



laetus in praesens

Alternative view of segmented documents via Kairos

12 January 2015 | Draft

Memetic Analogue to the 20 Amino Acids as vital to Psychosocial Life?

Number 37 as indicative of fruitful pathways of transformation?

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Introduction

Identifying 20 "amino acids" of a memetic code potentially vital to psychosocial life?

Global strategic significance of 20-fold configurations

Indicative examples of the recognized significance of 20-fold patterning

Potentially indicative patterns of prime numbers associated with polyhedra

In quest of number 37 through the pattern of spherical polyhedra

Polyhedral meta-patterns of relationships?

Pathway "route maps" of potential psychosocial transformation?

Requirement for emirps and enantiodromia in navigating songlines

Dependence of psychosocial life on meta-reflection and meta-cognition?

Requisite variety of "voices" for psychosocial wholth: 6, 8, 12, 20, 30?

Sphere packing as a clue to "voice hearing" and "voice touching"

Toneship design to enable noonautics by the voices of civilization?

References

Annex to *Changing Patterns using Transformation Pathways: exploring "camp-us" inspiration by an alien world view as a metaphor*,
2015

(in which bibliographical references are also located)

Introduction

As noted in the main paper, the following exercise derives from recent discoveries relating the codons of the genetic code governing life to patterns of numbers, as reported by Christopher Kemp (*Is the answer to life, the universe and everything 37 ?*, *New Scientist*, 20/27 December 2014). The report reviews research by Maxim Makukov, a cosmologist and astrobiologist at the Fesenkov Astrophysical Institute in Kazakhstan, in collaboration with the mathematician Vladimir shCherbak (*The "Wow! signal" of the terrestrial genetic code*, *Icarus*, 224, 2013). That title follows from a rare "Wow" moment in the SETI process in 1977 (J. R. Ehman, "Wow!": - a tantalizing candidate, 2011).

With respect to the number 37, as the key feature of the report, Kemp notes the discovery that: "37 recurs frequently within the code. For example, the mass of the molecular 'core' shared by all 20 amino acids is 74, namely 37 doubled". In an allusion to the imaginative tale of Douglas Adams regarding the meaning of life, Kemp comments: "Forget 42". This had been quixotically declared by Adams to be the *Answer to the Ultimate Question of Life, the Universe, and Everything* -- as determined by a supercomputer designed by "hyper-intelligent pan-dimensional beings".

The focus in the main paper was on the use of the drilled truncated cube -- because of the ease with which the 64 codons of the genetic code could be associated with its edges. The question here is how the argument can be taken further in the quest for the cognitive nature of a memetic equivalent to the 20 "proteinogenic amino acids" which may be fundamental to the integrative processes of understanding experiential engagement with daily life. These might also be understood in terms of psychosocial "metabolic pathways". Could they also be understood as a set of complementary generative metaphors -- for which the complementarity is itself a challenge to comprehension.

As indicated there this suggests a requirement that people be able to engage with the pattern rather than be simply confronted with it by informed elites, as separately explored (*Engaging with Insight of a Higher Order*, 2014). This concern is in the spirit of various authors (Joseph Campbell, *The Inner Reaches of Outer Space: metaphor as myth and as religion*, 1986; Henryk Skolimowski, *The Participatory Mind: a new theory of knowledge and of the universe*, 1994; George Lakoff and Rafael Núñez, *Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2000).

The issue of "where mathematics comes from" points to a potentially mysterious role of [prime numbers](#), like 37, in clarifying the quest. Prime numbers have long recognized as a mystery and a focus for speculation by mathematicians ([Marcus du Sautoy, *The Music of the Primes: searching to solve the greatest mystery in mathematics*, 2012](#)). However much remains to be discovered in terms of cognitive engagement with them.

The concern here is whether these threads acquire greater meaning through the elegance of the symmetrical polyhedra which are variously valued as emblematic of integrative organization -- and as approximations to a sense of globality. As with the Kazakh suggestion that there is a code embedded within the genetic code, the question here is whether polyhedral patterns suggest the existence of otherwise "hidden" pathways vital to psychosocial transformation.

Identifying 20 "amino acids" of a memetic code vital to psychosocial life?

In the debate regarding [memetics](#), [memes](#) and the possibility of a [memetic code](#), Agocs Viorel has made one proposal ("[Minimum separabile](#)" *and the memetic code*, 1 February 2003). This notes that there is no discussion of an analogue to an amino acid function, He argues that:

It is known that the gene is built up from sub-units we call codons and we define this in reference to the amino-acids. If the gene have such sub-units, I wonder why shouldn't the meme have too? ... In the same way the codons code for amino-acids, the memetic sub-units also code for something I will temporarily call "minimum separabile"... The term "minimum separabile" belongs to Lorenz, who studied the phylogenetic development of voluntary movements through the animal kingdom (the term was originally used to explain the separation power of the retina)... So, I conclude that these "minimum separabile" are in fact the encoding medium for the memetic code. They are anatomical structures used to create a variety of complex motions, in the same way the amino-acids are uses to create a large variety of complex proteins. Each amino-acid in the protein has its corresponding codon within the structure of the gene, and each "minimum separabile" has its corresponding sub-unit within the structure of the meme. One involves the other. In fact, all that a learning system needs is a code (genetic or memetic) and an encoding medium, a set of recombinable elements that we call amino-acids or, in the case of memetic code, these "minimum separabile". All we have to do now is to delimit anatomically these "minimum separabile"... If we accept all that I said above, we must also accept that each "synergistic activity of all the muscles which move the same joint", each "minimum separabile", has its corresponding "codon" within the memetic code. In respect with the term "codon", I will name it "memon".

Viorel explains his position regarding the relative lack of credibility of memetics by arguing that: *The reason there are so many unbelievers is that we do not have any reference to the memetic code and a mechanistic model of the structure of the meme. We also do not have a proper definition regarding the encoding medium of the memetic code.*

With respect to the framework formulated by [Matti Pitkänen](#) ([Topological Geometro Dynamics inspired theory of consciousness, NeuroQuantology](#), 2003; [Genes and Memes](#), 18 November 2003), the author subsequently asks [Could one find a geometric realization for genetic and memetic codes?](#) (30 March 2013). He focuses on the tetrahedron (4 faces) and the icosahedron (with 20 faces). He discusses the following speculative questions:

- Could the faces of tetrahedron correspond to the four DNA nucleotides?
- Could the 20 outer faces/tetrahedrons of the icosahedron correspond to amino-acids?
- Icosahedral realization of the memetic code?

The focus there is however on patterning. **The focus here is on the meaning which individuals could associate cognitively with such patterns.** as is characteristic of the *I Ching* hexagrams in practice -- and as discussed separately ([Transformation Metaphors derived experimentally from the Chinese Book of Changes \(I Ching\)-- for sustainable dialogue, vision, conferencing, policy, network, community and lifestyle](#), 1997). The debate with regard to memetics does not appear to have elicited any identification of either "memetic codons" or of any analogue to 20 "amino acids" as a distinct set of psychosocial functions. The possibility itself is disputed.

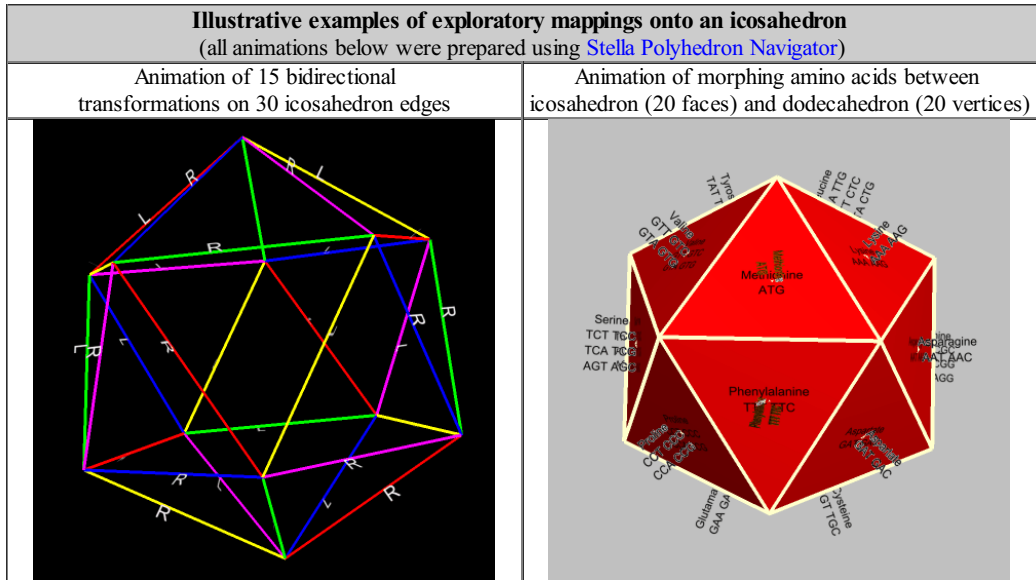
There are a number of works on psychosemiotics, (John A. Michon, Janet L. Jackson and René J. Jorna, [Psychosemiotics: semiotic aspects of psychology](#), 2003; Howard A. Smith ([Psychosemiotics](#), 2001). For Smith, it is framed as the study of how people learn, understand, and use the signs of culture. Applying insights from multiple intelligences theory, evolutionary psychology, and the semiotics of [Charles Sanders Peirce](#), Smith describes seven signways through which people come to know their worlds. As psychiatrist and psychotherapist, a psychosemiotic theory of mind has been developed by Matti Keinänen ([Psychosemiosis As a Key to Body-mind Continuum: the reinforcement of symbolization-reflectiveness in psychotherapy](#), 2006). This describes the transition from [biosemiotics](#) (based on spatial signs) to a temporal endo-semiotic sense of flowing. Signs that were previously physical become psychological. One useful overview of the field is offered by Marko Milic ([Psychosemiotics: communication as psychological action](#). 2008).

As with biosemiotics, there seems to have been little account taken of the insights offered by the Chinese perspective. Given the minimal use of diagrams in such texts, it is unclear that the challenge is recognized of rendering emerging insights more coherent, succinct and widely comprehensible -- despite the preoccupation with "signs". This justifies further speculative exploration of 3-dimensional symmetrical polyhedra (such as the drilled truncated cube), as well as additional comprehensibility potentially available through their animation. Curiously the use of multimedia could be recognized as being "alien" to academic research communication through journals -- in contrast to the high degree of significance associated with new media by the technologically sophisticated younger generations.

There is a case, for example, of extending recognition of the suggested association of the four DNA nucleotides with the tetrahedron ([Matti Pitkänen, 2013](#); [Fernando Castro-Chavez, 2012](#)) to the four psychological functions recognized by Jung. The question is then

what might be the psychological functions corresponding to the amino acids, as these might be associated with the icosahedron (Pitkänen, 2013). The value of the icosahedron for such mapping is explored separately (*Representation of Creative Processes through Dynamics in Three Dimensions: global insight from spherical reframing of mandalas, the zodiac and the enneagram*, 2014; *Visual representation of planning in a global context*, 2014).

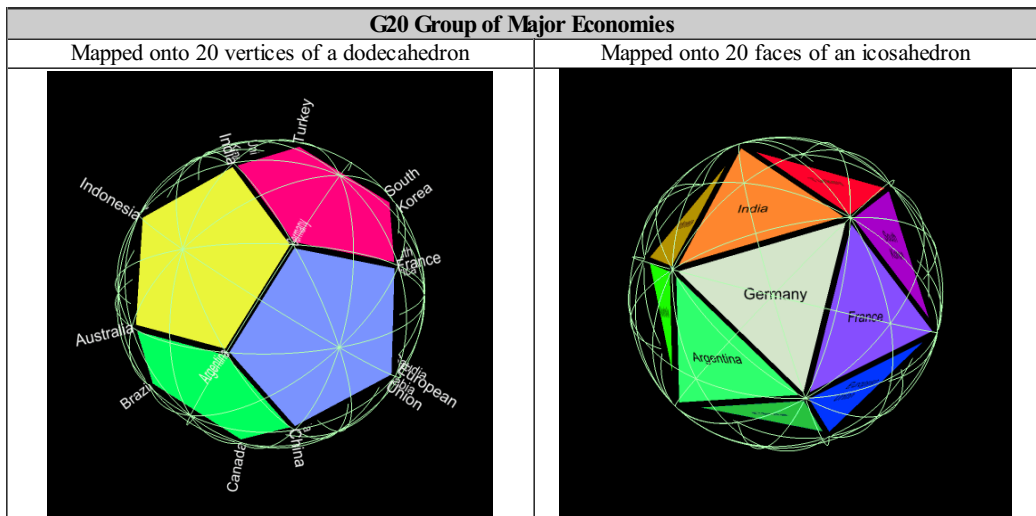
The animation on the right below (discussed in the latter document) is an exercise in presenting the fundamental 5-fold *Wu Xing* pattern, fundamental to traditional Chinese thinking -- tentatively understood here in terms of the interlocking of 5-fold cycles framing the 20 faces of an icosahedron. It is used to explain a wide array of phenomena, from cosmic cycles to the interaction between internal organs, and from the succession of political regimes to the properties of medicinal drugs. The animation on the left below tentatively associates the amino acids with the faces of an icosahedron -- but morphing the latter into its dual, the dodecahedron, where the amino acids are associated with the vertices.

