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8 June 2015 | Draft

Global Psychosocial Implication in the Pentagramma Mirificum

Clues from spherical geometry to "getting around" and circumnavigating imaginatively

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Annex 5 of *Correlating a Requisite Diversity of Metaphorical Patterns: entuning the dynamic of cognitive eases and diseases* (2015)

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Introduction

The challenge of how to get around the globe now appears to be trivial. With global positioning satellite (GPS) technology accessible in one form or another, the challenge of navigating around a sphere is no longer of active concern. The assumption can even be made that the Earth is flat, as has been emphasized by [Thomas L. Friedman](#) (*The World Is Flat*, 2005; *The World Is Flat: the globalized world in the twenty-first century*, 2006; *Hot, Flat, and Crowded: Why We Need a Green Revolution - and How It Can Renew America*, 2009). The first was given the first [Financial Times and Goldman Sachs Business Book of the Year Award](#). The award recognizes one business book that provides "the most compelling and enjoyable insight into modern business issues, including management, finance and economics". Although readily assumed the "flatness" of the Earth can be explored as inappropriate to the times (*Irresponsible Dependence on a Flat Earth Mentality -- in response to global governance challenges*, 2008).

It is indeed curious that in a global civilization, readily portrayed symbolically as a sphere, what globality may imply is elusive if not mysterious. Whilst the earliest explorers are upheld for their capacity to circumnavigate the globe, the skills which they required to do so are far from being common knowledge. Might this be the case with respect to a "global" civilization? How do people "get around" -- other than by assuming the Earth is somehow "flat"?

At the same time there is no lack of information to the effect that satellites somehow get "around" the Earth, providing information services and extracting surveillance information. Many are aware of the capacity of missiles to strike anywhere, having followed trajectories "around" the globe. However, at the same time, the skills for getting "around" society and the "global" nature of its issues seem to be lacking in some fundamental way. Things are not getting better and many have a sense of being lost with nowhere to go.

The question here is whether there are clues to be found from the insights which have enabled spherical navigation over recent centuries. To what extent do those insights reflect understandings of relevance to getting "around" a global information-based society? Is there more to that forgotten art than is implied by a recent study (Glen Van Brummelen. *Heavenly Mathematics: the forgotten art of spherical trigonometry*, 2013)?

As noted in the main paper, a key contributor into understanding of navigation around the globe was the mathematician [John Napier](#). He derived what continue to be cited as [Napier's rules for right spherical triangles](#). These were associated with a simple 5-fold structure later termed the *Pentagramma Mirificum* by the mathematician [Carl Friedrich Gauss](#). Their work continues to inspire more complex forms of mathematics whose potential significance for global understanding calls for exploration. As in the main paper, the concern here is not with that mathematics but with what such a structure may suggest for unrecognized possibilities of imaginative "navigation" in a complex world -- for "getting around".

As argued there, a case can be made for recognizing that the [10 Napier's Rules](#) for navigation in spherical geometry are indicative of the distinctive forms of metaphor required for the navigation of globality ([Napier's Nifty Rules](#), *ThatsMaths*, 12 August 2012). Ironically these are associated with what are termed [Napier's Analogies](#) (*What is the analogy in Napier's Analogy?* [Quora](#)).

