16 May 2022 | Draft

Memorability, Mnemonics, Maths, Music and Governance

Memory enhancement ensuring strategic credibility

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Introduction

In a period in which great emphasis is placed on the complexity of governance and the issues which it is required to address, remarkably little is said of the challenges to memory. This is evident in the case of decision-makers at the highest level and for the ordinary voter expected to approve strategic decision-making. The issue has also been argued more generally (*Comprehension of Numbers Challenging Global Civilization*, 2014).

One possibility has been specifically addressed through recognition of "dramatic situations" typical of crises -- whether recognized by leadership or familiar in narratives, fables and stories (*Thirty-six Dramatic Situations faced by Global Governance? Interrelating the array of narratives, plots, agendas, stories and conspiracy theories*, 2022). That argument invites further development from various perspectives.

Yet to be explained are the seeming preferences in practice for particular patterns of sets of elements, potentially of significance to the viable organization of governance -- as noted previously:

- *Requisite 20-fold Articulation of Operative Insights? Checklist of web resources on 20 strategies, rules, methods and insights* (2018)
- *Checklist of 12-fold Principles, Plans, Symbols and Concepts: web resources* (2011).\
- *Eliciting a 12-fold Pattern of Generic Operational Insights: recognition of memory constraints on collective strategic comprehension* (2011)
- *Pattern of 14-foldness as an Implicit Organizing Principle for Governance? Web resources* (2021)
- *Table of strategic structural attributions by number of elements* (2019)
- *Re-cognition of N-fold sets of "modes", "ways", "moves" and "ploys"* (2021)

Appropriateness and cognitive "goodness of fit"?

"Goodness of fit"? The earlier exercise with regard to "dramatic situations" frames the question as to whether any particular pattern of numbers is especially meaningful in relation to the significance with which it is variously associated. The focus here is the qualitative characteristics which have been associated with a 36-fold pattern, most obviously that of dramatic situations, especially from a Western perspective.. Somewhat surprisingly, that same pattern features in a fundamental manner in the traditions of other cultures.

Such considerations can be dismissed as coincidental and the consequence of arbitrary selection of factors -- as possibly suggested by the other patterns by which plots and narratives have been ordered. The assumption here is that the variety of instances through which a

36-fold pattern is favoured merits consideration as an indicator of a pattern that is experienced as ordering satisfactorily an array of elusive qualities. The pattern seemingly evokes a degree of conviction in relation to those qualities.

The conviction could be assumed to arise from some sense of a cognitive "goodness of fit" (Yori Gidron, *Goodness of Fit Hypothesis. Encyclopedia of Behavioral Medicine*, 2013). This term refers to the effectiveness of matching (fitting) a coping strategy to a situation's level of controllability, in relation to adaptation to stress. Whilst "goodness of fit" is primarily cited in relation to modelling of statistical data, the term is also used in a psychological context. More generally it could be understood as the sense of an explanation that "works", whatever that may be held to mean.

Another term for "goodness of fit" may be "appropriateness", and the challenges it poses for comprehension (*Comprehension of Appropriateness*, 1986). It is appropriate to ask whether there is any concern for the "goodness of fit" of the UN's 17 Sustainable Development Goals to the challenges of global governance -- most notably with respect to their memorability as a set and its uptake in practice (*Systemic Coherence of the UN's 17 SDGs as a Global Dream*, 2021).

More elusive is any sense that preference for any particular number may be culturally determined to some degree -- whether or not this is especially conditioned in practice by superstition, as with triskaidekaphobia or preferences for 8-fold patterns (*Systems of Categories Distinguishing Cultural Biases*, 1993). Any such superstition is naturally deprecated as a feature of modern arguments against numerology. Such deprecation is readily challenged by the unquestionable appreciation accorded to particular patterns in theology, most obviously 3-fold, 7-fold, 10-fold and 12-fold (*Mathematical Theology: Future Science of Confidence in Belief*, 2011).

