well-formed set of 20 subtle insights.

The possible approach is suggested by the following images based on the icosahedron (20 faces) and its dual the dodecahedron (20 vertices) -- both with 30 edges. In the images below the edges are treated as polarities, namely a dynamic calling for a cognitive balance in practice between extremes. In the case of the icosahedron 3 such polarities frame a complex -- the elements of the 20-fold set. The vertices can themselves only be labelled ambiguously. It is this configuration as a whole which offers insights into the coherence of the set -- despite any ambiguity in the labelling of its components.



The challenge is then to explore the use of such a framing in the case of specific 20-fold sets, and any correspondence with 12-fold sets and 30-fold sets.

Encoding distinctiveness in the light of regular polyhedra:

Distinctions between 5 Platonic and 13 Archimedean polyhedra		
Notation of (3, 4, 3, 4) means each vertex contains a triangle, a square, a triangle, and a square, in that cyclic order.		
2-3-5-fold symmetry		2-3-4-fold symmetry
	(3, 3, 3) tetrahedron	
(3, 3, 3, 3, 3) icosahedron		(3, 3, 3, 3) octahedron
(5, 5, 5) dodecahedron		(4, 4, 4) cube
	(3, 6, 6) truncated tetrahedron	
(5, 6, 6) truncated icosahedron		(4, 6, 6) truncated octahedron
(3, 5, 3, 5) icosidodecahedron		(3, 4, 3, 4) cuboctahedron
(4, 6, 10) truncated icosidodecahedron		(4, 6, 8) truncated cuboctahedron
(3, 3, 3, 3, 5) snub dodecahedron		(3, 3, 3, 3, 4) snub cube

(3, 4, 5, 4) rhombicosidodecahedron	(3, 4, 4, 4) rhombicuboctahedron
(3, 10, 10) truncated dodecahedron	(3, 8, 8) truncated cube
Presentation following Keith Critchlow (<i>Order in Space: a design source book</i> , 1969).	

With edges understood as polarities, the vertices at which they intersect are necessarily indicative of a higher order of ambiguity-subtlety. In the relation between the icosahedron (12 vertices) and the dodecahedron (12 faces), there is perhaps a greater challenge to comprehension of the elements of a 12-fold articulation than for a 20-fold articulation.

Cognitive operational sets recognized dynamically rather than statically

"Flexibility" of insight sets? The ambiguity and elusiveness of operational insights -- and of values more generally -- suggests that the obvious "rigidity" of polyhedra, notably as typically portrayed, may well be more than misleading when used for mapping purposes. As is evident with respect to cognitive skills, their use implies a dynamic between different skills in the light of their respective advantages and disadvantages in a particular situation.

The form of a polyhedron reinforces implications (for cognitive mapping purposes) that it can be treated as a so-called **Newtonian material**, namely one that exhibits a linear relationship between stress and strain rate from the perspective of materials science. More relevant to the dynamic ambiguity of the insights of concern here is the possibility that their relation to any polyhedron could be better understood in terms of non-Newtonian properties. Examples include:

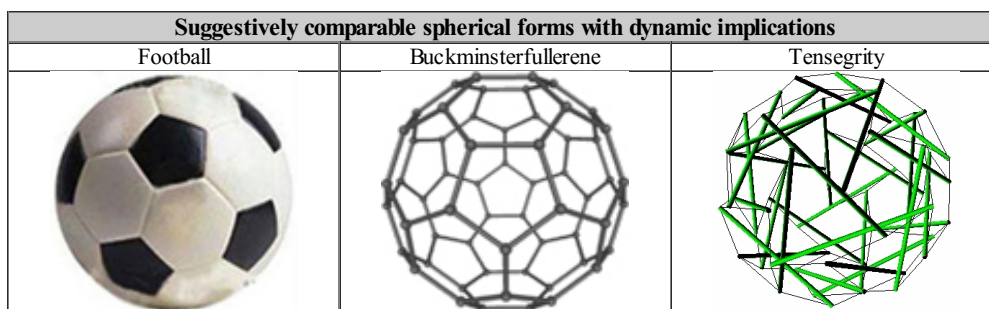
- **Maxwell material**, a **viscoelastic** material having the properties both of **elasticity** and **viscosity**.
- **Flubber**, a **non-Newtonian fluid** that flows under low stress, but breaks under higher stresses and pressures -- a combination of fluid-like and solid-like properties making it a **Maxwell solid**.
- **Silly putty**, widely used in a toy based on **silicone polymers** that have unusual physical properties. It bounces, but it breaks when given a sharp blow, and it can also flow like a liquid. It contains a viscoelastic liquid silicone, a type of non-Newtonian fluid, which makes it act as a viscous liquid over a long time period but as an elastic solid over a short time period.
- **Rheopecty** is the rare property of some non-Newtonian fluids to show a time-dependent increase in viscosity (time-dependent viscosity); the longer the fluid undergoes shearing force, the higher its viscosity. Rheopectic fluids, such as some lubricants, thicken or solidify when shaken. **Thixotropy** is the opposite and much more common type of behaviour, in which fluids become less viscous the longer they undergo shear.
- **Quicksand**, namely a shear thinning non-Newtonian fluid: when undisturbed, it often appears to be solid ("gel" form), but a minor (less than 1%) change in the stress on the quicksand will cause a sudden decrease in its viscosity ("sol" form).