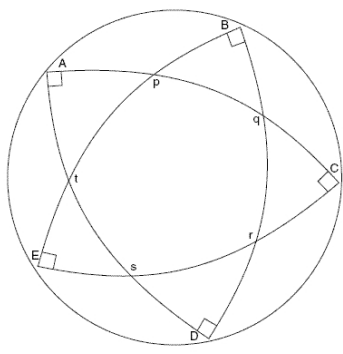
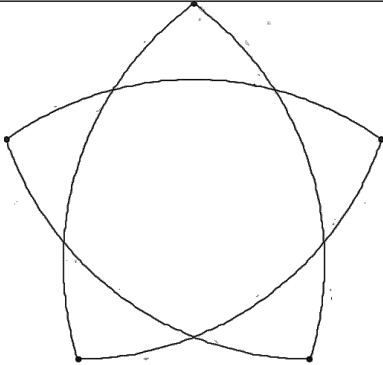
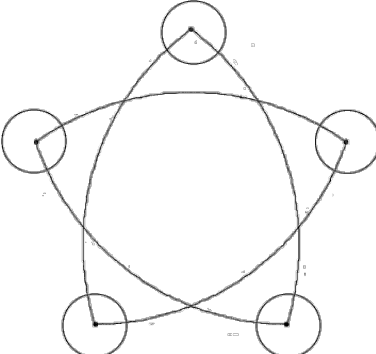
As the name of that form implies, the 5-fold structure is indeed a form of pentagram -- but an unusual one. Attaching new significance to a pentagram may seem somewhat irrelevant in the world of today. However there is little need to stress the key role played by [The Pentagon](#) in this period -- with whatever organization of knowledge and strategy a pentagonal structure may imply. The importance of 5-pointed stars is evident in the manner in which these figure in the iconography of national symbols of many nations, most notably those of Islamic faith. Exactly what determining force this may exert on such cultures remains unclear -- whether in terms of consciousness or by whatever may be signified by collective unconsciousness. The potential relevance of the latter at this time is indicated by studies by [John Ralston Saul](#) (*The Unconscious Civilization*, 1995; *The Collapse of Globalism and the Reinvention of the World*, 2006).

Major intercultural conflicts at this time might even be described as "star wars", as separately explored (*Middle East Peace Potential through Dynamics in Spherical Geometry: engendering connectivity from incommensurable 5-fold and 6-fold conceptual frameworks*, 2012). If there is any possible relevance to such arguments, then there is a strong case for exploring how the geometry of "stars" may frame thinking in some poorly recognized way -- potentially to be informed by neglected insights concerning the mathematics of globality. The main paper drew attention to the curious parallel with respect to health and healing between the pentagonal *Wu Xing* pattern, as a fundamental Chinese concept, and the Pythagorean symbol of the *Hygiea*, also compared separately (*Cycles of enstoring forming mnemonic pentagrams: Hygiea and Wu Xing*, 2012; *Potentially healthy developmental integrity from 5-fold symmetry*, 2012). That there is a degree of sensitivity to such pentagonal symbols is evident from the concern which can be aroused in the media by their inversion and association with questionable rituals.

It is this context which justifies renewed exploration of the *Pentagramma Mirificum* and the possibilities of visualization of its subtleties using [virtual reality](#) techniques which have not been available until more recently -- and which are especially familiar to the young.

Pentagramma Mirificum?

The main paper used the following table (reproduced here for convenience) in order to show the relation between the mathematical discovery of John Napier, leading to the naming of the form by Carl Friedrich Gauss -- and the work this has since inspired. The table also shows the relationship to the *Wu Xing/Hygiea* pattern which was a theme of the concluding arguments of that paper.

Pentagramma Mirificum -- a non-regular spherical pentagon		
As sketched by John Napier	Gauss's sketch of Napier's	Adaptation to Wu Xing pattern
		

The 5 circles on the traditional depiction could be considered a reminder that **the *Wu Xing* pattern is a spherical pentagram -- not planar**. Links are not straight lines. They are curves or arcs around a sphere -- as so unfortunately emphasized by depictions of missile trajectories, for which there are seemingly no cognitive equivalents. Of related significance is the fact that on a sphere the points of the *Pentagramma Mirificum* are not visible from each other, being effectively "over the horizon" in terms of any "flat earth" perspective from each -- suggesting a fundamental challenge for the comprehension of globality and the implementation of any "global plan".

Comprehension of globality through 5-fold patterns of metaphor? Exploration of the possible relationship between the pattern of *Wu Xing*, *Hygiea* and the *Pentagramma Mirificum* can be usefully related to that of the *non-sequiturs* of so-called [Knight's Move](#) thinking. As a move in chess, with its [correspondence in go](#), it offers a pattern for metaphor as being orthogonal to conventional linearity. The [Wikipedia](#) entry on [orthogonality](#) offers a valuable summary of the challenges this constitutes to communication in various domains. For example: *In communications, multiple-access schemes are orthogonal when an ideal receiver can completely reject arbitrarily strong unwanted signals from the desired signal using different basis functions.*

Metaphor enables this conventional constraint on connectivity to be transcended -- notably that between [information silos](#). Ironically it might be said, following the argument of the introduction with respect to birds, metaphors enable arguments to "fly". The point is carefully argued by [Douglas Hofstadter](#) and [Emmanuel Sander](#) (*Surfaces and Essences: analogy as the fuel and fire of thinking*, 2013).