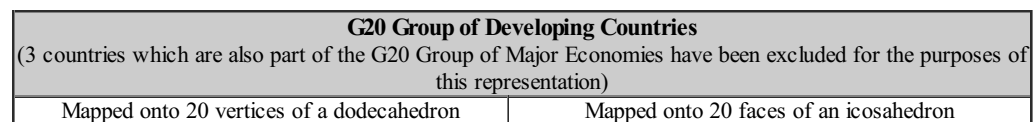


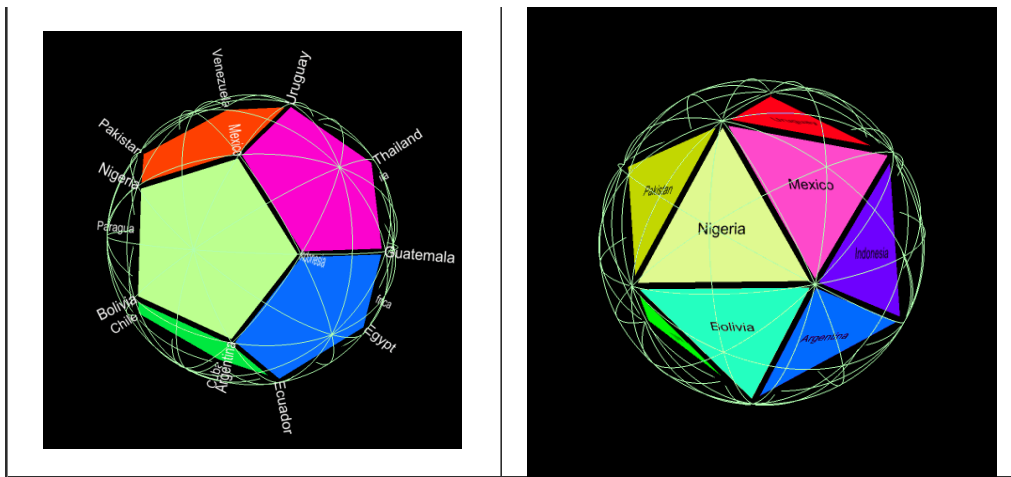
Global strategic significance of 20-fold configurations

As an instance of psychosocial organization at the global level, of particular interest is the coherence associated with identification of the [G-20 major economies](#) and of the [G20 developing nations](#). **Why the collective satisfaction with 20 in both instances?** How is this sense of coherence recognized and **how does it "work" in terms of the dynamic relationships between the 20 in each case?** How is this to be distinguished in these focal cases from any arbitrary choice of number in the organization of many "global" bodies with integrative functions?

As indicated previously, this may also be explored in terms of polyhedral representation (*Polyhedral Pattern Language: software facilitation of emergence, representation and transformation of psycho-social organization*, 2008; *Towards Polyhedral Global Governance: complexifying oversimplistic strategic metaphors*, 2008). The latter presents a mapping of the G20 Group onto an icosahedron then complexified to an icosidodecahedron and a rhombicosidodecahedron.



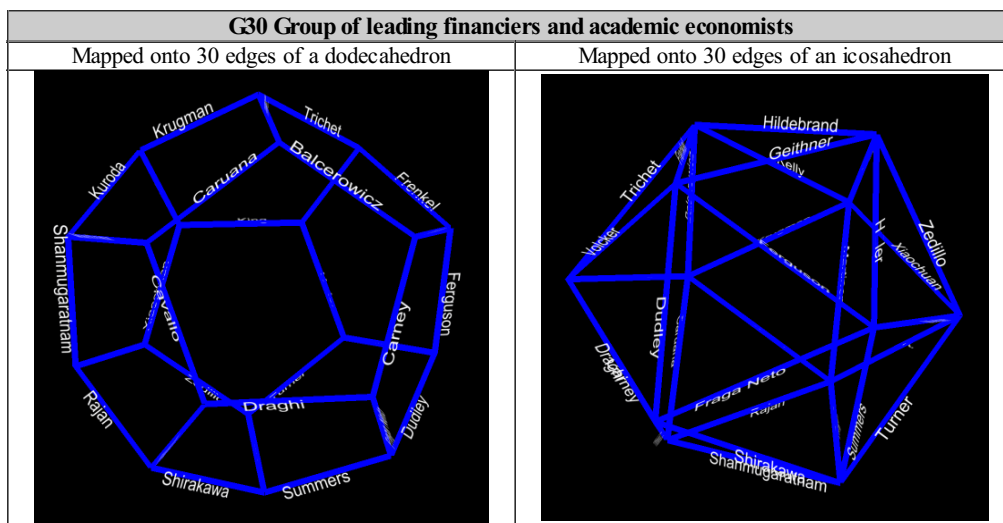




The above are variously indicative of the pattern of 20 distinctions, but further insight is clearly required as to how the pattern "works" -- preferably in cybernetic terms -- and is appreciated cognitively. What is the satisfaction associated with a Rubik cube solution or the completion of a magic square (*Patterns Essential to Individual and Global Health?* 2010; *Sustainability through Magically Dancing Patterns 8x8, 9x9, 19x19 -- I Ching, Tao Te Ching / T'ai Hsüan Ching, Wéiqi (Go)*, 2008)?

Another approach took the form of an experiment in detecting the challenges to comprehension in formulating declarations of from 1 to 20 elements, with different degrees of uncertainty -- and the consequent potential for encompassing the diversity of perspectives (*Distinguishing Levels of Declarations of Principles*, 1980). The results can be used as a way of reviewing varieties of dialogue by number. This experiment was in fact part of a more general investigation of some relevance (*Integrative Dimensions of Concept Sets: transformations with minimal distortion between implicitness and explicitness of set representation according to constraints on communicability*, 1981), which included a section on *Representation of sets by regular polyhedra*.

In the light of the relationship between 20-fold and 30-fold sets, as discussed further below, another relevant animation is that for the **Group of Thirty** leading financiers and academics which aims to deepen understanding of economic and financial issues and to examine consequences of decisions made in the public and private sectors related to these issues. The relevance of 30-foldness notably figures in the cybernetic preoccupations of **Stafford Beer** (*Beyond Dispute: The Invention of Team Syntegrity*, 1994).



Indicative examples of the recognized significance of 20-fold patterning

In the absence of pointers from psychosemiotics to a 20-fold pattern of psychosocial functions to which people may readily relate in practice, various other pointers merit exploration as having generative significance as fundamental as that associated with the set of amino acids. These could include:

- Vigesimal numbering system:** In the light of the argument of George Lakoff and Rafael Núñez (*Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2000), it is appropriate to ask why use of the **number 20** as a base for counting is evident in such a wide spread of modern and traditional cultures. It is currently common in Africa and is used by the **Inuit**. It was the base in the **Maya** and **Aztec** number systems (for which the system of notation bears a curious resemblance to the hexagrams of the *I Ching* and the quadgrams of the *T'ai Hsüan Ching*). There are many examples of its **continuing use in European languages**. The issue is of what pattern of experiential coherence is this an expression? The *Wikipedia* entry offers a **range of examples** of the significance of 20 in mathematical terms. For example, given reference in the main paper to Rubik's cube, 20 is the number of quarter or half turns required to optimally solve it in the worst case.
- Combinatorics**, as the branch of mathematics concerning the study of finite or countable discrete structures distinguishes in particular a "Twenty-fold Way" in contrast with a "Twelvefold Way" (Ottavio M. D'Antona and Vincenzo Marra, *The*

Combinatorics of M[ulti]Valued Sets. 2004; Kenneth P. Bogart, *Enumerative Combinatorics Through Guided Discovery*. 2005). With respect to the twenty-fold way (pp. 86-89). Bogart notes:

When we are passing out objects to recipients, we may think of the objects as being either identical or distinct. We may also think of the recipients as being either identical (as in the case of putting fruit into plastic bags in the grocery store) or distinct (as in the case of passing fruit out to children). We may restrict the distributions to those that give at least one object to each recipient, or those that give exactly one object to each recipient, or those that give at most one object to each recipient, or we may have no such restrictions. If the objects are distinct, it may be that the order in which the objects are received is relevant (think about putting books onto the shelves in a bookcase) or that the order in which the objects are received is irrelevant (think about dropping a handful of candy into a child's trick or treat bag). If we ignore the possibility that the order in which objects are received matters, we have created $2 \times 2 \times 4 = 16$ distribution problems. In the cases where a recipient can receive more than one distinct object, we also have four more problems when the order objects are received matters. Thus we have 20 possible distribution problems.

This suggests a possible "pathway" between sets of 16 psychological functions (as in the case of MBTI) and 20, and between 12 and 20. Given the fundamental challenge of global resource distribution, such a 20-fold way merits careful examination.

- **Hindrances to mental development in Buddhism:** 20 **secondary hindrances** binding people to illusion are recognized: growth of anger, avarice, grudge holding, pride, action resulting from anger, lack of faith or joy in virtue, intention to harm, laziness, jealousy, carelessness, hiding faults, forgetfulness, pretence of virtue, unalertness, inward shamelessness, depression/dullness, outward shamelessness, mental agitation, hiding hindrances, mental wandering (Lama Geshey Ngawang Dhargyey, *Tibetan Tradition of Mental Development, Library of Tibetan Works and Archives*, 1976, pp. 34-35). In Biblical symbolism, twenty denotes that which is unholy, unclean, and profane, namely remains. It is appropriate to note that the sets of "hindrances" and "mental factors" recognized by the schools of Buddhism are as various in number as those of Western psychology. With respect to "remains", this suggests a degree of relevance to the challenges of remaindering (*Reintegration of a Remaindered World: cognitive recycling of objects of systemic neglect*, 2011).
- *20 Manifestations of Bureaucracy* (as recognized by Chairman Mao, U.S. Joint Publications Research Service, JPRS.49826, 12 February 1970, pp. 40-43). Given the challenges of red tape resistance to social change, these would seem to call for attention.
- Dance movement: In the light of the arguments regarding the biological and existential significances of animation by **Maxine Sheets-Johnstone** (*The Primacy of Movement*, 2011), it is appropriate to note those of **Rudolf Laban** (*Choreutics*, 1966):

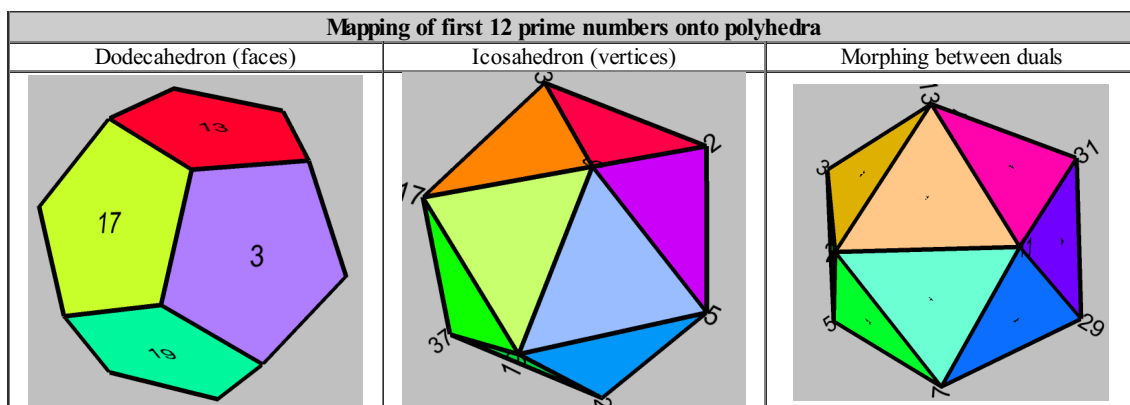
This can be clearly felt in the body, as the 1st and the 3rd scales contain movements essentially for the right side which are mirrored by the left in the movements of the 2nd and the 4th scales....If we now take... (the 1st and 2nd scales)...as a unit containing 24 transversals, we see that they do not represent 24 different inclinations, but only 20. This is because the 1st inclination of the right scale is identical to the 10th of the left, the right 4th to the left 7th, the right 7th to the left 4th, and the right 10th to the left 1st. The right-left symmetry causes the flat inclinations, which cross from one side to the other, to exchange their identity in the two scales. (p. 157). Of related relevance is the *Guide to the Rudolf Laban Icosahedron*

Kent Palmer (*Why does life use a quaternary system (A, T, G, C) to encode information instead of a binary system?* thinknet, 30 January 2012) ***

Potentially indicative patterns of prime numbers associated with polyhedra

The concern in what follows is the cognitive role of prime numbers in relation to patterns of psychosocial organization. How may they have a vital role in the emergence of patterns felt to be meaningful and integrative?

Prior to further discussion of polyhedra, within which the potential role of 37 may be further clarified, there is a case for recognizing the curious fact that 37 is the 12th prime number and therefore can be represented with the others either on an icosahedron or on a dodecahedron -- recognizing the morphing possible between them as duals, as illustrated below.



Wikipedia offers a [List of prime numbers](#), acknowledged to be incomplete. Of particular interest is the variety of so-called "primes" of many named forms and types -- of which 100 are identified.

It is intriguing to note the continuing interest in [whether one is a prime number](#). It is unclear whether this derives from the manner in which a prime number is defined, for purposes of mathematics, rather than any more fundamental criterion. It can be conventionally defined as:

- a number that can only be divided by one and itself with no remainder. When we talk about the divisors of a prime number, we are always talking about natural numbers (whole numbers greater than 0).
- a positive integer which has no factors other than 1 and itself. 1 itself, by definition, is not a prime number.

From this perspective, 2 is the first prime number -- although this is not the case in some varieties and types of primes. As such it is the only prime which is an even number. Whatever the degree of perceived ambiguity, this relates to the fundamental issues of the relation between 0, 1 and 2 from a cognitive perspective. It can also be seen as contributing to reflection on the ambiguity regarding numbers which are a "near" miss of some form of set completion (as with 63) or proximity to a regular prime, as can be seen below.

Within the set of primes, it is appropriate to note recognition by mathematicians (and others) of many curious facts regarding the [number 37](#) as the 12th prime (see notably lists of [37 factoids](#) and [prime curios](#)). There are so many such references to patterns associated with 37 that a major issue is how to distinguish those that are of relevance as being potentially indicative of fruitful pathways of transformation -- rather than verging into the obscure, recreational mathematics, number games or numerology.