These are suggestive of other ways of considering the nature of insight sets and the relationships between their elements. When the insights are values or principles, it then becomes clearer how they take solid, rigid or non-negotiable form through their definition and use as slogans -- but that they of a more fluid or liquid form as experienced in practice, or when put to the test. In this sense any mapping might be better made on a relatively malleable spherical ball, responsive to any temporary encounter with obstacles. The polyhedra noted above might then take the form of spherical polyhedra.

A striking example of this is the widely familiar association football (below left). The pattern is of the form of a spherical **truncated icosahedron** with 12 regular pentagonal faces, 20 regular hexagonal faces, 60 vertices and 90 edges. Given the argument above, there is a degree of irony to the fact that it is kicked and passed around in the quest for goals. It is necessarily flexible to a degree. It can be compared with the rigid **Buckminsterfullerene** a form of carbon with a cage-like fused-ring structure (truncated icosahedron) that obviously resembles a soccer ball.

Spherical tensegrity: However it is the spherical **tensegrity** structure on the right which perhaps best illustrates the dynamics of a set of cognitive insights. A simpler form of direct relevance to this argument is the **icosahedral tensegrity** (variously illustrated in that link, and **separately**).

As the basic for the architectural integrity of geodesic domes, such a tensional integrity, or floating compression, is a structural principle based on the use of isolated components in compression inside a net of continuous tension, in such a way that the compressed members (usually bars or struts) do not touch each other and the prestressed tensioned members (usually cables or tendons) delineate the system spatially.



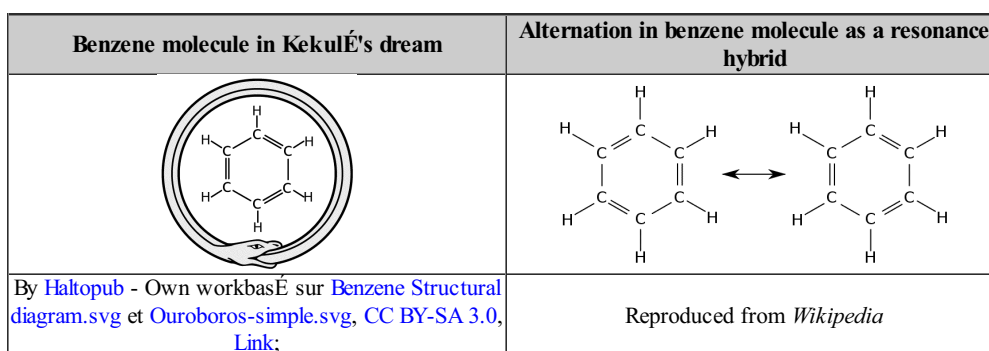
The question is whether a well-formed set of cognitive insights must necessarily be based on the structural principles of a tensegrity -- as argued from the perspective of **management cybernetics** by **Stafford Beer** (*Beyond Dispute: the invention of team synteegrity*, 1994). Given the dynamic ambiguity stressed above, it is perhaps appropriate to understand the rigid (non-compressible) and flexible (tension) elements alternating in a cognitive variant. The alternation could well be a matter of degree, rather than a binary switch between

extremes.

Beer's work focused on the relevance of the icosahedron to discourse (Gunter Nittbaur, *Stafford Beer's Syntegration as a Renaissance of the Ancient Greek Agora in Present-day Organizations*, *Journal of Universal Knowledge Management*, 0, 2006; J. Truss, C. Cullen, and A. Leonard, *The Coherent Structure of Team Syntegy: from small to mega forms*). The principle was used on the occasion of the *UN Conference on Environment and Development* (1992) in configuring **strategic dilemmas in intersectoral dialogue**, notably through mapping a *Representation of Issue Arenas on Icosidodecahedral Net* (1992).