Related arguments were developed in separate sections (*Insights from Knight's move thinking; Alternative representations: Naturomimicry: sourcing nature for strategic metaphors; Stratagems and ploys characteristic of Knight's move thinking*). The Knight is part of the emblem for the [US Psyops](#) as a traditional symbol of "special operations" -- signifying the ability to influence all types of warfare. A challenging comparison may be made between the Knight's move, *BaGua* of Chinese culture, and the Swastika, illustrated by separate animations (*Knight's move, Swastika and BaGua?* 2012).

The relevance of this pattern to that of the *Pentagramma Mirificum* was further emphasized by the following animations (reproduced from the main paper for convenience).

Experimental animations indicative of a cyclic pattern of metaphors

(each use of metaphor within an animation is associated with an orthogonal direction)		
8 of the Knight's moves across neighbouring cells of a chess board	<i>Wu Xing</i> cycle (one direction) superimposed on one <i>BaGua</i> mirror arrangement	Knight's moves superimposed on one <i>BaGua</i> mirror arrangement

Global integration of contrasting variants of *Pentagramma Mirificum*: Missing from such 2-dimensional animations is the sense implied by the *Pentagramma Mirificum* framed by the spherical geometry of globality. There is therefore the implication that only through recognizing the operation of such connectivity on a 3-dimensional surface that the alternative directionalities (indicated by the screen shots above) can be integrated into a single global pattern.

Of relevance in this sense is the fact that **the *Pentagramma Mirificum* has an inverted variant on the reverse side of the sphere** -- both being connected by the 5 [great circles](#) around the sphere (namely the extension of the 5 curves in the middle animation above). This geometry is remarkably illustrated by the interactive animations of the [LaRouche](#) group ([Full Circle](#); [The *Pentagramma Mirificum*](#)). Less evident are the cognitive, epistemological and experiential significance. Rather than being understood as circles in terms of spherical geometry, **the 5 great circles are more appropriately understood as 5 cyclic processes** through which the two variants of the *Pentagramma Mirificum* / *Wu Xing* are globally integrated.

This geometry can best be understood through virtual reality presentations to which the following screen shots provide links.

Screen shots of the complementary variants of <i>Pentagramma Mirificum</i> on opposite sides of a sphere (one pattern with 5 white balls, the other pattern with 5 black balls; 5 circles link both patterns together) [options for viewing interactive 3D animations: classic browser-based WRL format ; or via standalone FreeWRL viewer]		
White pattern in front (vertical); black pattern (inverted) seen through sphere	Side view of linkage between variants showing great circle continuity around sphere	Black pattern in front (inverted); white pattern (vertical) seen through sphere

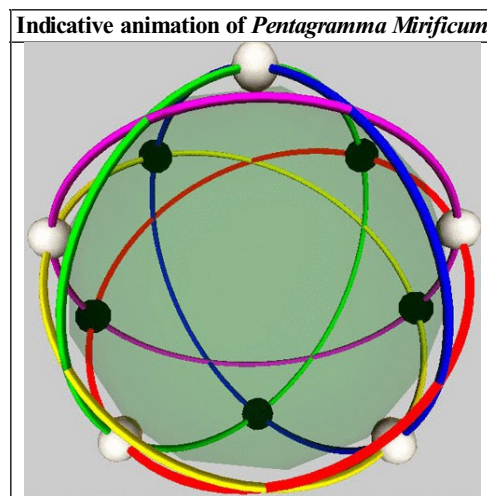
Technical comments: There are a number of presentations of the *Pentagramma Mirificum* in 2D, typically without any reference to its complementary form on the other side of the sphere -- to whatever degree it may be implied by any mathematical discussion. The most useful effort to provide an understanding of the two variants together in 3D seems to be the interactive animations and commentary of the [LaRouche](#) group ([Pentagramma Mirificum: investigations in geometry](#), [ScienceLarouchePAC.com](#); [Full Circle](#); [The *Pentagramma Solid*](#)).

Clearly the available virtual reality software enables more sophisticated approaches to interactive animations through which to acquire an understanding which is necessarily elusive in 2D depictions like those above. Configuring 5 great circles around a sphere such that they intersect at right angles where required (in order to form the complementary structures) seemed relatively straightforward -- but this proved not to be the case (for this author). The excellent software used was the freely downloadable [X3D-Edit](#) application. The instructive challenge lay in resolving issues of limited competence in both that software and in spherical geometry.