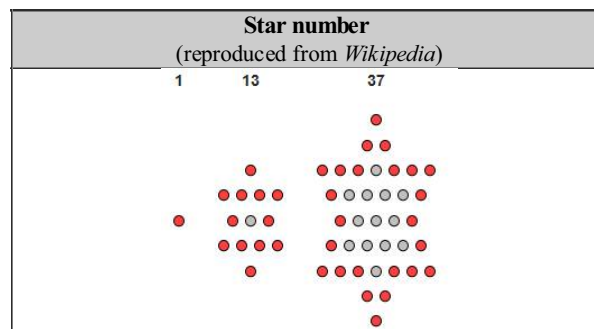
Any method of detecting significance is subject to criticism. The process as a whole is somewhat reminiscent of what was termed [moonshine theory](#) by mathematicians through which vital correspondences were found enabling discovery of the so-called [Monster Group](#) of [symmetry theory](#), as discussed separately (*Potential Psychosocial Significance of Monstrous Moonshine: an exceptional form of symmetry as a Rosetta stone for cognitive frameworks*, 2007; *Theories of Correspondences and potential equivalences between them in correlative thinking*, 2007).

The indications, variously clustered, include:

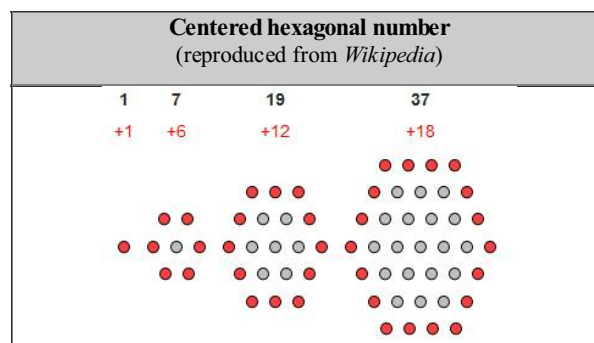
- Uniqueness:
 - 37 is the fifth good prime the fifth [lucky prime](#), the first [irregular prime](#), the third [unique prime](#) and the third [cuban prime](#) of the form.
 - 37 is the smallest prime that is not also a [supersingular prime](#).
 - Since the [greatest prime factor](#) of $372 + 1 = 1370$ is 137, which is obviously more than 37 twice, 37 is a [Størmer number](#).
 - 37 appears in the [Padovan sequence](#), preceded by the terms 16, 21, and 28 (it is the sum of the first two of these).
 - The least number of 5th powers needed to represent every possible integer
 - 37 is the only two digit number in base 10 with the following property: The difference between the two digits equals the [square root](#) of the difference between the number itself and the [least common multiple](#) of the two digits.
 - 37 is the initial prime which is not a factor of the order of the Monster Group having cardinality:
 $808017424794512875886459904961710757005754368000000000 = 2^{46} \times 3^{20} \times 5^9 \times 7^6 \times 11^2 \times 13^3 \times 17 \times 19 \times 23 \times 29 \times 31 \times 41 \times 47 \times 59 \times 61$.
This finite sporadic [simple group](#) has generated much interest and constitutes a group of symmetries on 196883 dimensions.
 - The maximal number of regions into which a circle can be divided by eight lines.
- Sums and products:
 - $37 = 1 + 2 + 3 + 4 + 5 + 6 + 7 + 9 = 37$. Note that $12345679 \times 3 = 37037037$.
 - $37 \times 03 = 111$; $37 \times 06 = 222$; $37 \times 09 = 333$; $37 \times 12 = 444$; $37 \times 15 = 555$; $37 \times 18 = 666$; $37 \times 21 = 777$; $37 \times 24 = 888$; $37 \times 27 = 999$.
 - $3 \times 7 \times 37 = 777$
 - The sum of the first 37 primes is a [Fibonacci number](#)
 - $37 = 33 + 3 + 3/3$.
 - 37 is the sum of the first five consecutive composite numbers; $4 + 6 + 8 + 9 + 10$
 - 37 is the sum of the prime digits appearing in all previous primes.
 - $37 = 33 + 3 + 3/3$
 - $37/3.7 = 3 + 7$
 - $37 = 33 + (3 \times 3)$
- Significance is attributed to reversal of the digits in a number, especially that related to primes -- therefore termed [emirps](#), when the reversal gives rise to a different prime:
 - 37 is the fourth emirp, as indicated by the sequence: 13, 17, 31, 37, 71, 73, 79, 97 [*of relevance to the discussion which follows*]
 - 37 is the first of three consecutive primes that have the same sum as their reversals.
 - 37 and its reversal are the only primes formed from a pair of cousin primes
 - 37 is the only known number n such that the reversal of $n^{\text{prime}(n)}$ is prime.
 - 37 is the only two-sided emirp whose reversal is also a two-sided emirp
 - The smallest emirp p such that $\text{reversal}(p + \text{reversal}(p))$ is prime.
 - The smallest emirp p such that $\text{reversal}(p^2)$ is prime.
 - The prime $p = 37$, and its reversal $q = 73$, are the only known emirp pair such that $p! + 1$ and $q! + 1$ are both primes.
 - $\text{pi}(37) = 12$ and $\text{pi}(73) = 21$.

- $3! * 7!$ minus 37 is a palindromic prime.
- 37 is the only two digit number in base 10 whose product, when multiplied by two, subtracted by one, and then read backwards, equals the original two digit number: $37 \times 2 = 74$, $74 - 1 = 73$, 73 backwards is 37.
- Biology:
 - Mitochondrial DNA commonly found in most animals contains 37 genes.
 - Normal **human body temperature** is 37 in degrees Celsius
- Symbols
 - 37 can be represented as 100101 in binary notation. Note that the 0s are in prime positions and the 1s are in non-prime positions when read left-to-right.
 - The most well known multiple of 37 is the beast number (666). The first occurrence of 666 in appears on digits 2441, 2442 and 2443, when including the initial 3 before the decimal point, i.e. the whole series of 's digits. The sum of these is 7326 or $11 * 666$.
 - 37 minutes is about a Golden Section of an hour.
- Games and packing
 - The French version of solitaire uses a board with holes for 37 pegs.
 - European Roulette is played using a wheel containing 37 numbered slots (1 to 36, plus a 0).
 - There are 37 **nonominoes** (a polygon in the plane made of 9 equal-sized squares connected edge-to-edge) with holes.
 - 37 is the number of centered hydrocarbons with ten atoms.
 - 37 is the number of hydrocarbon structures that can be drawn (excluding stereoisomers) for 4 carbons
 - 37 is a **centered hexagonal number** (a "hex number"), and a **star number** (as noted below)

As a star number, 37 is a centered **figurate number** that represents a centered **hexagram** (six-pointed star), such as the one that **Chinese checkers** is played on.



A **centered hexagonal number** is a centered figurate number that represents a **hexagon** with a dot in the center and all other dots surrounding the center dot in a **hexagonal lattice**.



Which of these factoids are of potential significance, and which are indeed mere curiosities, if not trivia?

In quest of number 37 through the pattern of spherical polyhedra

The main paper associated patterns of transformation with a particular polyhedron, namely the drilled truncated cube. The question meriting exploration is whether the spherically symmetrical polyhedra commonly recognized -- Platonic and Archimedean -- offer a sense of pattern which can be depicted as suggestive of transformation between different forms of order. The exercise here is designed to determine whether the prime number 37 figures significantly in the pattern -- as potentially implied by interpretation of the Kazakh report (in the main paper, as noted above).

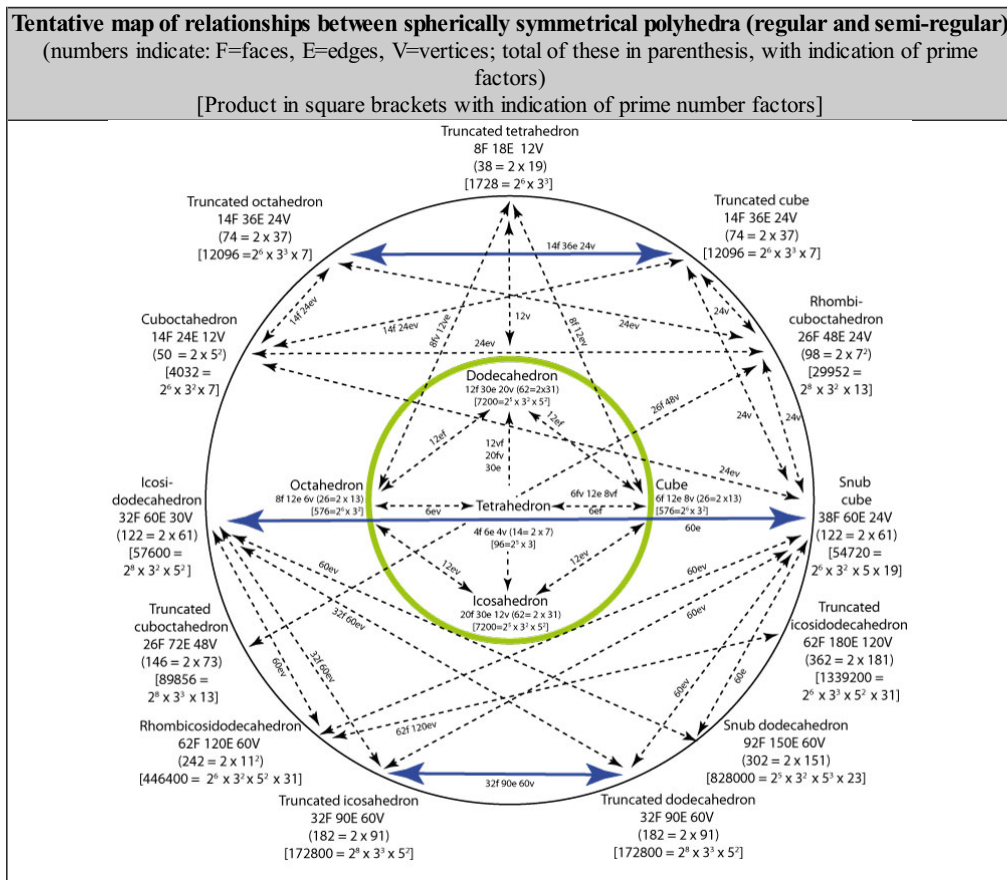
The neglected psychosocial ordering role of polyhedra has been variously considered previously (*Spherical Configuration of Categories - to reflect systemic patterns of environmental checks and balances*, 1994; *Spherical Configuration of Interlocking Roundtables: Internet enhancement of global self-organization through patterns of dialogue*, 1998; *Representation of Interlocking Elements for a Sustainable Global System: configuring strategic dilemmas in intersectoral dialogue*, 1992; *Polyhedral Empowerment of Networks through Symmetry: psycho-social implications for organization and global governance*, 2008). These followed an earlier exercise in endeavouring

to map the transformations associated with the cuboctahedron alone (*Vector Equilibrium and its Transformation Pathways*, 1980).

The focus here is on how the relationships between the selected polyhedra could be depicted in the light of the numbers associated with their faces, edges and vertices. Where any such numbers are identical, irrespective of whether they are associated with faces, edges or vertices, this suggests the possibility of transformation -- a pathway. This may be understood in geometrical terms (duality, etc) or through associated categories (namely collapsing or expanding sets of distinguished elements). This suggests a form of **cognitive route map** between different patterns of order (as highlighted further below). Polyhedral "stations" on the map may then offer the possibility of switching to another "route" associated with a different number. The polyhedron at each node in the network is then usefully understood as a mode of organization -- a potential configuration of categories or experiences.

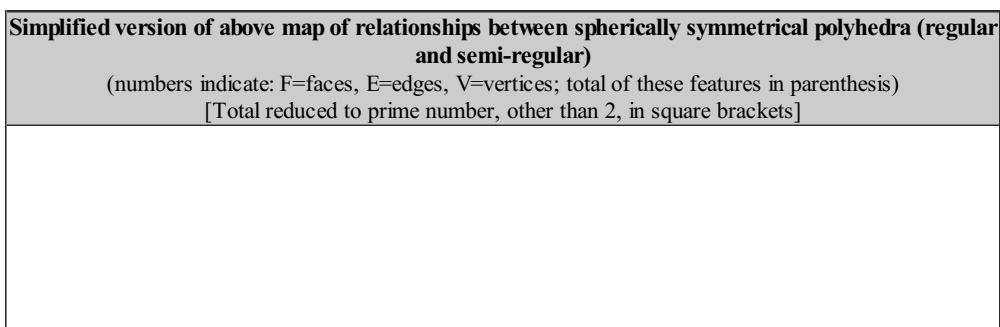
In the following map the simpler 5 **Platonic polyhedra** are positioned in relation to a central circle with the 13 **Archimedean (semi-regular) polyhedra** positioned around a larger circle. The relative complexity of the polyhedra -- indicated by indiscriminate totalling of their faces, edges or vertices -- is used as a guide to vertical positioning. This enables indication with:

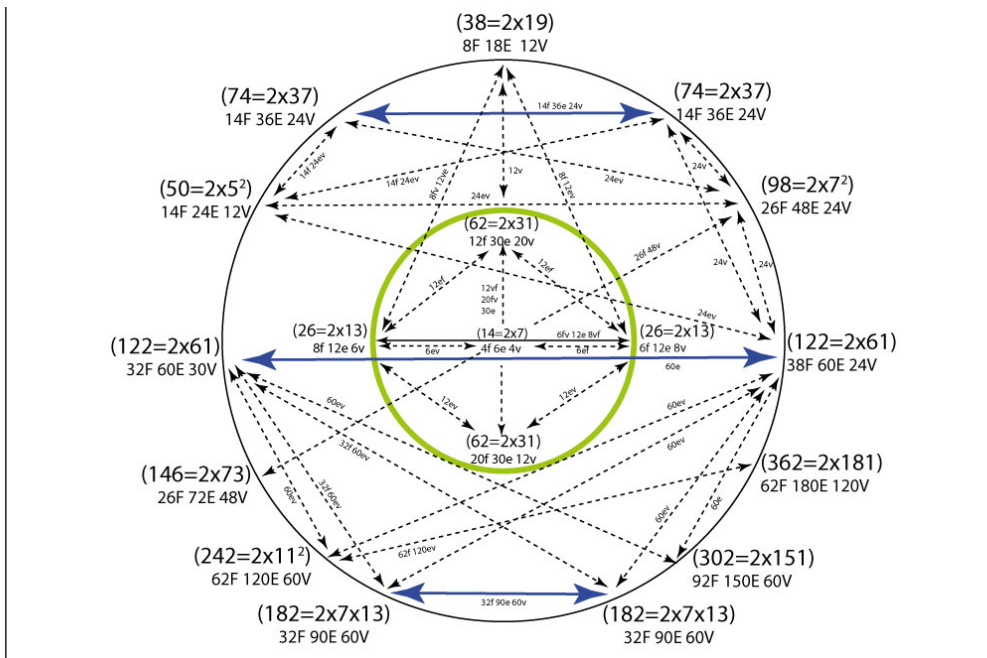
- **solid horizontal lines** of an equivalence between three pairs of Archimedean polyhedra, linked in the map: truncated octahedron / truncated cube (74); icosidodecahedron / snub cube (122); truncated icosahedron / truncated dodecahedron (182).
- **dotted lines** of various relationships between polyhedra (based on faces, edges and vertices) -- duly marked with the numerical commonality between them (irrespective of whether it relates to one or more such features).