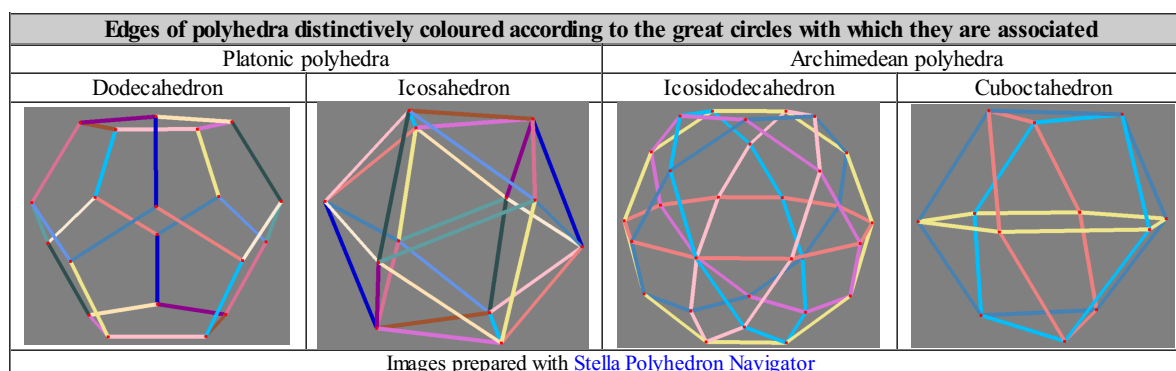
Operational insight sets as resonance hybrids?

In the light of the above argument for "flexibility" and a "non-Newtonian" approach to the configuration of insight sets -- given their subtle ambiguity -- further inspiration may be sought from the structure of the molecule fundamental to organic chemistry, biology and life -- namely the iconic **benzene molecule**. The strange manner in which that structure was famously **recognized in a dream** by August Kekulé merits attention. In particular of interest is current understanding of the molecule as a **resonance hybrid**. To correctly interpret the molecular structure described by a resonance hybrid, all significant contributors of the resonance hybrid must be considered together, since the hybrid represents the actual molecule as their "average", **Why indeed should it be assumed that fundamental cognitive sets should be of lesser complexity than the structure so fundamental to the viability of life?**



The argument above suggested that Edward de Bono's *Six Frames: For Thinking About Information* (2008) could be usefully recognized as associated with 6 polyhedral great circles, most notably 6 of the **31 great circles of the spherical icosahedron**. Of interest in the following images, the edges associated with great circles are not continuous in the two Platonic polyhedra on the left. They are however continuous in the two Archimedean polyhedra on the right. The 10 edges in each of the 6 great circles in the case of the icosidodecahedron (of 60 edges) can then be compared with the 6 edges in the 4 great circles of the cuboctahedron (24 edges).

Each great circle could then be understood as a form of cognitive resonance hybrid with its particular integrity and stability. As configured together they form a kind of cognitive cage of even greater integrity -- for which, as chemical metaphors, **clathrates** and **inclusion molecules** raise valuable questions. How these various arrangements relate to the concerns above with regard to 12-fold, 15-fold, 20-fold and 30-fold sets is a matter for further consideration. Some indications are offered by Li-Yuan Zhang (*Self-equilibrium and super-stability of truncated regular polyhedral tensegrity structures: a unified analytical solution*, *Proceedings of the Royal Society A*, 25 July 2012).



Constraint of the 7-fold on comprehension of the 20-fold

The introduction to this argument noted the importance attached to the much-cited study of George Miller (*The Magical Number Seven, Plus or Minus Two: some limits on our capacity for processing information*, *Psychological Review*, 1956) -- and subsequent research on human **working memory capacity**. Any such constraint is clearly of particular relevance to comprehension of the many 20-fold cognitive toolkits cited above -- whether of principles, strategies, rights, or values. Presumably it is both a constraint on comprehension of the *10 Commandments*, or of the 30 rights in the *Universal Declaration of Human Rights* -- "as a whole". In the latter case, it might be asked why the set of rights is effectively beyond human "working memory capacity" -- without any consideration of the matter.

More generally it could be asked, if there is a 7-fold constraint on use of a cognitive toolkit of requisite variety, **how is it appropriate to address the challenge of enabling people and society to "get their act together"** -- and to keep it together in the light of any aspirations to sustainability.