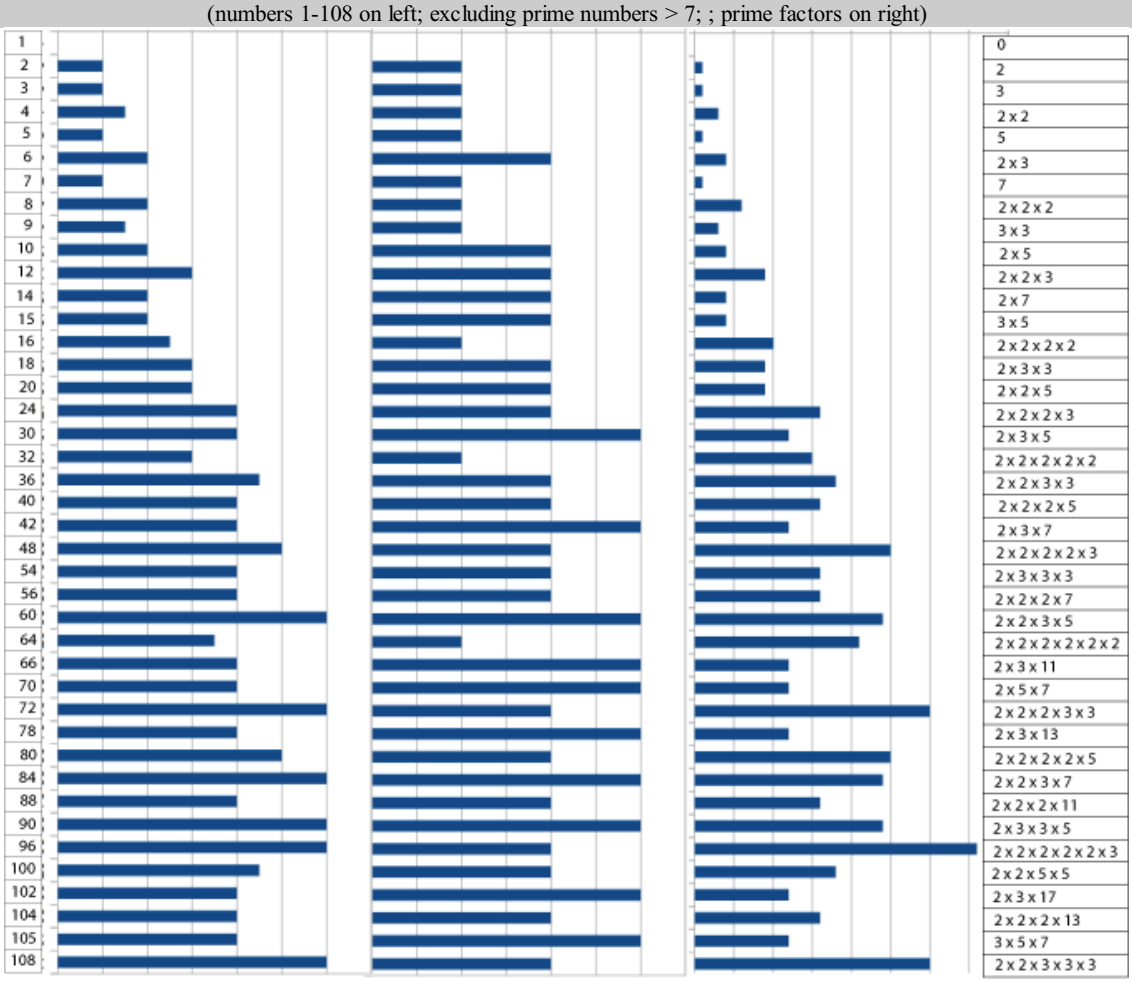
However deprecated, the implications of the recognition from some perspectives of auspicious and inauspicious numbers in practice would seem to be especially relevant to the credibility of any strategic initiatives. For example, *Feng Shui* offers a table of *81 Auspicious/Inauspicious Numbers* (*Which Numbers are Unlucky or Bad Numbers in Numerology*, *umastro*).