The result is consequently somewhat imperfect, possibly as a consequence of the precision required to get the succession of great circles to interlock appropriately, and notably because of any accumulating minor errors in that process. The resulting files (freely downloadable) would allow further expertise to be brought to bear to adjust the geometry -- or to adjust the aesthetics to other tastes (colours, relative sizes, etc). More interesting is the possibility of using other features of X3D-Edit to enable more sophisticated interaction with the configuration. Difficulty was experienced, for example, in getting the best orientations for the Viewpoint facility characteristic of interaction with such forms in virtual reality. At present, although the Viewpoint features are active, users are obliged to make slight adjustments via the cursor to achieve the best views..

Progress in developing the figure via the software was checked (on a local drive) using [H3DViewer](#) (freely downloadable, notably for Windows). This can directly process [X3D files](#). Final output was exported from X3D-Edit to [VRML 97](#) (WRL) format to enable viewing on browsers with the [Cortona3D Viewer](#) plugin. There are [other options](#) for viewing/interacting with both formats. Note that the central sphere is then rendered as an irregular polyhedron.

Unfortunately the situation for (casual) developers and (casual) users of 3D animations seems to remain as chaotic as it has been over the past decade or more. Whilst particular combinations of browsers, viewers and formats undoubtedly work, the risks of failure in some combination are great. Thus the files saved in X3D format did not appear to be directly viewable via the web (although working locally), so the safest option has been to rely on the legacy browser facility offered by Cortona. This works well (in Windows) with the file indicated above. Assuming that too fails, a very crude animation is offered below (generated as a succession of screen shots from the Cortona rendering).



Psychosocial implications?

Interrelating positive and negative: Given the symbolic concerns associated with pentagrams and pentacles (but curiously not pentagons), it is striking that the *Pentagramma Mirificum* integrates the two forms within a global configuration -- through 5 great circles which encompass and frame both. The pentagrams visible in fact each provide a framework for a pentagon -- remembering that these forms are spherical rather than planar as conventionally depicted and imagined.

Irrespective of the orientation of the variants, it is striking that the framework calls for reflection regarding the appropriateness of conventional reflection on "positive" versus "negative" as it pervades most global discourse, with unquestioning approval of one and condemnation of the other -- extending to "white" and "black". The point has been strongly argued by [Barbara Ehrenreich](#) (*Smile Or Die: how positive thinking fooled America and the world*, 2010). As recognized by cybernetics, the value of both [positive feedback](#) and [negative feedback](#) in any integrated system has been argued separately (*Being Positive Avoiding Negativity: management challenge of positive vs negative*, 2005). The prevailing view is that if only the negative could be eliminated completely, all would then be well in a global system. This would seem to be cultivated from a "flat Earth" perspective which denies the underworld thereby implied, as can also be argued more fruitfully (*Designing Global Self-governance for the Future: patterns of dynamic integration of the netherworld*, 2010).

Encompassing globality by great circles: What might such great circle processes imply in cybernetic and psychosocial terms? As stressed in the main paper, the *Wu Xing* pattern offers indications which have been valued over millennia in China. Through the manner in which they are associated through metaphor with environmental processes, there is clearly a case for exploring the degree of integration they imply systemically. The further extension to psychosocial interpretation was also a feature of the discussion in the main paper.

Especially intriguing is the interlinking via portions of such great circles between the two variants of the *Pentagramma Mirificum*. As shown by the central screen shot above, those links form a criss-crossing pattern between white and black balls marking the vertices of the two pentagrams.

Horizon and visibility effects: When depicted in 2D, pentagrams and pentacles reinforce the illusion that the vertices are visible from each other. They are not. The projection of the 2D forms onto a sphere helps to show how these are "over the horizon" -- or "under it". Even when the vertices are marked with balls of some size, one ball is not necessarily visible from another. This is as true between those of one *Pentagramma Mirificum* as with respect to the visibility of balls between such forms.