What is required is a way of relating the 7-fold to the 20-fold. One of the polyhedral configurations above offers an approach to this. The cuboctahedron of 14 faces (above right) has 7 axes of symmetry through those opposing faces. As noted above, it also offers a much-studied path of transformation between the Platonic polyhedra through the so-called jitterbug process explored through [synergetics](#) by Buckminster Fuller (*Synergetics: explorations in the geometry of thinking*, 1975/1979). Unfortunately, as discussed separately, Fuller does not interpret the promise of that title with respect to the cognitive issues explored here (*Geometry of Thinking for Sustainable Global Governance: cognitive implication of synergetics*, 2009).

Mapping options: Those axes can be used as a means of mapping various 7-fold sets for purposes of comparison. It is a means of giving an ordered focus to the confusion of decision-making and choice, whether in the momentary here-and-now for the individual, or on a larger scale for elaboration of global strategy. The examples mapped arbitrarily onto those axes below derive from:

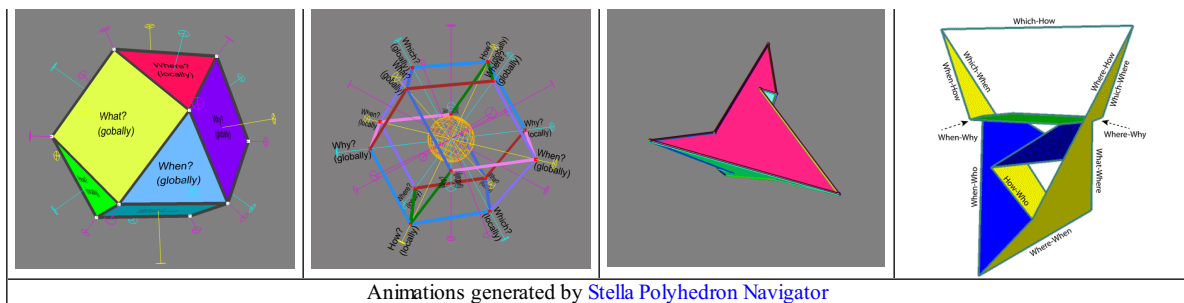
- the classical set of 7 WH-questions, as discussed separately (*Conformality of 7 WH-questions to 7 Elementary Catastrophes: an exploration of potential psychosocial implications*, 2006; *Interrelating Cognitive Catastrophes in a Grail-chalice Proto-model: implications of WH-questions for self-reflexivity and dialogue*, 2006)
- the 7 axes of bias derived from the philosophical work of W. T. Jones (*The Romantic Syndrome: toward a new method in cultural anthropology and the history of ideas*, 1961) as summarized separately (*Axes of Bias in Inter-Cultural Dialogue*, 1993).
- the 7 pairs of opposites of [Oliver C. Robinson](#) (*Paths Between Head and Heart: exploring the harmonies of science and spirituality*, 2018), as summarized by the author (*Palintonos Harmonia: the alchemy of opposites*, Paradigm Explorer, 2018, 2). That theme is inspired by the insight of Heraclitus and others into "taut harmony" (or "counter-stretched harmony"), as extensively reviewed by [Bernd Seidensticker](#) (*Palintonos Harmonia, Hypomnemata*, 72, 1982)

Examples of 7-fold sets mapped arbitrarily onto 7 axes of symmetry of a cuboctahedron		
7 WH Questions	7 Axes of Bias (Jones, 1961)	7 Pairs of Opposites (Robinson, 2018)
Axes of symmetry generated by Stella Polyhedron Navigator . Axes through the vertexes -- mauve -- are not used		

Oppositional logic: Each example highlights the challenge of dilemmas in engaging with the elements of a 20-fold set -- especially those taking the form of opposites to be reconciled. Of great potential relevance are ongoing explorations of oppositional logic and oppositional geometry, as discussed separately (*Oppositional Logic as Comprehensible Key to Sustainable Democracy: configuring patterns of anti-otherness*, 2018; *Neglected recognition of logical patterns -- especially of opposition*, 2017). The latter discusses explorations of [logical geometry](#) and [Aristotelian diagrams](#), as most recently summarized in a very comprehensive paper by Lorenz Demey and Hans Smessaert (*Logical and Geometrical Distance in Polyhedral Aristotelian Diagrams in Knowledge Representation, Symmetry*, 2017). That paper develops the idea that Aristotelian diagrams can be fruitfully studied as geometrical entities. In particular, it focuses on four polyhedral Aristotelian diagrams for the Boolean algebra B4, viz. the [rhombic dodecahedron](#), the [tetrakis hexahedron](#) [dual of the [truncated octahedron](#)] the [tetraicosahedron](#) and the [nested tetrahedron](#).