This schematic acquires greater meaning when used (below) to identify "route maps" of possible change between modes of organization based on sets of a given size. It is however noteworthy how the psychosocial proclivity for 12-fold organization is "nested" within the inner Platonic circle of the schematic (*Checklist of 12-fold Principles, Plans, Symbols and Concepts: web resources*, 2011; *Eliciting a 12-fold Pattern of Generic Operational Insights*, 2011; *Implication of the 12 Knights in any Strategic Round Table*, 2014). Such exercises associate 12-foldness with a variety of qualities, notably recognizable through characteristic "languages" variously considered appropriate to strategic articulation (*12 Complementary Languages for Sustainable Governance*, 2003).

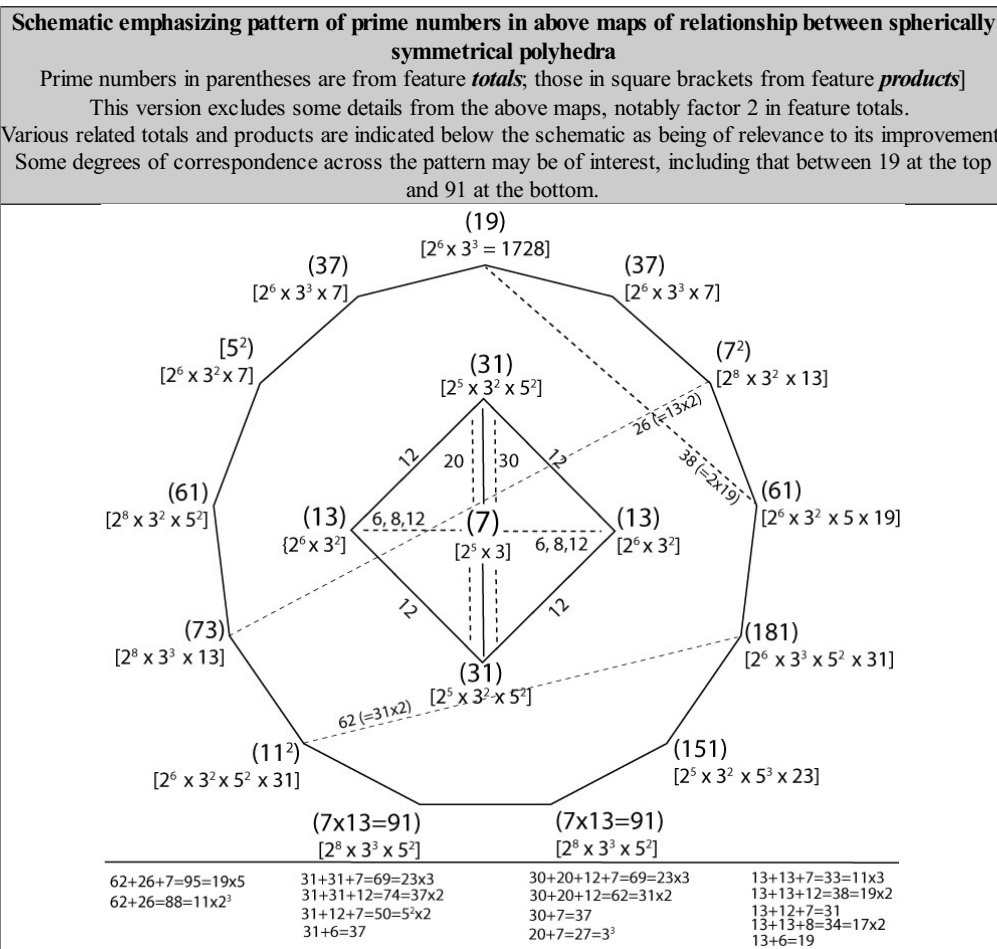
With respect to the nature of 20-foldness, again this is to be noted within the central circle, closely associated with the 30-foldness which notably figures in the cybernetic preoccupations of **Stafford Beer** (*Beyond Dispute: The Invention of Team Syntegrity*, 1994)





The following schematic takes the prime numbers of the map above and emphasizes to a higher degree the recurrence of particular numbers. Especially interesting, and potentially significant to any intuitive sense of the integration of the pattern as a whole, is the degree of patterning amongst those numbers. **Prime numbers derived from polyhedral feature totals and from feature products are distinguished.**

Within the set of numbers indicated, of the complete set of the first 12 primes (2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31 and 37). The first four are especially evident with respect to the tetrahedral pattern of Platonic polyhedra. Only 29 is not immediately evident, although 17 is seemingly relatively rare. Perhaps 29 is to be understood as derived from selected tetrahedral relationships: 37-8, 23+6. As suggested by the Kazakh research noted in the main paper, **the number 37 is indeed evident and significantly so.**



Of particular interest is the interlocking of the primes associated with the central set of Platonic polyhedra. There is of course some probability that the interlocking results from more general implications of the [Euler characteristic](#). A similar approach could be taken to the primes in the outer circle of Archimedean polyhedra.

The method can of course be challenged, whether as exemplifying deprecated "number games" (however these may be associated with a legitimate sense of integrative satisfaction), or because of use of totals of faces, edges and vertices (and removing the factor 2 to isolate any other prime). This does however bear some resemblance to the Kazakh use of the "molecular core", and their mathematical verification of the statistical probability of their result -- including their highlighting of 37. A further step would be to switch to a number base other than 10. Twenty might be especially interesting. Note that the emirps are base dependent, whereas primes are not.

Many of the apparent correspondences may well be trivial, including the curious relationship (by reversal) between 26 and 62 (namely 13×2 and 31×2), and between 37 and 73; this may also hold for that implied between 16 and 61, and between 19 and 91, although one of each is **not** a prime (as noted below with respect to emirps). As indicated by lists of the characteristics of 37, many are associated with operations in addition to summation and multiplication. This suggests the need for a critical approach to the emergence of patterns as a result of operations such as $61+12=73$, $61-12=7^2$, or $13+7=20$

In this respect, as discussed further below, of particular potential interest is a (questionable) operation of the form $(2^2 \times 5^2) + 37 = 137$, given the special [significance attached to 137](#). With respect to the seeming rarity of 17, in the above pattern, it should be noted that the prime factors of the reversal of 137 (namely 731) include 17 and 43.

How the method might be related to (or extended by) more conventional distinctions amongst polyhedra -- such as axes of symmetry, the Euler characteristic, the [Schläfli symbol](#), or the number of **cells** -- justifies future exploration. A particular reservation to be borne in mind is a degree of recognition that patterns can be found anywhere -- if investigation is sufficiently assiduous and criteria are shifted accordingly.

Deprecation of the detection of such patterns may obscure the question of the factors that may well be associated with a vital sense of psychosocial coherence lasting centuries -- whether illusory or otherwise.

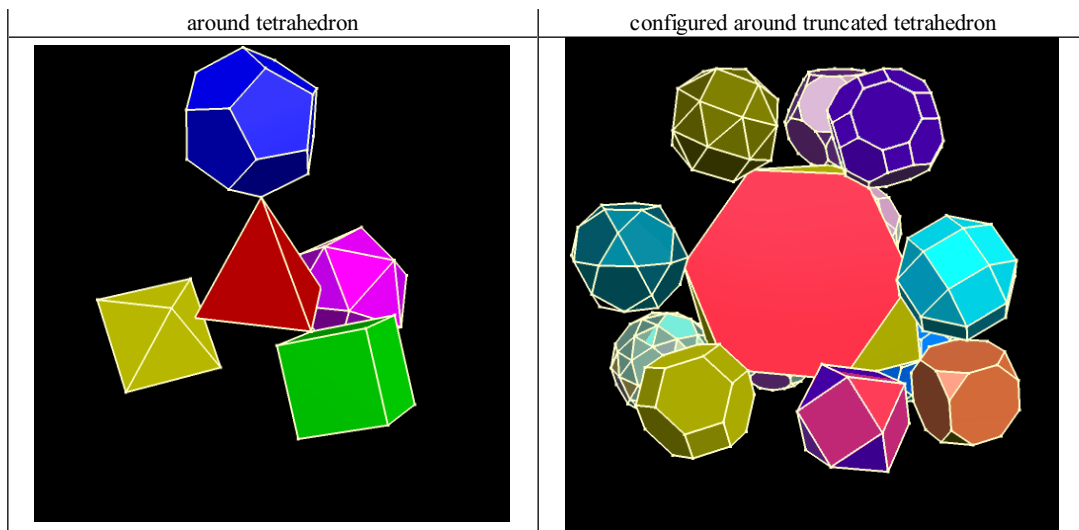
Polyhedral meta-patterns of relationships?

It is of course very possible that a more insightful representation of the pattern of relationships encoded by polyhedra could be produced through further iterations (or may have already been) -- or simply one based on alternative design choices. For example, [Keith Critchlow](#), has presented an arrangement of the 12 Archimedean polyhedra in their most regular pattern, as a [cuboctahedron](#), around a 13th, the [truncated tetrahedron](#) (*Order in Space*, 1969, p. 39). This is presented in modified form below.

Archimedean polyhedra (reproduced from <i>Towards Polyhedral Global Governance complexifying oversimplistic strategic metaphors</i> , 2008, and from <i>Union of Intelligible Associations: remembering dynamic identity through a dodecameral mind</i> , 2005)	
Successive truncations of octahedron 2, 3, 4-fold symmetry	Successive truncations of icosahedron 2, 3, 5-fold symmetry
<ol style="list-style-type: none"> 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) 	<ol style="list-style-type: none"> 1. truncated icosahedron (32 polygons: 5 / 6 sided) 2. icosidodecahedron (32: 3 / 5) 3. truncated icosidodecahedron (62: 4 / 5 / 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	

The configuration around a truncated tetrahedron of the Archimedean polyhedra in the above map can be clarified to some degree by animation (on the right below). That on the left is an indication of a similar configuration around a tetrahedron. In each case that central polyhedron occupies a focal position in the earlier maps (above), despite the distortion of representation in two dimensions.

Configuration in three dimensions of Platonic and Archimedean polyhedra	
Indication of 4 Platonic polyhedra configured	Indication of 12 Archimedean polyhedra



Pathway "route maps" of potential psychosocial transformation?

As emphasized, the question is the possible psychosocial engagement with the configurations above -- rather than their potentially interesting geometrical and mathematical properties.

The mapping exercises above suggest that it is best to explore the possibility of "route maps" at different layers of complexity -- considering the easier to understand (the "highways"), with which it is possible to engage cognitively, before the potential implications of the more complex (based on less evident relationships).

Polyhedra as processes: In exploring such "route maps", as a metaphor, it is useful to consider that the individual polyhedra are better thought of as **dynamic process complexes**, rather than as **static structures** as is the conventional approach to them. Then, beyond their role as "stations" on the map (where it is possible to switch "lines"), they can be thought of as resembling engines or dynamos, in some way, through which the "lines" are enabled with motive power. It is with such reframing that the metabolic role of the 20 proteinogenic amino acids may be fruitfully understood in relation to metabolic pathways by which biological life is sustained -- not as static compounds but as enabling processes.

Buckminster Fuller makes the point that all systems may be understood as polyhedra, the possible corollary that systems may be represented by polyhedra merits exploration. In that sense complex systems could be, in principle, fruitfully mapped onto complex polyhedra such as to highlight vital complementarity and necessary communication patterns (notably feedback loops). For Fuller (*Synergetics: Explorations in the Geometry of Thinking*, 1975):

- *Synergetics is the geometry of thinking. How we think is epistemology, and epistemology is modelable; which is to say that knowledge organizes itself geometrically...* (I, 905.01)
- *Any conceptual thought is a system and is structured tetrahedrally. This is because all conceptuality is polyhedral. (I, 501.101). By tetrahedron, we mean the minimum thinkable set that would subdivide Universe and have inter-connectedness where it comes back upon itself. (I, 620.03)*
- *All systems are polyhedra: All polyhedra are systems. (II, 400.56)*
- *Human thoughts are always conceptually and definitively confined to system considerability and comprehension...All systems are subject to comprehension (I, 400.07-20)*
- *Initial comprehension is holistic. The second stage is detailing differentiation. In the next stage the edges of the tetrahedron converge like petals through the vector-equilibrium stage. The transition stage of the icosahedron alone permits individuality in progression to the omni-triangulated spherical phase. (I, 1005.63)*
- *Dimension begins at four. Four-dimensionality is primitive and exclusively within the primitive system's relative topological abundances and relative interangular proportionment. Four-dimensionality is eternal, generalized, sizeless, unfrequented. (II, 1033.611)*
- *All conceptually thinkable, exclusively metaphysical experlencings are fourfoldedly characterized...(systematically, topologically, angularly, numerically). All generalized principles are conceptually thinkable and fourfoldedly definable. Generalization is conceptually (i.e. systematically) imaginable independent of (5) frequency. (II, 1072.22)*
- *By tetrahedron, we mean the minimum thinkable set that would subdivide Universe and have interconnectedness where it comes back upon itself. (I, 620.03)*