This is usefully indicative of the relative invisibility of the domains or functions with which each ball may be associated through metaphor or otherwise. In contrast with assumptions reinforced by conventional network maps in 2D, global connectivity may require other

insights. The issue then raised is the implication of curvature. Ironically this has long been a primary preoccupation in the case of missile ballistics. Curiously the relevance has not been appreciated in the psychosocial case. A "curveball" is a deprecatory term in communication, although the skill required may be admired in sport, for example Value is attached primarily to being "straight" -- avoiding what may be necessary in a global context to sustain fruitful discourse between a requisite variety of perspectives.

With such mutual invisibility around a sphere, it is no wonder that disciplines and institutions with distinctive preoccupations consider themselves to be mutually irrelevant in many respects. As the continents of the planet indicate, they may well be on contrasting "sides" of the Earth. It might be asked how, for example, the UN Specialized Agencies understand such curvature in their desperate efforts to elaborate "global plans" -- usefully recognized as a contradiction in terms from a geometrical perspective. The point can be argued provocatively (*Adhering to God's Plan in a Global Society: serious problems framed by the Pope from a transfinite perspective*, 2014). Missives from one domain to the other need to take account of curvature in some way.

Knight's moves and connectivity via metaphor: As noted above, the main paper drew attention to the strategic dynamics of the Knight's move in chess, with its [correspondence in go](#) (see chess animation above). These offer a pattern for metaphor as being orthogonal to conventional linearity in communication. The pentagram pattern is the formalization of the *non sequitur*, otherwise deprecated in the logic of conventional discourse (irrespective of its role as a [literary device](#)). The *Wikipedia* entry on [orthogonality](#) offers a valuable summary of the challenges this constitutes to communication in various domains. For example: *In communications, multiple-access schemes are orthogonal when an ideal receiver can completely reject arbitrarily strong unwanted signals from the desired signal using different basis functions.*

The principle criterion of the *Pentagramma Mirificum* is the pattern of right angles -- with such orthogonality being a key to the interlocking of the form around a sphere, and the associated emergence of the complementary form. In that sense **the *Pentagramma Mirificum* is a self-closing cycle of non-sequiturs in which connectivity is ensured by metaphor.**

Metaphor enables the conventional constraint of linearity on connectivity to be transcended -- notably that between information silos. Ironically it might be said, following the argument of the introduction with respect to birds, metaphors enable arguments to "fly". The point is carefully argued by [Douglas Hofstadter](#) and [Emmanuel Sander](#) (*Surfaces and Essences: analogy as the fuel and fire of thinking*, 2013).

Strategic "challenges" and "new thinking": The confrontation of a strategic process with an "intractable challenge" can be usefully explored in terms of orthogonality. The "business-as-usual", through which it is assumed that a "plan" may otherwise be pursued, is then recognized as "not fit for purpose" in "global" terms -- psychosocially understood.

The quality of unconventional, creative thinking associated with the Knight's move is then appropriate -- understood here as indicative of a metaphor appropriate to reframing the situation to achieve global connectivity -- within an essentially global system. Unfortunately metaphor may well be deprecated as inferior thinking in various modes of conventional strategic discourse -- especially when arguments have to be clarified by visualization.

The main paper drew attention to the pattern of [15 global strategic challenges](#) highlighted by [The Millennium Project](#). The 15 elements through which the *Pentagramma Mirificum* is constructed offer a mapping of both such strategic "blocks" and the possibility of bypassing them through the orthogonality of "new thinking". The associated recognition of the complement through that construction -- its emergence -- offers a further indication of the need to integrate "positive" and "negative" to constitute a viable global strategic system.

That argument also drew attention to the recognition by [Christopher Alexander](#) of 15 transformations which could then be similarly understood as associated with the points of orthogonality (*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). In the light of this work, these transformations are discussed separately (*Harmony-Comprehension and Wholeness-Engendering: eliciting psychosocial transformational principles from design*, 2010). The latter noted that the simplest **regular** polyhedron with the geometric properties that could accommodate these 15 transformations is the [icosahedron](#). This is clarified by the Wolfram Demonstration Project of a dynamic variant by [Sándor Kabai](#) (*Fifteen Great Circles on a Sphere*) showing:

- three [golden rectangles](#) at right angles to each other determine the vertices of an icosahedron.
- there are 15 different circles through the pairs of opposite edges of the icosahedron.
- these circles are the [great circles](#) of a sphere circumscribing the icosahedron, since they are in the plane of the golden rectangles, and by one definition, a great circle is the intersection of a sphere and a plane passing through the center of the sphere.