With respect to the above argument, the rhombic dodecahedron (12 faces, 14 vertices) is of interest as the dual of the cuboctahedron. Rather than mapping any 7-fold pattern of dilemmas onto the cuboctahedron, it could then be more appropriately mapped onto a rhombic dodecahedron where the 7 axes through 14 faces (as above) are now presented as 14 vertices through which 7 axes pass (as shown below). The form is used to distinguish different extremes of the 7 WH-questions -- contrasting the local here-and-now for the individual with the global challenges of collective strategy. The elusive compromise is then associated with the neologism [glocal](#) -- essentially dynamic. It is understood as the simultaneous occurrence of both universalizing and particularizing tendencies in contemporary social, political, and economic systems. In the animation below it is usefully indicated by the central sphere -- as **a nexus of dynamic reconciliation of dilemmas**.

Experimental 7-fold mapping possibilities			
7 WH-question dilemmas on cuboctahedron and its dual		Szilassi polyhedron	
Cuboctahedron (rotation) sides distinctively coloured	Rhombic dodecahedron (rotation) edges coloured by great circle	7-sided Szilassi polyhedron (rotation) sides distinctively coloured	Mapping of question-pairs (some sides transparent)



Animations generated by Stella Polyhedron Navigator

How distinctions could be usefully mapped in relation to one another onto such forms remains to be investigated. As noted above, one consideration in the case of the 7 WH-questions follows from exploration of their possible conformality to the set of 7 [elementary catastrophes](#) variously studied by [René Thom](#) (*Structural Stability and Morphogenesis*, 1972; *Semio Physics: A Sketch*, 1990).

Like the pairs of 8 triangular faces and 6 square faces of the cuboctahedron, these fall into two groups: 4 [potential functions of one active variable](#) (fold catastrophe, cusp catastrophe, swallowtail catastrophe, butterfly catastrophe) and 3 [potential functions of two active variables](#) (hyperbolic umbilic catastrophe, elliptic umbilic catastrophe, parabolic umbilic catastrophe). With the WH-questions understood as "cognitive catastrophes" of a kind -- especially in the practice of global discourse -- their possible relation to those catastrophes is discussed separately (*Correspondence of WH-questions to elementary catastrophes*, 2006).

Collapsing 7-fold dilemmas? As axes through opposing vertexes, the dynamics of the associated set of cognitive challenges are usefully held in a global configuration. Of interest is the consequence of "collapsing" this challenge. This collapse may be usefully explored through a polyhedron of 7 sides -- with "sides" then indicative of fixed positions in a dialogue. Valuable in this respect is the highly unusual [Szilassi polyhedron](#) (above centre) where the **7 sides (of 4 types) are each in contact with all the others**. Like the rhombic dodecahedron, it has 14 vertices (but of 7 types). It has however 21 edges (of 12 types).

The elegant symmetry of the polyhedra discussed above is seemingly completely lost in a form which could be seen as a useful reflection of the ugliness of the "collapsed discourse" which is currently so characteristic of global debate. The Szilassi polyhedron is a curious reflection of mistaken assumptions regarding how to "get any act together". Having the "sides" all "in touch" with each other -- upheld in the symbolism of many conferences -- clearly avoids more fundamental issues of conceptual configuration (*Visualization Enabling Integrative Conference Comprehension: global articulation of future-oriented 3D technology*, 2018).

Whilst the sides of the Szilassi polyhedron can usefully hold the 7 WH-questions, potentially more interesting in the quest for coherence, is the use of the edges to hold pairs of WH-questions, as shown in the image on the right, and discussed separately (*Mapping of WH-questions with question-pairs onto the Szilassi polyhedron*, 2014). Somewhat ironically, given the above argument regarding the football, a related mapping can also be explored with respect to the "beautiful game" (*Mapping of WH-questions with question-pairs onto a memorable polyhedron (a football)*, 2014).

The Szilassi polyhedron holds further surprises in its relation to the strange dynamics of cube inversion, as illustrated separately (*Association of the Szilassi polyhedron with cube inversion*, 2018). As a consequence, it offers insights into the *Dynamics of discord anticipating the dynamics of concord* (2018). Animations there show an unsuspected coherence to the dynamics of either 6 or 7 Szilassi polyhedra variously connected.