Memorability and number factors?

Another response to the argument for the arbitrary ordering of patterns (in the instances cited in the earlier exercise) is that it may prove to be the case that the memorability of patterns, especially more complex patterns, is enhanced and facilitated by the number of factors defining the N-foldness of the pattern. In the case of 36, as composite factors these are: 1, 2, 3, 4, 6, 9, 12, 18, and 36; as prime factors this reduces to 2x2x3x3 (or 2^2 x 3^2).

One simplistic exercise in distinguishing numbers by the number of factors is illustrated by three sets of bars in the following table. This is derived from distinct manipulations of the number of prime factors and composite factors associated with each number.

Towards a visual comparison of numbers in terms of memorability
(numbers 1-108 on left; excluding prime numbers > 7; ; prime factors on right)



Memorability and symmetry

Faced with complexity, recognition of symmetry is an obvious clue to memorability -- even as an attractor in its own right (*Symmetry as a strange attractor*, 2008).

Symmetry is extensively studied in mathematics (F. Attneave, *Symmetry, Information, and Memory for Patterns*, *The American Journal of Psychology*, 68, 1955, 2). This has notably resulted in the recognition of symmetry of the highest order -- a hyperobject beyond human comprehension -- otherwise known as the monster group. Speculatively it can be asked whether it offers clues to the high orders of complexity faced by governance (*Potential Psychosocial Significance of Monstrous Moonshine: an exceptional form of symmetry as a Rosetta stone for cognitive frameworks*, 2007). Potentially problematic however are the ways in which any such investigations are inhibited (*Dynamics of Symmetry Group Theorizing: comprehension of psycho-social implication*, 2008).

Memorability in relation to symmetry is extensively studied with respect to images -- but seemingly to a far lesser degree with respect to patterns of a given size (Phillip Isola, et al., *Understanding the Intrinsic Memorability of Images*, MIT, 2011). Sets patterned by number may merit the consideration inferred with respect to their enhancement of shared memories of relevance to any strategic initiative like the UN's Sustainable Development Goals (Wilma A. Bainbridge, *Shared memories driven by the intrinsic memorability of items*, 2021).

From that perspective, are some numbers intrinsically memorable? Ironically, irrespective of the potential relevance of memorability to governance, the primary research focus with respect to numbers is on the memorability of telephone numbers and passwords (Julie Thorpe, et al., *Graphical Dictionaries and the Memorable Space of Graphical Passwords*, *Proceedings of the 13th USENIX Security Symposium*, 2004). Should global strategic patterns feature in "graphical dictionaries"?

One approach of interest is through the much-studied symmetry-preserving operations framed by the Conway notation (*Memorability of cognitive implication in symmetry-preserving operations on polyhedra*, 2021; *Identifying Polyhedra Enabling Memorable Strategic Mapping: visualization of organization and strategic coherence through 3D modelling*, 2020).

Given the importance of numbers to theology -- indicative of an ultimate form of governance, as noted above with respect to mathematical theology -- of relevance is the study by Joseph Sommer, et al. (*The Memorability of Supernatural Concepts: some puzzles and new theoretical directions*, *Journal of Cognition and Culture*, 22, 2022, 1-2). The study evaluate the literature on the memorability of supernatural concepts (e.g., gods, ghosts, souls), itself part of a growing body of work in the emerging cognitive science of religion. Specifically, it focuses on the Minimally Counterintuitive (MCI) hypothesis according to which supernatural concepts tap a cognitively privileged memory-enhancing mechanism linked to violations of default intuitive inferences.

Memorability and types of number recognized by mathematics?

The representation above anticipates use of subtler insights by which numbers could be variously distinguished in terms of interestingness and memorability (*The Most Interesting Numbers*, Number Academy; David Wells,*The Penguin Dictionary of Curious and Interesting Numbers*, 1997). Whilst there is some debate regarding how some numbers might be distinguished as uninteresting, and the associated interesting number paradox, the debate does not extend to the relative memorability of those which are deemed to be interesting (Charles R. Greathouse, *Uninteresting Numbers*, 2018).