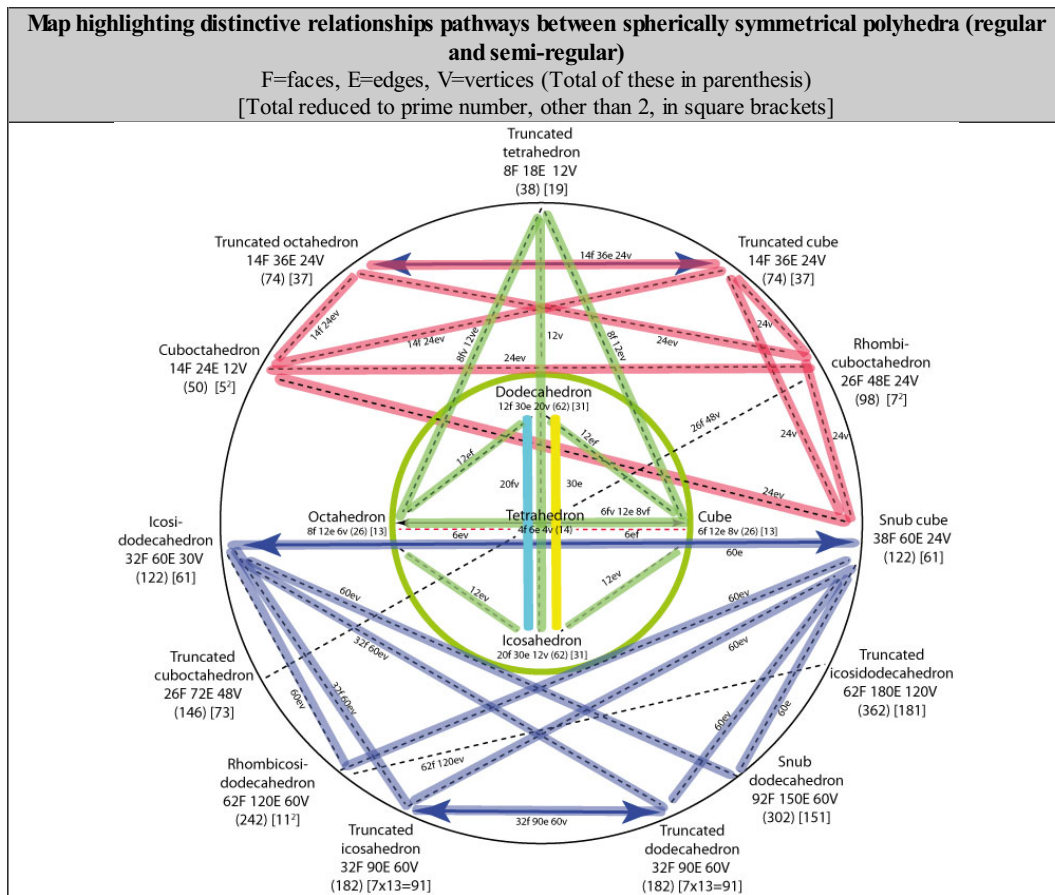
Patterns of order: The conventional approach to polyhedra is as patterns of order, hence the title of the study of Keith Critchlow (*Order in Space*, 1969) from which the configuration above was adapted. The concern here is however with psychosocial life, namely the nature of order in cognitive space -- or with that of the **noosphere**. It follows that the multi-volume study by **Christopher Alexander** (*The Nature of Order: an essay on the art of building and the nature of the universe*, 2003-4) then calls for similar reframing in psychosocial terms. A first exercise to that end was the adaptation of the 254 interlinked patterns as originally elaborated by Alexander (*A Pattern Language*, 1977) into a similar pattern of psychosocial analogues (*5-fold Pattern Language*, 1984).

Alexander developed the insights arising from his research in subsequent papers (*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; *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 emphasized the need for a geometrical approach, partly justifying the separate argument (*Harmony-Comprehension and Wholeness-Engendering: eliciting psychosocial transformational principles from design*, 2010). This included sections on:

- Use of pattern language for the material world as a template
- Tentative adaptation of Alexander's 15 transformations to the psychosocial realm
- Systemic comprehensiveness of sets
- Geometrical configuration of Alexander's 15 transformations
- Relevance to global governance in the psychosocial realm
- Associating qualities of harmony and wholeness with geometry
- Beauty as a verb: de-signing the future, human nature and the environment

Basic route map? The following simplified map, based on those above, offers a sense of particular transformational pathways between patterns of order -- in which prime numbers appear to play a determining role as indicated above. The colouring of the "routes" serves to highlight pathways of contrasting significance. Arguably some of the features derive simply from design choices, although the degree of symmetry calls for future comment.



Some points of interest include:

- division of the map into upper and lower portions (ignoring the extent to which 12 is common to both portions):
 - upper (red routes): based on 24 specifically (excluding consideration of 12, whether its divisors or multiples, 36, 48, 60, etc)
 - lower (blue routes): based on 60 specifically (excluding consideration of divisors or multiples, 120, etc)
- central dependence on a 12-fold complex (green routes):
 - those directly associated with the truncated tetrahedron (at the top)
 - those directly associated with the tetrahedron (at the centre)
- particular routes of special relevance to this argument, linking the dodecahedron and the icosahedron:
 - "route 20" (cyan route)
 - "route 30" (yellow route)
- four horizontal routes of potential interest (marked with arrows), deriving from equality of the feature totals of the polyhedra so linked
 - upper route: 37-37
 - central core route: 13-13
 - central route: 61-61
 - lower route: 182-182 (namely 7x13 to 7x13)
- emergence of 37 as fundamental to one horizontal line (at the top), namely as a multiple of 2
- curiosities of potential significance include
 - special "routes" (uncoloured) based on reversed numbers 26 (2x13) and 62 (2x31), each with prime factors significant

elsewhere in the map

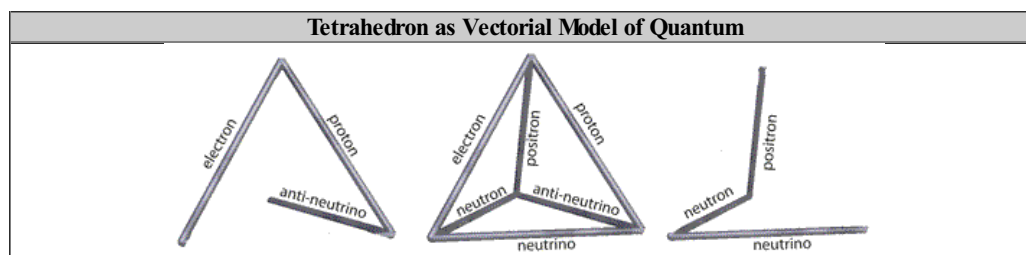
- prime numbers "hidden" in other features of the map

Note that other potentially significant relationships could be added to the map above, as with those associated with 19 as a prime number.

Implication of 64 (namely 2^6): The main paper is focused on the mapping of the 64 codons or hexagrams -- with the mystery of analogues to the "20 amino acids" discussed above. The question might then be asked how 64 is to be associated with the above mappings. As 2^6 , it is of course visibly associated with the truncated tetrahedron in the polyhedral map.

This could also be considered as deriving in part from the manner in which 2, as the first prime, was stripped from the feature totals in order to highlight other prime factors. The stripping of 5 such 2s from the central Platonic polyhedra -- configured around the tetrahedron -- suggests a patterning based on 2^5 , namely 32. A further factor of 2 could be associated with the manner in which the tetrahedron (understood as a process with implied directionality) can be configured in two forms, as argued by [Buckminster Fuller](#) (*Synergetics: Explorations in the Geometry of Thinking*, 1975) and depicted below. For Fuller:

Tetrahedron as Vectorial Model of Quantum: The tetrahedron as a basic vectorial model is the fundamental structural system of the Universe. The open-ended triangular spiral as action, reaction, and resultant (proton, electron, and anti-neutrino; or neutron, positron, and neutrino) becomes half quantum. An association of positive and negative half-quantum units identifies the tetrahedron as one quantum.



Requirement for emirps and enantiodromia in navigating songlines

Emirps as indicative of "through the looking glass": The relationship between key primes in the pattern above is strikingly apparent, through their reversal into another prime -- namely as an **emirp** ("prime" reversed). This calls for particular comment with regard to the quest for psychosocial "route maps", and the challenge of navigating the cognitive transformations for which such "songlines" of the noosphere may call (*From Information Highways to Songlines of the Noosphere: global configuration of hypertext pathways as a prerequisite for meaningful collective transformation*, 1996; *Noonautics: four modes of travelling and navigating the knowledge "universe"?* 2006).

This paradoxical relationship -- a questionable mathematical curiosity in its own right -- derives significance from reversal of a number. What might that imply -- perhaps as might be suggested by research on the experience of doing mathematics ([Philip J. Davis](#) and [Reuben Hersh](#), *The Mathematical Experience*, 1981). It recalls the extensive mythology associated with mirroring in a variety of forms -- including the need to "walk backwards" under certain conditions, recalling the ambiguity associated with the appreciation and deprecation of Knight's move thinking (*Predictability and pattern-breaking: the Knight's move*, 2011). Cognitive significance attached to such reversal includes that associated with the so-called **mirror test of self-recognition**.

As noted in the main paper, this may be understood in terms of a "cognitive twist". Its nature has been variously framed by the titles of the famed tales of [Lewis Carrol](#) (*Alice's Adventures in Wonderland*, 1865; *Through the Looking-Glass, and What Alice Found There*, 1871). These obscure recognition that his primary occupation was as a mathematician and logician. Such use of "looking glass" contrasts fundamentally with conventional strategic use of optical metaphors -- vision, image, focus, and the like -- implying a fundamental form of cognitive inversion, as separately discussed (*Stepping into, or through, the Mirror: embodying alternative scenario patterns*, 2008).

Reversal and cognitive twist: A route marked by emirps is therefore an indication that it cannot be effectively used without inversion. It requires a form of creative "cognitive magic" beyond what is now appreciated as lateral thinking. It is curious that issues of reversal are well understood in optics and the use of mirrors -- even though this understanding does not extend to their metaphorical use in strategy development. The reversal of digits is readily perceived as nonsensical in conventional mathematics, irrespective of any cultivation of that interest by mathematicians. Its meaning is much more readily associated with **reversal of financial patterns**, in **retrograde music**, and where there is any emphasis on reciprocation. Visually evoked pattern reversal is of significance in some human pathologies.

Encompassing such reversal, the wider implications of the **theory of harmony**, as modelled and widely understood through music, remain to be explored (*Paradigm-shifting through Transposition of Key: a metaphoric illustration of unexplored possibilities for the future*, 1999). Douglas Hofstadter points to this in his reference to the 30 *Goldberg Variations* in the music of Bach (*Gödel, Escher, Bach: An Eternal Golden Braid*, 1979). As he argues:

Every aspect of thinking, can be viewed as a high-level description of a system which, on a low level is governed by simple, even formal, rules...The image is that of a formal system underlying an 'informal system' - a system which can make puns, discover number patterns, forget names, make awful blunders in chess and so forth.

The paradoxical nature of the twist can be variously discussed and illustrated (*Sphere eversion as guide to the cognitive twist of global*

introversion? 2013; *Requisite cognitive inversion: higher orders of twistedness*, 2014). Of particular interest is the account of a video produced by Jos Leys (Colin Marshall, *The Genius of J.S. Bach's "Crab Canon" Visualized on a Möbius Strip in Music*, *Open Culture*, 11 February 2013). As Marshall indicates:

You can follow the score, note for note, and then watch as the piece reverses itself, running back across the staff in the other direction. So far, so easy, but another layer appears: Bach wrote the piece to then be played simultaneously backwards as well as forwards. But prepare yourself for the mind-blowing coup de grâce when Leys shows us at a stroke just what the impossible shape of the Möbius strip has to do with the form of this "crab canon," meaning a canon made of two complementary, reversed musical lines. Hofstadter had a great deal of fun with that term in *Gödel, Escher, Bach*, but then, he has one of those brains -- you'll notice many Bach enthusiasts do -- that explodes with connections, transpositions, and permutations, even in its unaltered state.

As discussed separately (*Cognitive "twist"*, 2007), of particular interest is the possibility of understanding the "cognitive twist" in terms of the **adaptive cycle of complex systems** -- especially with respect to how it might be navigated. Many helpful images of this are available on the web in two and three dimensions.

Familiarity with use of mirrors enabling a sense of self recognition, suggests that "route maps" of psychosocial life could well be experienced as having an analogous function. As designed above, they have a degree of resemblance to **mandalas**, with all that is implied in their construction and use. Of some relevance to global organization is the past use of the **mandala as a political model** indicative of patterns of distribution of diffuse power -- in contrast to current preoccupation with unified political power.

Netherworld: Lewis Carroll's phrase "down the rabbit hole" has recently been used in a widely distributed multimedia presentation to frame the recognition of an emerging reality based on a spiritual connection between quantum physics and consciousness (*What the Bleep! Down the Rabbit Hole*, 2006). The cognitive nature of going "down the rabbit hole" can be usefully explored in terms of the inversion characteristic of optical systems in representing and focusing an image.

As a form of "loopery" (discussed in the main paper), the process can be usefully explored through a torus (*Now as the Ultimate Cognitive Strange Attractor: a continuing invitation "down the rabbit hole"?* 2014). As indicated there, the drilled truncated cube has a toroidal form as one of the **toroidal polyhedra**.

The phrase is also somewhat reminiscent of the mythology regarding the encounter with Hades as it may be variously framed (*Designing Global Self-governance for the Future: patterns of dynamic integration of the netherworld*, 2010). Given the nature of the demonisation by "Us" of "Them", as highlighted in the main paper, this process merits attention -- especially increasing recognition of the role of the "black economy", corruption and criminal networks, otherwise readily ignored. Given the manner in which demonisation leads to weaponisation, that argument follows appropriately from an earlier discussion (*Tao of Engagement -- Weaponised Interactions and Beyond: Fibonacci's magic carpet of games to be played for sustainable global governance*, 2010).

In the light of the method employed to highlight the "routes" -- namely by first excluding the factor 2 -- questions can be asked about its relation as the first prime with enabling and sustaining the polarizing dynamic of "us and them" which has proven to be so problematic in global society. The method used is indicative of a means of transcending such polarization, as may be variously explored (*Psychosocial Energy from Polarization within a Cyclic Pattern of Enantiodromia*, 2007; *Coherent Value Frameworks: pillar-ization, polarization and polyhedral frames of reference*, 2008).