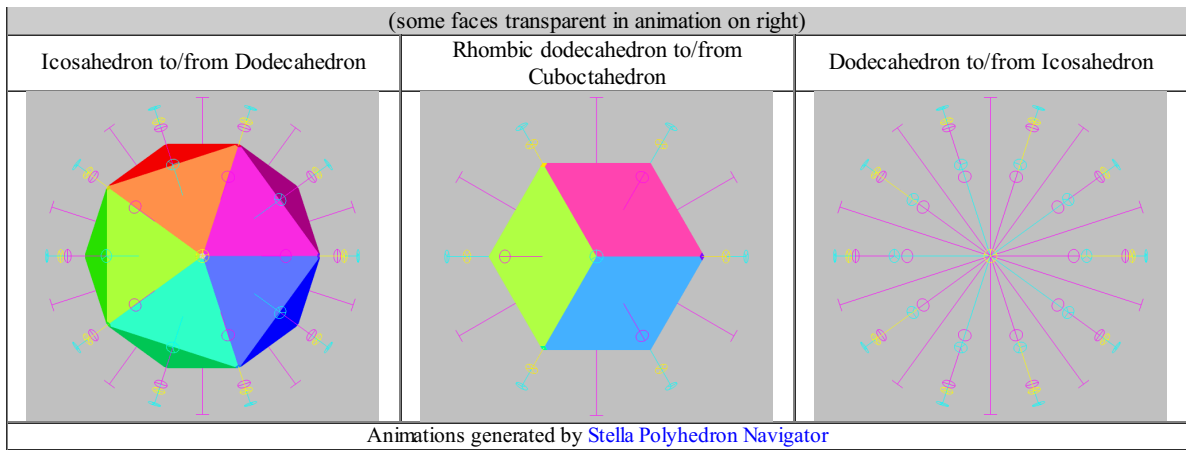
Transformation of principles into "sides" through "truncation" of cognitive sets?

Truncation of cognitive sets: A key question is how a set of 30 insights, such as is embodied in the *Universal Declaration of Human Rights*, gets "reduced" to the 20 insights embodied in the European Commission's *European Pillar of Social Rights in 20 principles*, or to the UN's 15(+1) *Sustainable Development Goals* -- itself "expanded" from the UN's *Millennium Development Goals*.

A valuable clue to this "cognitive operation" is provided by the well-studied and illustrated [geometry of truncation](#) (*Truncating*; Livio Zefiro, *Vertex- and edge-truncation of the Platonic and Archimedean solids leading to vertex-transitive polyhedra*). This is an operation in any dimension that cuts polytope vertices, creating a new facet (or side) in place of each vertex. The term originates from Kepler's names for the Archimedean solids. The *Wikipedia* entry illustrates the distinction between uniform truncation, edge-truncation, and alternation (or partial truncation), and generalized truncations. How are patterns of insights then to be understood as variously "truncated"?

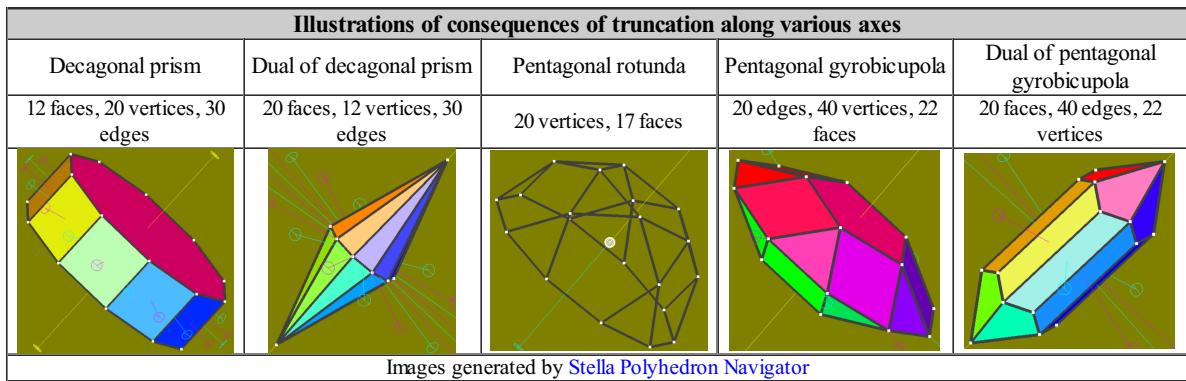
It is then of interest to recognize how a set of principles mapped onto vertexes, at the extremes of axes of symmetry, get transformed by effectively turning each original vertex into a side -- thereby increasing the number of vertexes. As can be seen from the animations below, the truncation is associated with the creation of a side closer to the centre of axial symmetry -- the side expands in size as it moves away from the original vertex. This process could be understood as implying one of "taking sides" rather than recognizing what the original vertex "stood for".