In exploring the *Geometrical configuration of Alexander's 15 transformations*, the argument illustrated the succession of 17 fully 'supported stellations' of the icosahedron.

However the 5 great circles of the 2-fold *Pentagramma Mirificum* delineate an **irregular** polyhedron.

Cognitive metabolic pathways and polyhedral patterns : In the light of [biomimicry](#), these arguments suggest that there is a case for using the metaphor of [metabolic pathways](#) to explore the role of the great circles in providing coherence to a global system.

The 2-part *Pentagramma Mirificum* could be considered as indicative of a form of minimal cognitive system to enable global cognitive circumnavigation. It recalls the cybernetic preoccupations of [Stafford Beer](#) with a [viable system model](#) (VSM). He subsequently adapted this thinking to groups, as articulated in his presidential address to the World Organization of Systems and Cybernetics (*World in Torment: a time whose idea has come*, 1993), and thereafter (*Beyond Dispute: the invention of team syntegrity*, 1994).

The possibility invites a variety of complementary, and potentially convergent, approaches highlighting the value of visualization based on sets of related size (in this case factors of 5 and 6):

- *Correspondences between Traditional Constellations and Pattern Languages: requisite simplicity for sustainable comprehension*

of complexity (2014)

- *Dynamic Exploration of Value Configurations: interrelating traditional cultural symbols through animation* (2008).
- *Memetic Analogue to the 20 Amino Acids as vital to Psychosocial Life?* (2015)
- *Convergence of 30 Disabling Global Trends: mapping the social climate change engendering a perfect storm* (2012)

Embodying symbols of globality and identity

Dual Pentagramma Mirificum as a metaphorical framework for identification and embodiment? To the extent that the spherical configuration can be understood from a cybernetic perspective as indicative of a comprehensive global system, it can be explored as a means of mapping cognitive processes by a person or a group.

This could be considered following the arguments of Stafford Beer, or in recognition of the manner in which the mapping constitutes a form of mandala traditionally used by individuals to that end. As an exercise in rendering explicit what may be otherwise considered implicit in the symbolism of the pentagram / pentacle / pentagon pattern, the question is then the further insights that emerge through integrating the *Pentagramma Mirificum* as a duality in relation to globality.

"Star wars" enabled by symbols of identity: It is remarkable the extent to which countries of the world make use of [stars in heraldic devices](#), most notably their flags. In many cases, across fundamental political and religious divides, use is made of the 5-pointed star -- 50 figure on the US flag for example. They have been as common in those of communist regimes as in those of Islamic countries. Other examples are based on 6-pointed, 7-pointed, 8-pointed, and more (conveniently summarized in the *Wikipedia* entry). Why is this considered meaningful in evoking a sense of individual or collective identity?

Mention was made above of the "star wars" characteristic of the ongoing battle between cultures variously inspired by 5-fold and 6-fold stars, and the possibility for transcending that framework in some way, as separately argued (*Middle East Peace Potential through Dynamics in Spherical Geometry: engendering connectivity from incommensurable 5-fold and 6-fold conceptual frameworks*, 2012).

Immersion in symbols of identity via virtual reality representations: Much is made of the feeling of [immersion in virtual reality](#) scenes and the sense of reality that is carefully cultivated to that end -- most notably in online gaming. This is the perception of being physically present in a non-physical world. The perception is created by effectively surrounding the user with images, sound or other stimuli that provide an engrossing total environment. Use of an appropriate application to view the *Pentagramma Mirificum* can be considered in this light -- although a deeper sense of immersion can be achieved with more sophisticated environments. Thus it is possible (even with the legacy Cortona facility) to zoom into the configuration and to "be inside it" and view it from within (as within a chamber).

It could be considered extraordinary that central symbols of a culture can now be "visited" in this way -- recalling the role and architecture of temples with their evocative iconography. These continue to be constructed at great cost to this end. The pattern is replicated in the architecture of national and international agencies.