Enantiodromia: An emirp associated with a route map may therefore signal the requirement for **enantiodromia** (or its probability) in order to navigate the pathway in question. This strange process, named by Carl Jung, indicates that the superabundance of any force inevitably produces its opposite. When things get to their extreme, they turn into their opposite. In Jungian terms, however, a thing psychically transmogrifies into its **Shadow** opposite, in the repression of psychic forces that are thereby **cathected** into something powerful and threatening. This can be anticipated as well in the principles of traditional Chinese religion -- as in **Taoism** and **yin-yang**. This is discussed separately (*Psychosocial Energy from Polarization within a Cyclic Pattern of Enantiodromia*, 2007; *Mirroring of self and other: enjoyment "through" the world*, 2011).

Enantiodromia is consistent with a felt need to be able to shift "between worlds". Enantiodromia is therefore highly relevant to extremism and the extreme response it evokes -- the "Us" and "Them" dynamic which is a focus of the main paper. Each of these worlds is potentially associated with the cognitive organization framed by the pattern of categories of a particular polyhedron in the route map (*Living as an Imaginal Bridge between Worlds: global implications of "betwixt and between" and liminality*, 2011). The facility curiously resembles the familiar process of changing gear in an automobile, or perhaps shifting to a different broadcast channel -- a different wavelength.

Such metaphors highlight the sense in which it not a particular condition which is vital to the integrity of psychosocial living, but rather the capacity to shift between conditions and forms. Understood as "wholth", it is how the dynamic of that pattern is embodied rather than its static representation (*Wholth as Sustaining Dynamic of Health and Wealth: cognitive dynamics sustaining the meta-pattern that connects*, 2013; *En-minding the Extended Body: enactive engagement in conceptual shapeshifting and deep ecology*, 2003).

From 37 to 137 ? As noted above, of particular potential interest is the (questionable) relationship between 37 and 137, given the special **significance attached to 137** in both mathematics and physics. The friendship of **Carl Jung** and **Wolfgang Pauli**, and their search for the meaning of 137 in science, medieval alchemy, dream interpretation, and the *I Ching*, is described by **Arthur I. Miller** (*Deciphering the Cosmic Number: the strange friendship of Wolfgang Pauli and Carl Jung*, 2009; *137: Jung, Pauli, and the Pursuit of a Scientific Obsession*, 2010) and by **Giorgio Piacenza Cabrera** (*The Mystery of 137: Calling for a new scientific relationship with interiority? Integral World*). Somewhat curiously, given its association with the **fine structure constant** fundamental to the organization of matter, the

hyped appreciation of 137 now corresponds to that for 37 indicated in the introduction (Sam Leith, *The Answer to Life, the Universe and Everything*, *DailyMail Online*, 19 June 2009).

Further comments of some relevance to the argument are developed by Peter Collins (*The Number 137*, *Integral Science*, 28 October 2009), with respect to the psycho-mathematical connotation as a symbol of integration, notably:

From one perspective prime numbers can be viewed as the basic building blocks of the natural number system (which we literally view in a linear manner as stretched out on a straight line). However when we take the reciprocal of prime number a fascinating transformation is involved whereby a highly circular numberpattern is involved, with the same sequence of digits continually recurring in a predictable manner.

So for example when we obtain the reciprocal of 7 the six digit sequence 142857 continually recurs. This represents a fine example of a prime number whose reciprocal has a full periodic cycle. A full cycle is measured as one less than the prime number in question which in this case gives a cycle of $7 - 1 = 6$. Though many other prime numbers e.g. 17, 61 and 97 exhibit full cycles in the digit sequence of their reciprocals, most prime reciprocals operate with a cycle of digits that is an exact fraction of the original prime number less one.

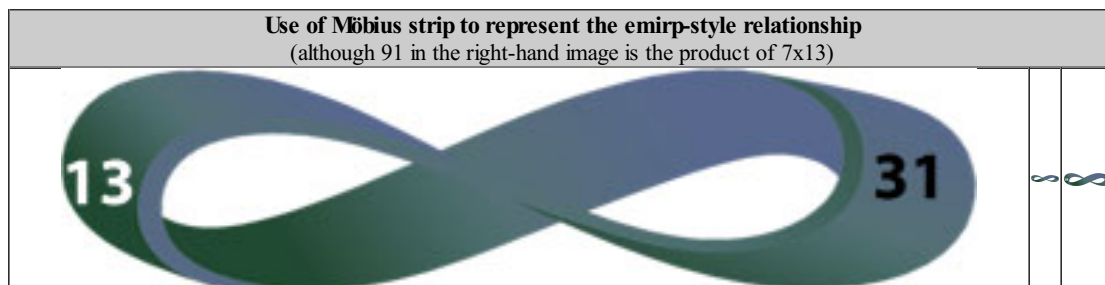
Dependence of psychosocial life on meta-reflection and meta-cognition?

The value associated with the [mirror test of self-recognition](#) was noted above. It might be expected that extraterrestrials would make use of an analogous test of maturity (*Self-reflective Embodiment of Transdisciplinary Integration (SETI): the universal criterion of species maturity?* 2008). Given the appreciation of optical metaphors (vision, image, focus, and the like), there is a case for considering the extent to which psychosocial life is currently (overly) dependent on "reflection" and "speculation".

Complementary organizing principles: The configuration of polyhedra in the maps above suggests that the polyhedra could be understood as contrasting organizing principles -- necessarily complementary principles of organization. As a form of container, this is reminiscent of the organization of the biological cell within which life, as it is commonly known, is engendered and sustained. Its nature can be understood through other metaphors, as suggested by the much-cited study by Gareth Morgan (*Images of Organization*, 1986). The point is reinforced in the extensive study by Douglas Hofstadter and Emmanuel Sander (*Surfaces and Essences: analogy as the fuel and fire of thinking*, 2012). In this sense the "container" recalls the preoccupation of alchemists with an [athanor](#), combining the sense of furnace with that of container -- specifically framed in cognitive terms by Eastern reflection on "[internal alchemy](#)". Within the biological metaphor, it is the metabolic processes which engender the energy on which physical life is dependent. The container can be envisaged otherwise as a form of reactor (*Enactivating a Cognitive Fusion Reactor: Imaginal Transformation of Energy Resourcing (ITER-8)*, 2006).

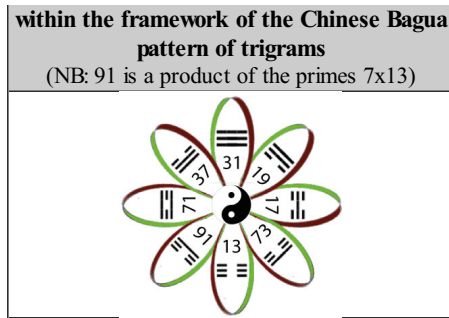
Curiously the emphasis here on the complementarity of the set of 12 semi-regular polyhedra fruitfully recalls the early association of polyhedra with classical Greece and the mythology of the [Dodekatheon](#) -- the 12 Gods of that culture, later coopted by the Roman Empire as the [Dii Consentes](#). Are their respective organizing principles to be associated -- whether externally or internally -- with 12 complementary languages of psychosocial life, as speculatively explored (*12 Complementary Languages for Sustainable Governance*, 2003)?

Enabling meta-cognition through reflection: The interlocking of the organizing principles represented by the set of polyhedra was shown above to be ensured by a paradoxical form of "reflection", associated with the incidence of emirps warning of the associated psychosocial process of enantiomorphism. There is then a sense in which the integrity of psychosocial life is dependent on a form of "meta-reflection" -- notably enabled by metaphor -- through which "meta-cognition" is enabled and sustained. One means of expressing this understanding is through the use of the Möbius strip to represent the emirp relationship between any pair of organizing principles. This might take the following form.



This representation recalls the title of an earlier study by Douglas Hofstadter (*I Am a Strange Loop*, 2007), with its emphasis on self-reflexivity and its references to the Möbius strip. The challenge might be framed in terms of the co-existence and interlocking of complementary paradoxes of that kind, as partly argued separately (*Sustaining a Community of Strange Loops: comprehension and engagement through aesthetic ring transformation*, 2010).

The argument might be further developed by exploring the configuration of such emirps as in the following, given the role of 8 in the centre of the above maps (associated with 16 and 61, as another non-emirp prime). This would accord with the Chinese understanding of the [Bagua configuration](#) whose pattern of trigrams exemplifies the dynamics of such reciprocation / reversal.



Life of the imagination: As a speculative exercise it might be asked how life within a biological cell might be imaginatively experienced, given the variety of interlocking processes. Shifting metaphors, given the recourse to insights offered by mathematics, more could be made of understanding the nature of the mathematical experience and its associated excitement. How are patterns detected and experienced? What is the satisfaction of recognizing them -- as in recreational mathematics and the long fascination with the significance of **magic squares**? Echoes of this are evident in widespread enthusiasm for sudoku, crosswords, and other brain teasers -- all increasingly available via new technologies.

The variety relished in such experience is notably evident in certain games, exemplified by poker, chess and go. There is a sense in which the meta-cognition associated with psychosocial life involves engagement with "dancing" patterns, as separately explored (*Sustainability through Magically Dancing Patterns: 8x8, 9x9, 19x19 -- I Ching, Tao Te Ching / T'ai Hsüan Ching, Wéiqí (Go)*, 2008). The metaphor of dance has long been one used to frame the experience of life, as well as that of doing physics (*Gary Zukav, The Dancing Wu Li Masters: an overview of the new physics*, 1979).

Avoiding closure: Of particular interest is the role of **cognitive closure**, as may be implied by use of the container metaphor, and explored by **Hilary Lawson** (*Closure: A Story of Everything*, 2002). Here again the paradoxical form associated with the Möbius strip is of value in reframing boundedness -- namely the Klein bottle (*Intercourse with Globality through Enacting a Klein bottle: cognitive implication in a polysensorial "lens"*, 2009).

There is some irony to the manner in which alchemy was preoccupied with **alkahest** as the universal (cognitive?) solvent, capable of dissolving the form of any container -- given the current preoccupation of nuclear fusion reactor design with preventing the plasma it contains from coming into contact with its toroidal container. This could prove to be a valuable caution against seeking closure in route map elaboration -- if this is liable to inhibit creative reflection vital to the living experience, as may be speculatively discussed (*Paradoxes of Engaging with the Ultimate in any Guise: Living Life Penultimately*, 2012).

It is in this sense that there is a strange interplay between the **incompleteness theorems of Kurt Godel** in mathematical logic and the aspirations to a form of closure through **metamathematics** by **Gregory Chaitin** (*Meta Math!: The Quest for Omega*, 2006). Curiously psychosocial life would seem to be fundamentally dependent on the process of not-knowing, however this may be interpreted, as may be variously discussed (*Global Strategic Implications of the "Unsaid": from myth-making towards a "wisdom society"*, 2003; *Being What You Want: problematic kataphatic identity vs. potential of apophatic identity?* 2008; *University of Ignorance: engaging with nothing, the unknown, the incomprehensible, and the unsaid*, 2013).

It is in the latter sense that psychosocial life can be framed through the metaphor of a **multiverse**, exploiting the poetic connotations (*Enactivating Multiversal Community: hearing a pattern of voices in the global wilderness*, 2012; *Being a Poem in the Making: engendering a multiverse through musing*, 2012).

Epimemetics? The main paper was instigated in response to the suggestion that the organizing pattern of the genetic code had a hidden code originally embedded within it by extraterrestrials -- most notably indicated by the number 37. Any preoccupation with extraterrestrials can be fruitfully reframed by recognition of the demonstrated determinative inadequacy of "genetics" and the subsequent emphasis on "epigenetics". The issue of "extraterrestrials" can be similarly reframed by a focus on "epiterrestrials" and the potentially greater significance of epimemetics -- in contrast with memetics (*Sensing Epiterrestrial Intelligence (SETI): embedding of "extraterrestrials" in episystemic dynamics?* 2013).

The quest for "20 amino acids" sustaining psychosocial life would seem to be intimately associated with a form of game-playing reminiscent of music -- and recalling traditional interest in the **music of the spheres** (*Musica Universalis*), perhaps understood here through the approximations offered by polyhedra. This metaphor can be fruitfully explored through the study by **James P. Carse** (*Finite and Infinite Games: a vision of life as play and possibility*, 1987). Highlighting the game metaphor potentially reframes those games involving opposing teams -- exemplifying the "Us and Them" dynamics explored in the main paper. Further speculation is required on the felt appropriateness of team size in the light of empiric indications regarding reversal, as discussed separately (*Numbers in play in psychosocial organization*, 2014).

Recognizing the nature of the "20 amino acids" is therefore very much associated with the traditions of a quest. It would appear to be a question of comprehending elusive patterns characteristic of ordinary experience -- and rendering them memorable rather than evanescent. It is largely irrelevant as to whether the game was designed by "extraterrestrials", however intriguing any such encounter might be, as speculated separately (*Engaging with Insight of a Higher Order: reconciling complexity and simplicity through memorable metaphor*, 2014).

Requisite variety of "voices" for psychosocial wholth: 6, 8, 12, 20, 30?

Solidarity and singularity: The introductory argument of the main paper was preoccupied with the dangerous limitations of the "us and

them" dynamics in psychosocial life -- framed there from the perspective of "camp-us". This has been explicitly presented by [Edward de Bono](#) (*I Am Right, You Are Wrong*, 1991) in a study subtitled as *From This to the New Renaissance: From Rock Logic to Water Logic*. The dynamic is only too evident at the time of writing with the focus on solidarity in the face of threat, reinforced by repression, incarceration, flogging, capital punishment, and the like.

Curiously the quest for "solidarity" has been matched by recognition of the need for "liquidity" -- as became evident in the course of the ongoing global financial crisis. The quest could then be framed in Douglas Hofstadter's terms (*Fluid Concepts and Creative Analogies*, 1995).