In the animations below each polyhedron gets transformed through transformation into its dual. Thus the icosahedron of 12 vertex ("principles") gets truncated into a dodecahedron of 12 sides -- itself to be understood as characterized by 20 (lesser?) principles. In the reverse process, the 20 principles are conflated ("integrated") to constitute 12 principles. A corresponding animation of the cuboctahedron of 12 vertexes is shown transforming into its rhombic cuboctahedral dual of 12 sides. In all the animations various intermediary configurations are evident.



The above animations fail to show the consequence of truncations of different degrees along different axes, or from the extremes of the same axis. These would typically generate polyhedra of greater or lesser degrees of regularity (understood as an approximation to a "global" configuration). This could then be seen as corresponding to a greater or lesser degree of adherence to a principle in some cases, in contrast with "taking sides" to a greater or lesser degree in others.

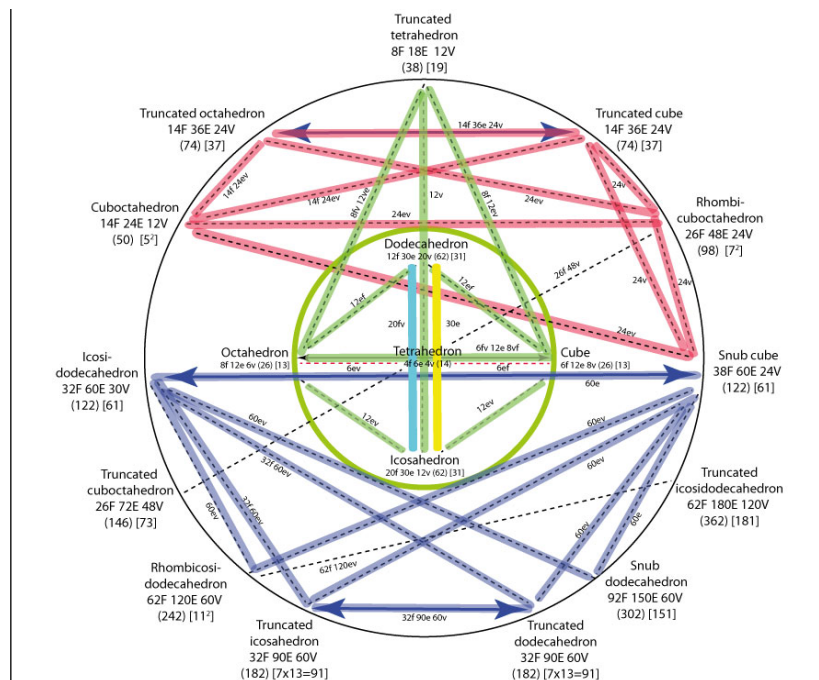
An example of a particular interest would result from truncation with respect to a single down to the centre of axial symmetry, as might correspond to the complete failure to recognize the principle associated with one extreme of that axis. The principle could then be said to have been transformed completely into a side, with all that that would imply for the non-globality of discourse. The images below are then interesting illustrations of that condition.



Juxtaposition of the dual of a polyhedron frames the provocative possibility that if one serves as a recognizable mapping of a set of conscious cognitive insights (as in any declaration), the other may constitute an indicative mapping of the set of insights which is effectively denied or of unconscious significance. This would then be a mapping of the *shadow* in psychoanalytical terms, and as implied by the arguments of [John Ralston Saul](#) (*The Unconscious Civilization*, 1995). The variety of polyhedra would then offer a pattern language through the collective shadow could be discussed in the light of the cognitive biases implied by the truncations along various axes of bias

Transformational "route maps"? The relation between the articulations of insights suggestively mapped onto the polyhedra indicated above offers the further sense that a "cognitive toolkit" could well vary in scope -- in the number of "tools" held to be relevant to a particular set of circumstances. This is suggested by a kind of "route map", discussed separately and reproduced below (*Pathway "route maps" of potential psychosocial transformation?* 2015). As indicated there, this might be understood as a *Polyhedral meta-patterns of relationships?* (2015).

Map highlighting distinctive relationships pathways between spherically symmetrical polyhedra (regular and semi-regular) F=faces, E=edges, V=vertices (Total of these in parenthesis) [Total reduced to prime number, other than 2, in square brackets]
Empty space for the map



Dynamics of force-directed layout of concept sets beyond truncation of rigid polyhedra

The emphasis above has been on rigid polyhedra and the possibility of their transformation through truncation. In practice emphasis could be placed at any moment on one or more concepts in a set of insights. Although these can be understood as configured in polyhedral form -- as a 20-vertex dodecahedron, for example -- in particular circumstances this could be "distorted" out of its ideal regularity in response to circumstances. As mentioned above, the edges linking concepts could then be likened to rubber bonds, stretching or shortening within the constraints of the set as a whole.