Beyond the issues cultivated for online gamers, the question is **what could be the psychosocial implications of "getting inside" one's national, group or religious symbol?** The *Wikipedia* entry on the immersive experience comments:

The name is a metaphoric use of the experience of [submersion](#) applied to representation, fiction or simulation. Immersion can also be defined as the state of consciousness where a "visitor" ([Maurice Benayoun](#)) or "immersant" ([Char Davies](#))'s awareness of physical self is transformed by being surrounded in an artificial environment; used for describing partial or complete [suspension of disbelief](#), enabling action or reaction to stimulations encountered in a virtual or artistic environment. The degree to which the virtual or artistic environment faithfully reproduces reality determines the degree of suspension of disbelief. The greater the suspension of disbelief, the greater the degree of presence achieved.

Long before the technology had enabled it, the possibility of (collectively) exploring **knowledge structures** in this way was envisaged by [Douglas Engelbart](#) (*Augmenting Human Intellect: a conceptual framework*, 1962) who continued to promote the possibility (*Toward augmenting the human intellect and boosting our collective IQ*, 1995). However the issue of further interest is the implication in **symbolic structures** explored by such a process, and the extent to which it enables forms of identity and embodiment. The question could be framed in terms of **value structures**, as explored separately (*Dynamic Exploration of Value Configurations: interrelating traditional cultural symbols through animation*, 2008).

Can personal identity be carried by such embodiment -- as is implied to a degree with use of the mandala? To what extent can one's sense of identity be enabled, held and sustained by such a process?

Topological decomposition of the symbolic experience: Symbols are of course conventionally displayed to be "viewed" from without. There has been little interest in the possibility of exploring them "from within". The *Pentagramma Mirificum* is indicative of one such possibility. The experience could of course be enhanced by rendering more explicitly what the portions of the symbol might denote -- returning to the association made to the 5-fold *Wu Xing* cycle, for example. This might be done by allusion as with the skills of interior decoration.

Potentially more provocative is the possibility of exploring in this way a symbol which is much more widely recognized, namely the representation of the insights of the [Kabbalah](#), with its strong association with Judaism. This is schema of 10 [Sefirot](#) in 3 columns, as a tree of life with roots above and branches below. There is an intriguing irony to the emphasis in the above argument on 5-fold patterning, further to that in the main paper. The irony derives from the fact that the 10-fold duality of the 5-fold *Pentagramma Mirificum* bears a striking resemblance in terms of its connectivity to that of the traditional depiction of the 10-fold Sefirot.

Especially intriguing with virtual reality technology (and associated applications) is the capacity to "decompose" any symbolic structure into its elements, namely to allow its parts to remain linked but to "loosen" the connections between them. It is the topological connectivity which is then fundamental, rather than any particular way in which they can be brought together.

In the case of the Kabbalah there are various web resources on the Kabbalah in 3D. Especially intriguing is a YouTube video in which the parts are indeed exploded and recombined (*3D Tree of Life (Kabbalah)*). There are of course a number of more complex video variants exploiting iconography. These can be considered as distracting from the underlying topological relationships -- or enhancing an advocated experience (see, for example, Steven Ashe, *The Qabalah Codex Video*)

Generic possibilities in the topology of cultural symbols?

Such exercises then frame the question of how seemingly disparate cultural symbols might be compared and interrelated through their experience in virtual reality. In this case, how different is the structure of the *Pentagramma Mirificum* from the Kabbalah in topological terms? Can the one be fruitfully mapped onto the other? How are differences to be interpreted as misrepresentation (and loss of vital distinctions) or suggesting further insight?

The possibilities of exploration can be further extended, using common [morphing applications](#), by considering how different are disparate symbols in the light of how many topological operations are involved in morphing one into the other as part of the virtual experience. How can such structures be "collapsed" and "expanded", as is now familiar with use of map zooming facilities?

The Kabbalah also provides a valuable example because of the amount of work done on it, or inspired by it, from a mathematical perspective. Thus there are many references combining Kabbalah and topology. Of particular relevance, in the light of the cybernetic arguments above, is the work of Gabriel Burstein and Constantin Virgil Negoita (*Foundations of a postmodern cybernetics based on Kabbalah*, *Kybernetes*, 2011; *A Kabbalah System Theory of Ontological and Knowledge Engineering for Knowledge Based Systems*, *International Journal of Advanced Research in Artificial Intelligence*, 2013; *Kabbalah Logic and Semantic Foundations for a Postmodern Fuzzy Set and Fuzzy Logic Theory*, *Applied Mathematics*, 2014).