Multiple "voices": The argument here can be taken further by using the factors elicited in the polyhedral mappings above as indicative of "voices" -- understood metaphorically as the voices in any instrumental, operatic or dramatic work. The difficulty faced by society is that solidarity is most readily expressed and understood through a single voice -- with any other then perceived as a challenging threat. This dynamic can be expressed in music and song -- and successfully reframed by use of a range of techniques. Clearly two voices do not necessarily make for the most attractive musical expression.

The central portion of the polyhedral map indicates how the number of voices might be increased, most evidently to 4 or 6. The manner in which these may work together is well illustrated by musical groups, whether in a chamber orchestra or a jazz group, or in small groups of singers. It is in this range that Edward de Bono stresses the need for a variety of ways of handling information, as he argues in several books (*Six Thinking Hats*, 1985; *Six Action Shoes*, 1991; *Six Frames For Thinking About Information*, 2008). However the core of the map points to other numbers, potentially indicative of a larger range of "voices", whether 8 or 12 -- or extending to 20 and 30 in some way.

Collective cognitive constraints: There is however a major constraint in the capacity to comprehend the subtleties of increasing complexity. This has been highlighted by 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), as discussed separately (*Comprehension of Numbers Challenging Global Civilization: number games people play for survival*, 2014). The latter notes other constraints which are variously evident in the polyhedral maps:

- **"Spreadthink number":** as identified by [John N. Warfield](#) (*Spreadthink: Explaining ineffective groups*, 1995). This reflects the inability of groups to reach agreement on complex issue. This can be assumed to be 5.
- **"Dunbar's number":** as formulated by [Robin Dunbar](#), This is a suggested cognitive limit to the number of people with whom one can maintain stable social relationships. The commonly used value is 150.
- **Span of control:** The number of subordinates a leader can efficiently control or manage, currently understood as ranging up to 10.

Recognition in biology of the [Hayflick limit](#), namely the number of times a normal human cell population will divide until cell division stops, merits consideration that there may well be a cognitive analogue of systemic significance. Such constraints feature in assessments of problematic-strategic complexity, as with the [Situational Complexity Index](#) (SCI) of the [Institute for 21st Century Agoras](#).

Transcending constraints through interplay over time: The musical metaphor of voices is valuable in that it indicates that comprehension of greater variety is however possible through **appreciation of the interplay of many more voices over time**, namely through the manner in which they play off against each other in more complex music, notably in opera and other compositions, especially multi-part singing. This contrasts with the solidarity currently framed by defensive leaders as a matter of ensuring that everyone "sings from the same hymn sheet" -- or that the keynote of such leadership at this time should be presumptuously assumed to be unquestionably associated with the sounding of a mystical **OM** of cosmic unity as an expression of the highest values.

As an omnipresent factor in the polyhedral maps, a twofold dynamic clearly enables psychosocial space to be navigated. However current dynamics suggest that it tends to obscure the subtleties associated with the emergence of other factors. Given the importance of their role in global society, should the dynamics of any G20 or G30 group then be explored in terms of a higher order of complexity? But how? There is clearly a need to be able to disengage from factor-2 thinking under certain circumstances.

What might be the nature of an epic composition which would give fruitful expression to the variety of voices so problematically evident in society, as may be speculatively explored (*A Singable Earth Charter, EU Constitution or Global Ethic?* 2006). How many voices makes for fruitful global civilization -- and what extinction of voices constitutes its "deflowering" (*Flowering of Civilization -- Deflowering of Culture: flow as a necessarily complex experiential dynamic*, 2014).

Succinctly stated, the processes of requisite psychosocial variety need to be played out overtime to enable meaningful engagement with them. One indication in this respect is recognition of the number of dramatic plots which can be played out over time. A **fictional plot** is the sequence of interrelated events arranged to form a logical pattern and achieve an intended effect. The classic approach to organizing the dynamics of such plots is that of [Georges Polti](#) (*The Thirty-Six Dramatic Situations*, 1916) who endeavoured to categorize every dramatic situation that might occur in a story or performance -- building on the earlier work of [Carlo Gozzi](#).

Theories of variations: In the quest for "20 amino acid" memetic analogues, it is then arguably in musical terms that the case for requisite variety may be better argued. The complex arguments of Hofstadter make extensive reference to the music of [Johann Sebastian Bach](#), most notably the 30 *Goldberg Variations*. Are there insights of relevance to be gleaned from the musical theory of such variations? There are many studies of those variations, of which one brief but valuable overview is provided by the pianist and composer [Tjako van Schie](#) (*J.S. Bach: the architect and servant of the spiritual*). Other sets of musical variations have been composed ([Joseph Haydn](#), 20 variations in G; [Sergei Rachmaninoff](#), 20 Variations on a Theme of Corelli; [Edward Elgar](#)'s 14 *Enigma Variations*).

The mystery of the core operations of the memetic analogue is: **why 30, why 20, why 14?** Why do such numbers "work"? Given the role of an **orbifold** in ordering musics ([Dmitri Tymoczko](#), *The Geometry of Musical Chords*, *Science*, July 2007), it is intriguing that orbifolds have a recognized role with respect to what can be termed the "moonshine" connectivity of such subtle correspondences ([Michael P.](#)

more about one unopposed idea being explored, mined, twisted and turned in a monologue of elaboration.

A contrasting perspective is offered by the avant-garde composer, [Vinko Globokar](#), articulates guidelines for improvisation by a group of instrumentalists (*Drama and Correspondences*, *Harmonia Mundi*, 1973). Correspondences are based on the principle of mutual psychological reactions and attempts to "join" the four participants with each other and to make them increasingly dependent on each other. He distinguishes four levels:

- (a) The musical material is entirely fixed, but the choice of instruments is left open.
- (b) Each musician possesses only incomplete instructions. In order to be able to play, each musician must search for missing material in the performance of the neighbour (pitches from the first, length from the second, etc) and react to it in different ways: imitate, adapt himself to it (if need be, further develop), do the opposite, become disinterested or something else (something 'unheard of').
- (c) The composed material is completely substituted by the description of the possibility arising from the reactions of the performers to their neighbours.
- (d) On the last level, it is left up to the performers whether to cease playing or to continue; for not even the selection of reactions is now necessary.

Subtlety and exclusivism: Such thinking is effectively the antithesis of the "camp-us" approach criticized in the main paper. Unfortunately, whilst there is much to be learned from music and multi-part singing, it is curious to note the manner in which "camp-us" mindsets emerge amongst musical elites with respect to the subtleties of multiple variations and voices. In a sense the more complex patterns suggested by the polyhedral relationships are upheld as "hidden" and accessible only to the few. In his commentary, Tjako van Schie quotes the pianist [Dirk Schäfer](#) on Bach:

The more perfect the work, the less the quantity of those to whom it reveals itself completely. In despite of exhibitions, reviews, yes seeming popularisations the Art Work is and remains the property of solitude. A perfect contrapuntist certainly shall be able to analyze Bachs works technically and, being musically talented, also musically. But Bach is more than a miraculous contrapuntist. He is deeply devoted, not according to a certain formula... but devoted 'in the spirit'...

Hofstadter cites a related argument by [Albert Schweitzer](#):

Many performers have been performing Bach for years without experiencing for themselves the deepening that Bach is capable of bringing out in any true artist. Most of our singers are far too caught up in technique to sing Bach correctly. Only a very small number of them can reproduce the spirit of his music; the rest are incapable of penetrating into the Master's spiritual world. They do not feel what Bach is trying to say, and therefore cannot transmit it to anyone else. Worst of all, they consider themselves to be outstanding Bach interpreters, and have no awareness of what it is they lack. (cited in *I Am a Strange Loop*, 2007, p. 351)

The implied elitism is then readily to be perceived as yet another variant of "camp-us" sensibility. [Jacques Attali](#) has argued that the modern period is currently living out the mode of organization characterized by classical music and has yet to organize psychosocial life in a manner which transcends its constraints (*Noise: The Political Economy of Music*, 1985).

The insight from the polyhedral maps is that **it is necessary to disengage from factor-2 thinking ("I am right; you are wrong") in order to recognize and navigate the more elusive pattern of other pathways** (*Walking Elven Pathways: enactivating the pattern that connects*, 2006; *Climbing Elven Stairways: DNA as a macroscopic metaphor of polarized psychodynamics*, 2007).

Multifold cognition? The issue at the polyhedral core, on which this quest for "20 amino acids" has focused, is how to think about the interplay between the various number-associated processes. In memetic terms the "acids" might be usefully understood as mindsets, processes or styles. The indications cited above from [combinatorics](#) regarding a "12-fold way" and a "20-fold way" merit exploration in relation to proposals for a "30-fold way" by Michael Lugo (*The Thirtyfold Way*, *God Plays Dice*, November 2007). They contrast with arguments for a **Third Way** in politics. This then appears simplistic by comparison -- notably in the light of various arguments for a **Buddhist Eightfold Way**, an **Eightfold Way in Particle Physics**, or the **Eightfold Path of Policy Analysis**.

Also of relevance, as noted, is the extensive discussion of 30-fold syntegegration from a cybernetic perspective (Stafford Beer, *Beyond Dispute: The Invention of Team Syntegrity*, 1994; J. Truss, et al., *The Coherent Architecture of Team Syntegrity: from small to mega forms*, 2000). The challenge lies in the nature of "beyond" if it is questionably assumed to be comprehensible only to the few, as may be speculatively explored (*Engaging with Insight of a Higher Order: reconciling complexity and simplicity through memorable metaphor*, 2014).

The argument here is that, as fruitfully understood through musical voices, the "wholth" vital to psychosocial life has something to do with emergence associated with whatever is associated with the interplay of the number-associated organizing principles (*Wholth as Sustaining Dynamic of Health and Wealth: cognitive dynamics sustaining the meta-pattern that connects*, 2013). The interplay suggests that such wholth may involve a dynamic understanding of personal identity as discussed separately (*Emergence of Homo undulans -- through a "grokking" dynamic?* 2013; *Encountering Otherness as a Waveform: in the light of a wave theory of being*, 2013) in the light of the argument of Daniel Dervin (*Creativity and Culture: a psychoanalytic study of the creative process in the arts, sciences, and*

Sphere packing as a clue to "voice hearing" and "voice touching"

World views as "voices": The argument of the main paper could be understood as the challenge for "camp-us" of hearing the voice of "camp-them" -- even of being "touched" by others in some fruitful way. The presentation by Ernest McClain of a tonal array as a lattice (as depicted above) can be thought of otherwise when each tone, as a "voice", is fruitfully understood as engendering a world, or a world view (even a universe). In discussion of the array, McClain refers to the early traditional practice of pebble counting. It is from that recognition that star numbers and centered hexagonal numbers arise -- notably highlighting the number 37.

From pebble counting naturally follows the question of how spheres can be packed. Hence the extensive literature on [sphere packing](#), namely with regard to the arrangement of non-overlapping spheres within a containing space. In three-dimensional Euclidean space, a particular concern is with [close-packing of equal spheres](#). With each sphere understood as a world (or as a world view), sphere packing possibilities then offer intriguing pointers as to the extent to which the worlds can be arrayed such that each can "see" (or recognize) the other, or "hear" the other, or be "touched" by the other -- especially when each voice is held to be "equal". Succinctly stated, **the organization of global society frames the question as to how many distinct voices can be recognized, how many can be heard, and by how many each is touched.**

Packing possibilities and "kissing numbers": With respect to close packing, two simple arrangements correspond to regular lattices:

- cubic close packing (or [face centred cubic](#)) -- where the layers are alternated in the ABCABC sequence.
- hexagonal close packing -- where the layers are alternated in the ABAB sequence.

Many other layer stacking sequences are possible (ABAC, ABCBA, ABCBAC, etc.), in order to generate a close-packed structure. In all of these arrangements each sphere is surrounded by 12 other spheres. Especially valuable with respect to sphere packing, is the clarification of Buckminster Fuller's arguments offered by [Amy Edmondson](#) (*A Fuller Explanation: the synergetic geometry of R Buckminster Fuller*, 1992).

Somewhat ironically, given the sociopolitical connotations of "touching", the geometry of touching is defined and termed as the [kissing number problem](#). This seeks the maximum possible kissing number for *n*-dimensional spheres in (*n* + 1)-dimensional Euclidean space. Ordinary spheres correspond to two-dimensional closed surfaces in three-dimensional space. In one dimension the kissing number is 2 (as characteristic of the quality of thinking of the "us and them" of "camp-us"). In two dimensions it is 6. The *Wikipedia* description lists kissing numbers up to 24 dimensions -- relating to the problem of [hypersphere packing](#).

Beyond "us and them": Ironically again, this offers the challenging question of the dimensionality of an individual, otherwise too readily framed schematically as a point identity, a circle or a sphere. The sense of higher dimensionality emerges in the arguments of various authors (Ron Atkin, *Multidimensional Man; can man live in 3-dimensional space?* 1981; [Antonio de Nicolas](#), *Meditations through the Rg Veda: Four-Dimensional Man*, 1978; [Steven M. Rosen](#), *Topologies of the Flesh: a multidimensional exploration of the lifeworld*, 2006), as discussed elsewhere (*Global Brane Comprehension Enabling a Higher Dimensional Big Tent?* 2011; *Hyperaction through Hypercomprehension and Hyperdrive: necessary complement to proliferation of hypermedia in hypersociety*, 2006).

Framed in musical terms, McClain's argument extends from the 2-dimensional hexagonal array to what he discusses extensively in terms of a "magic mountain" of tones as associated with defining prime numbers. The form of this mountain is a challenge to comprehension, as he presents (and depicts) in 2-dimensions what is effectively (at least) a 3-dimensional array. He makes no reference to polyhedral sphere-packing arrays which could render any such form more readily comprehensible to the musically challenged.