A valuable approach to this is through the use of [force-directed graph drawing](#), characteristic of [Data-Driven Documents](#) (d3.js), to elicit self-organizing convex polyhedra -- without the conventional prerequisite for vertex coordinates ([Elijah Meeks, D3.js in Action](#), 2015). The approach is discussed separately ([Use of force directed layout to elicit memorable polyhedra](#), 2015). The following interactive examples are reproduced from that exercise. The polyhedra can be "distorted" by interactive use of the mouse. Some implications of such distortion are also discussed ([Potential significance of memorable irregularity?](#) 2015).

Of greater relevance to the above argument are the conditions in which the "force" distorting the polyhedra is a consequence of conscious or unconscious emphasis (or deprecation) on particular insights (or strategic modalities) in relation to others. This could be understood as sensitivity or insensitivity to particular axes, or to one or other extreme on that axis. It can be usefully reflected in exaggerating or diminishing those particular axes of symmetry -- implicit, and therefore "hidden", with respect to visualization of the polyhedral articulation of the set.

Screen shots of selected results of force-directed layout for selected polyhedra (not to scale relative to one another; subject to further tests; interactive animations currently only work in Internet Explorer)				
Dodecahedron (20 vertexes) (force-layout animation; mp4)	Cuboctahedron (force-layout animation; gif; mp4)	Truncated cuboctahedron (force-layout animation)	Drilled truncated cube (64 edges, 32 vertexes, 32 sides) (force-layout animation)	(rotation)

The images on the right illustrate the possibilities of mappings onto more complex polyhedra with their particular coherence and memorability. A [proof of concept exercise](#) for mapping on the drilled truncated cube is discussed separately ([Changing Patterns using Transformation Pathways](#), 2015). The approach suggests the nature of the coherence offered by dynamic integrity -- subject to a variety of distortions -- beyond the rigid integrity of polyhedra as commonly understood.

Twenty as "God's number"?

There is worldwide familiarity with [Rubik's Cube](#) and the competitive approach to its solution. Its surfaces can be used as mapping devices for strategic preoccupations -- notably the [Sustainable Development Goals](#) of the UN ([Interplay of Sustainable Development Goals through Rubik Cube Variations](#), 2017). Those developing skills for its solution use algorithms and competencies which could be

usefully considered comparable to those required for operacy in other domains.

Much has been made of discovering the minimum number of moves required to solve the cube. However it is only recently that it has been determined that the minimum number of moves in which it can be solved is 20 -- now variously acclaimed (*Rubik's Cube (solved in 20 moves or less)*, *DailyInfographic*, 21 November 2013). The process has been described in the following terms by those involved (*God's Number is 20*):

With about 35 CPU-years of idle computer time donated by Google, a team of researchers has essentially solved every position of the Rubik's Cube™, and shown that no position requires more than twenty moves. We consider any twist of any face to be one move (this is known as the half-turn metric.)

Every solver of the Cube uses an algorithm, which is a sequence of steps for solving the Cube. One algorithm might use a sequence of moves to solve the top face, then another sequence of moves to position the middle edges, and so on. There are many different algorithms, varying in complexity and number of moves required, but those that can be memorized by a mortal typically require more than forty moves.

One may suppose God would use a much more efficient algorithm, one that always uses the shortest sequence of moves; this is known as *God's Algorithm*. The number of moves this algorithm would take in the worst case is called God's Number. At long last, God's Number has been shown to be 20.

It took fifteen years after the introduction of the Cube to find the first position that provably requires twenty moves to solve; it is appropriate that fifteen years after that, we prove that twenty moves suffice for all positions.

Aside from preoccupation with solutions of Rubik's Cube, it is also interesting to note the concern with twenty in other games, most notably chess:

- *Checkmate in 20 Moves or Less!* (*Chess Forums*)
- *Best under 20 move mates* (*ChessGames.com*)
- *I made a summary of all 20 opening moves for White* (*European Chess Club/Reddit*)
- *How to beat your opponent in 20 moves or less* (*Chess.com*)
- *Could you hold off a GM for 20 moves?* (*Chess.com*)
- *Quick Games under 20 moves* (*ChessGames.com*)
- *20 Benefits of Playing Chess* (*YouTube*)

Upheld as the essence of strategic thinking, this focus in chess merits careful consideration in the light of the generic question raised above.

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