To what extent does such thinking apply to the *Pentagramma Mirificum*? More intriguing is the possibility that **the class of symbolic structures of this kind -- purporting to organize fundamental knowledge -- may lend themselves to even more generic exploration**. Consideration could for example be given to the nature of the relationship between the following, especially when understood as potentially indicative of dynamic cognitive processes:

- icosahedral and related patterns, as notably explored by Stafford Beer to dialogue processes, and applied to Christopher Alexander's transformations
- topological approaches, as notably applied to the Kabbalah, and to depictions by various cultures of the [Tree of Life](#) and the [Flower of Life](#) (Andrew Monkman, *Sacred Geometry - Flower of Life*, 2007), as discussed with respect to *Recognition of cultural icons within a pattern of nested circles? (Eightfold Configuration of Nested Cycles of Cognitive Transformations: meta-pattern of connectivity through a hypersphere?* 2012)
- patterns of systemic integration implied by the genetic code and the associated set of 20 amino acids, as notably explored by Chi Ming Yang (*The naturally designed spherical symmetry in the genetic code*, 2003; *On the 20 canonical amino acids by a cooperative vector-addition principle based on the quasi-20-gon symmetry of the genetic code*. 2003). The 16 genetic code doublets and their 20 cognate amino acids are fitted into a polyhedron model. Based on the structural regularity in nucleobases, and by using a series of common-sense topological approaches to rearranging the Hamiltonian-type graph of the codon map, it is identified that the degeneracy of codons and the internal relation of the 20 amino acids within the genetic code are in agreement with the spherical and polyhedral symmetry of a quasi-28-gon (an icosikaioctagon). Two evolutionary axes within the 20 standard amino acids are suggested. Further relationships have been noted by Tidjani Négadi (*A Connection between Shcherbak's arithmetical and Yang's 28-gon polyhedral "views" of the genetic code*, *Internet Electronic Journal of Molecular Design* 2003)

The question meriting exploration is why the patterns of numbers cited seem to prove so valuable to systemic integration. The [recognized significance of 20-fold patterning](#) are exemplified, for example, by the "groups of 20" of global governance, and the "twenty-fold way" in combinatorics (*Memetic Analogue to the 20 Amino Acids as vital to Psychosocial Life?* 2015). There is the implication that the amino acids are better understood as implying a mode of process organization intimately associated with metabolic pathways for which cognitive analogues are yet to be fully recognized. The fundamental issue is how "cognitive metabolism" is embodied and how "cognitive metamorphosis" is enabled -- issues explored by René Thom (*Structural Stability and Morphogenesis*, 1972; *Semio Physics: A Sketch*, 1990).

A generic approach to global organization of knowledge and cognition would seem to follow from references to generalization of Napier cycles and [Hamiltonian cycles](#) in relation to the particular instances cited (Eric W. Weisstein, [Hamiltonian Cycle](#), *MathWorld*; Johannes Böhm, *Generalized hyperbolic Napier cycles and their hyperbolic kernels*, *Jenaer Schriften zur Mathematik und Informatik*. 2008; Hans-Christoph Im Hof, *Napier cycles and hyperbolic Coxeter groups*, *Bulletin de la Société Mathématique de Belgique*, 1990). The concern of the latter with "negative curvature" might, for example, prove of value in addressing the strategic issues of so-called [wicked problems](#) (Jon Kolko, *Wicked Problems: Problems Worth Solving*, 2012). Of particular value to psychosocial application is the cited work of Stafford Beer (1994) and Christopher Alexander (2009).

In this respect, given the bloody conflicts engendered by what may be "superficial" understanding of elusive insights, the main paper indicated a case for exploration of mathematical theology, as separately argued (*Mathematical Theology: Future Science of Confidence in Belief: self-reflexive global reframing to enable faith-based governance*, 2011).

Given the nature of the immersive experience in virtual reality, how might belief be evoked and sustained by experiencing symbol structures in this way? How do the elements of the structure serve as vehicles (containers) and conduits (pathways) for belief and

conceptual processes -- especially when framed by metaphor?

Indicative possibilities are offered by the work of Steven M. Rosen (*Topologies of the Flesh: a multidimensional exploration of the lifeworld*, 2006; *Dimensions of Apeiron: a topological phenomenology of space, time, and individuation*, 2004; *Dreams, Death, Rebirth: a topological odyssey into alchemy's hidden dimensions*. 2014).

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