Of particular interest is the 3-dimensional array which would correspond to the larger [star numbers](#) and [centered hexagonal numbers](#) (as noted above):

- In the case of the star numbers, this takes the form of a centered hexagram (six-pointed star), of which the prime numbers earliest in the series are highlighted in the polyhedral maps above, namely: 13, 37, 73, 121, and 181.
- In the case of a centered hexagonal number, this takes the form of a hexagon with a dot in the center and all other dots surrounding the center dot in a [hexagonal lattice](#). The earliest in the series, which are primes, are again highlighted in the polyhedral maps above: 7, 19, 37, 61. They also include 91, figuring there, itself the product of two primes in those maps (7x13).

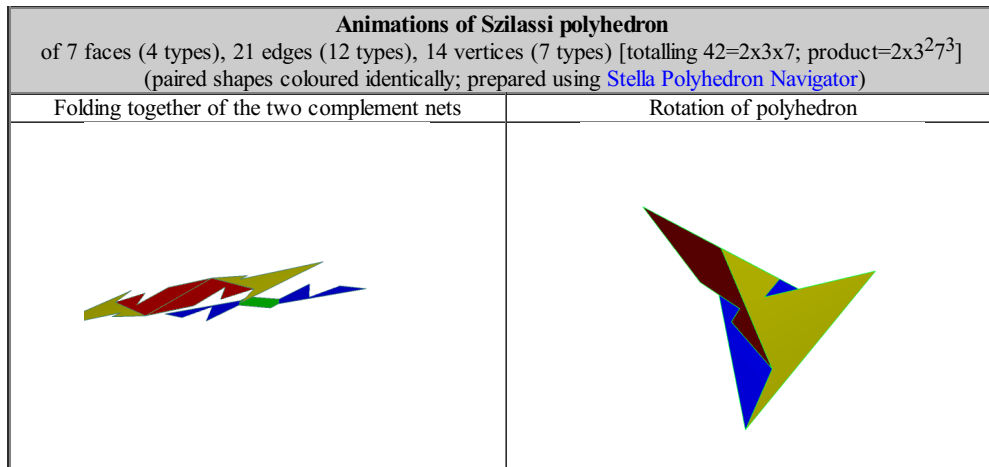
Global organization as "close packing": With respect to the sociopolitical preoccupation of this argument, a significant issue is whether a polyhedral form would help to clarify the distinction between "seeing" (understood as recognizing, or even "re-cognizing"), "hearing" and "touching" -- in the light of distinct packing patterns. This offers a language for (provocative) discussion of the question as to whether global sociopolitical organization should be explored as one of "closest packing" -- and the nature of the looser arrays to be considered as alternatives (with the criteria of seeing, hearing and touching understood otherwise).

Could this reframe "us and them" situations ("kissing number" of only 1?), degrees of relevance with respect to complex issues ("spreadthink"), or understanding of the constraints suggested by the [Dunbar number](#) (circa 150). The latter is the suggested cognitive limit to the number of people with whom one can maintain stable social relationships (as in social media) -- potentially to be generalized to the number of organizations with which any one of them can maintain fruitful relationships? (Maria Konnikova, *The Limits of Friendship*, *The New Yorker*, 7 October 2014; Drake Bennett, *The Dunbar Number, From the Guru of Social Networks*, *Businessweek*, 10 January 2013; Jacob Morgan, *Why Dunbar's Number is Irrelevant*, *Social Media Today*, 25 January 2010). Is this number also a constraint on democratic representation in national and international assemblies?

Hyperdimensional identity: All such constraints would need to be reconsidered in the light of, any "hyperdimensional" understanding of personal identity, as highlighted by [Anil Ananthaswamy](#) (*The Man Who Wasn't There: investigations into the strange new science of the*

self, 2015), and as may be imagined (*Being a Waveform of Potential as an Experiential Choice: emergent dynamic qualities of identity and integrity*, 2013). Such argument can be extended to collective identity -- as with the so-called "international community".

With the cognitive constraint indicated by [George Miller](#) (*The Magical Number Seven, Plus or Minus Two: some limits on our capacity for processing information*, *Psychological Review*, 1956), is the challenge represented by the 20-fold/30-fold dynamics in the core of the polyhedral maps to be explored in terms of extraordinary forms of packing -- ensuring degrees of mutuality which do not lend themselves to verbal articulation? One such form is the [Szilassi polyhedron](#) -- topologically a torus, with seven hexagonal faces, **each face sharing an edge with each other face** -- perhaps to be recognized as an extreme form of touching. This is a characteristic shared only with the tetrahedron at the centre of the polyhedral maps above.



As an aid to cognitive clarification, the polyhedron can notably be used to configure the relationships between questions, as extensively discussed and illustrated separately (*Mapping of WH-questions with question-pairs onto the Szilassi polyhedron*, 2014; *Potential insights into the Szilassi configuration of WH-questions from 4D*, 2014). With respect to looking at an "other" -- namely the "us and them" challenge for "camp-us" -- the Szilassi polyhedron has been used to explore the variously discussed "13 ways of looking" (and listening) framed by the theme *Anticipating When Blackbirds Sing Chinese* (2014), in sections on:

- | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> Post-modern challenge to simplistic binary framing of the other Imaginative composition of ways of looking or listening | <ul style="list-style-type: none"> Embodying a multiverse of uncertainly ordered incongruity Thirteen ways of apprehending blackbird song |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|

These notably refer to insights to be derived from the pattern of polyhedra.

Toneship design to enable noonautics by the voices of civilization?

The spaceship metaphor has long been widely used as a much-appreciated trigger for the imagination -- as is evident by movie-enhanced speculation on space travel and extraterrestrials, notably characterized by evocative mottos such as the following:

- *Battlestar Galactica* (1978-2003): ... *the last Battlestar, Galactica, leads a ragtag, fugitive fleet, on a lonely quest -- for a shining planet known as Earth.*
- *Star Trek* (1966-2000): ...*to explore strange new worlds, to seek out new life and new civilizations, to boldly go where no man has gone before.*
- *Star Wars* (1977-2005): *A long time ago in a galaxy far, far away...*

It is unfortunate that such modern myths have tended to replicate unfortunate patterns of "us and them" thinking, as usefully illustrated by the movies *Avatar* (2009) and *Interstellar* (2014). These are especially valuable given the tendency to replicate the pattern of exploitative colonialism and to imagine the possibility of escape from the unresolved challenges of the planet. Previous speculation has considered the related use of astrophysics as a way of understanding the distribution of variety in a global knowledge society (*Towards an Astrophysics of the Knowledge Universe? from astronautics to noonautics*, 2006; *Towards an Astrophysics of the Knowledge Universe? from astronautics to noonautics*, 2006).

A case can be made for a shift from the space metaphor to a time metaphor, given the credibility already attributed to the future possibility of [time travel](#). This opens the possibility for reflection on timeship design, as separately explored (*Timeship: Conception, Technology, Design, Embodiment and Operation*, 2003; *Embodying a Timeship vs. Empowering a Spaceship*, 2003). It could be argued that current global challenges derive in part from considering the Earth as a spaceship -- as in use of [Spaceship Earth](#). This is a world view highlighting the limited resources available and encouraging harmonious action -- as with a crew working toward the greater good. Strategically there is however significant incapacity to engage with the longer periods of time which might be associated with any notion of "Timeship Earth" (*Strategic Embodiment of Time: configuring questions fundamental to change*, 2010).

The argument above reframes the challenge in memetic terms, namely how to enable the diversity of "voices" of civilization to travel the noosphere in the present. Rather than further exploring the metaphor of how the genetic seeds of humanity (and of the sustaining environment) could be safely transported wherever and whenever, the question then becomes the nature of the vehicle through which the [meme pool](#) could be "transported" and "expressed", whatever these are held to mean. A classic response is to embody the voices in a cultural [epic](#) capable of traversing the centuries -- as with the *Mahabharata* of Hindu culture. A notable clarification of the contrast between voices -- understood as the "languages" of the as intentionality structures carried by the *Rg Veda* -- has been produced by

Antonio de Nicolas (*Meditations through the Rg Veda: Four-Dimensional Man*, 1978).

Through the above argument, the "voices" have been associated metaphorically with an extensive array of tones. This suggests the merit of reflecting on the design of a "toneship", whatever that might be imagined to mean. To that end, following the quest for the organizing principle arguably associated with the primes exemplified by 37, the extraterrestrial hypothesis evoked by the Kazakh research can be speculatively related to a very particular kind of "tone vessel". In the spirit of the argument, this would involve one embodying the above-cited array of 37 tones in some way.

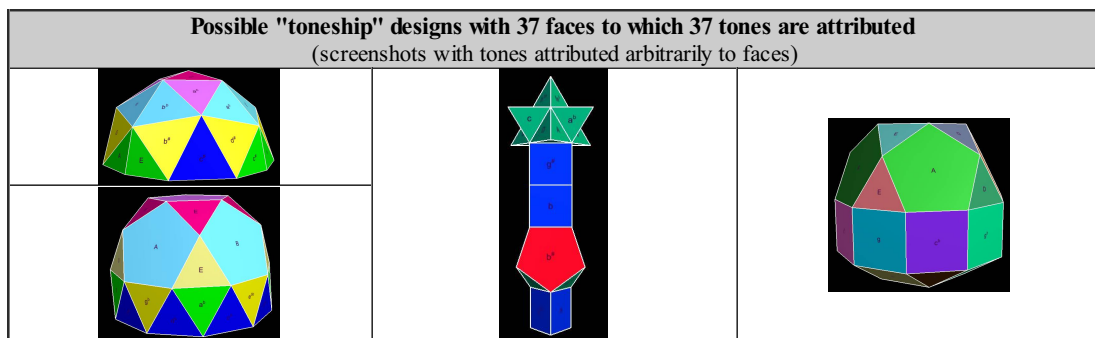
It is appropriate to the argument that these tones were originally understood as "guardians". This is consistent with the expressed concern with the need for an array of voices to guard against potential dysfunctionalities, notably that characterized by "us-and-them" thinking as a monotone -- with all that implies in terms of the dangers of **monoculture**. The voices are then the guardians of memetic variety -- otherwise endangered by monotonal dominance -- perhaps to be recognized in terms of a psychosocial analogue to the **keystone species** of the natural environment.

An initial step in imagining the design would then be to configure the tones in the light of a polyhedral structure especially characterized by 37 elements. Possible candidates accessible through the **Stella software** (used in the animations above) include those in the table below.

Polyhedra with 37 faces (as identified in Stella Polyhedron Navigator)						
Name	Faces		Edges		Vertices	
	Number	Types	Number	Types	Number	Types
Star tower	37	13	63	21	28	10
Elongated Pentagonal Orthocupolarotunda	37	9	70	14	35	7
Gyroelongated Pentagonal Rotunda	37	9	65	13	30	6
3-Frequency Octahedral Geodesic Hemisphere	37	10	60	15	25	7
Elongated Pentagonal Gyrocupolarotunda	37	9	70	14	35	7
Wings	37	19	65	33	30	15

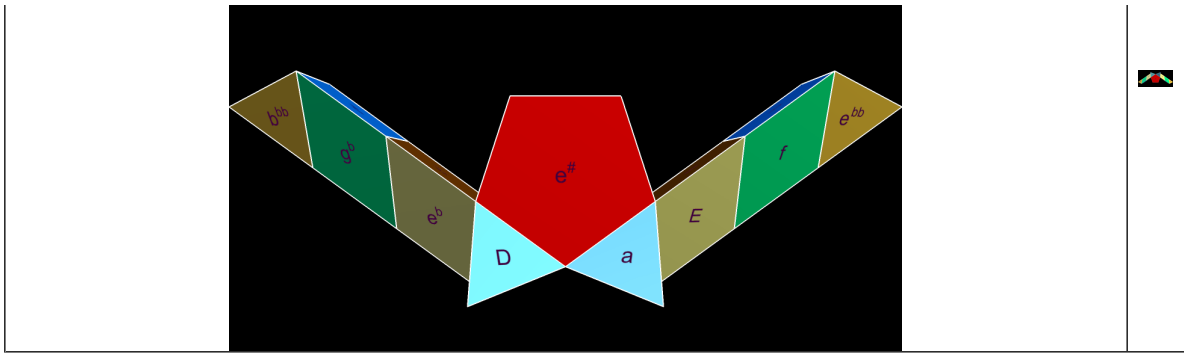
Unfortunately for the argument, no evident polyhedra exist with only 37 edges, with which tones might perhaps be more appropriately imagined to be associated -- then to be understood as strings, with the harmonic associations to stringed instruments and resonant structures, as partially explored (*Polarities as Pluckable Tensed Strings: hypercomprehension through harmonics of value-based choice-making*, 2006). A toneship as a stringed instrument would be a marvellous catalyst for imaginative reflection -- perhaps to be compared with the manner in which the epics noted above serve as vehicles for cultures. Could elaboration of global initiatives and constitutions be explored in such terms, as speculatively discussed (*Structuring Mnemonic Encoding of Development Plans and Ethical Charters using Musical Leitmotifs*, 2001; *Knowledge Gardening through Music: patterns of coherence for future African management as an alternative to Project Logic*, 2000)?

The 37 faces allow the tones distinguished by McClain to be associated each with an individual face of those polyhedra, as indicated in the screen shots and animations below. It should be stressed that McClain offers extensive musical and mathematical commentary distinguishing the tones in the array in his later works (*The Pythagorean Plato: prelude to the song itself*, 1978; *Meditations Through the Quran: tonal images in an oral Culture*. 1981). In particular these include the following tables in McClain (1978), variously cited in McClain (1981): *37 The Guardians as a Sequence of Superparticular Ratios* (p. 110); *Guardians as Smallest Integers* (p. 112); *Trigonometric functions of 37 Guardians* (p. 118); *Symmetric trigonometric functions within 432,000* (p. 120). Screen shots of the first four are presented below.



The last candidate in the table is the polyhedron named "Wings" -- an appropriate extraterrestrial polyhedral provocation in the light of Kazakh research. Its features total to $2^2 \times 3 \times 11$, with a product of $2 \times 3 \times 5^2 \times 13 \times 37$.

Animations of a polyhedron named "Wings" with tone values attributed to the faces (in two orientations) Polyhedron with 37 faces (of 19 types), 65 edges (5x13 of 33 types), 30 vertices (of 15 types) (prepared using Stella Polyhedron Navigator)	



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