Especially relevant to this argument is the study by Marisca Milikowski and Jan J. Elshout (*What makes a number easy to remember? British Journal of Psychology*, 86, 1995, 4). As summarized by the authors:

> This study tested memory for number lists, using numbers between 1 and 100 in a list-learning task in which both recall and recognition tests were given to over 500 subjects. Stepwise regression on the memorability scores for each number between 1 and 100 indicated that four attributes made a significant contribution to the variance.... The order of memorability was
>
> > (a) single digit numbers,
> > (b) teen numbers (10-19),
> > (c) doubled numbers (e.g. 44, 77, 22),
> > (d) large tabled numbers (numbers which factor and therefore appear in the multiplication tables, such as 49, 36, 60, 84, 27), and
> > (e) other numbers that do not fall into any of these categories.
>
> While memorability for single digit numbers was above 80 per cent, that for other numbers (no subcategory) was only around 40 per cent.

There is a case for systematically extending the focus on categories (d) and (e) in the light of the following

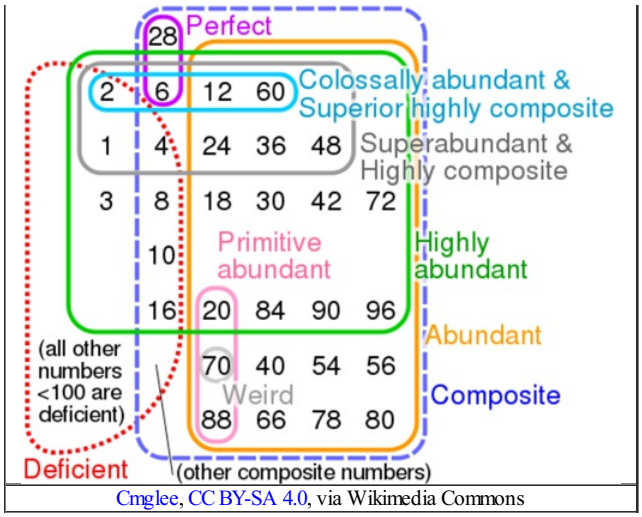
Tentative indication of criteria of memorability/forgettability of sets		
Pattern composition	More forgettable	More memorable
Larger numbers	Increasingly less memorable	
Larger prime numbers	Increasingly less memorable	
More composite factors		Possibly
More prime factors	Increasing with size of prime	Possibly
Squares of prime factors	Increasing with size of prime	Possibly
Cubes of prime factors	Increasing with size of prime	Possibly
Products of squares and cubes	Increasing with size of prime	Possibly

Many of the numbers above are distinguished in mathematics by the categories indicated below (and others), as extensively presented by William Tappe (*Number Theory: types of math numbers*, *Math Goodies*). Some may be correlated with memorability -- or even forgettability. Those of potential relevance to this argument are termed integer sequences -- having been recognized as memorable patterns (*On-Line Encyclopedia of Integer Sequences*, OEIS Foundation; *List of integer sequences*, *Wikipedia*). There are currently some 350,000 such sequences in the OEIS. Whereas there are initiatives towards the classification of integer sequences, missing is any classification of integer sequences in terms of memorability.

Indicative list of types of numbers identified by mathematics as integer sequences (with instances for numbers less than 108 in some cases; asterisked sequences excluded from mapping below)					
abundant numbers		12, 24, 36, 48, 60...	partition numbers	*	1, 1, 2, 3, 5, 7, 11, 15, 22, 30, 42...
-- primitive abundant numbers		20, 70, 88, 104...	Pascal's triangle numbers	*	
Baum–Sweet sequence	*		Pell numbers		1, 2, 5, 12, 29, 70...
Bell numbers		1, 1, 2, 5, 15, 52...	Pentatope numbers		1, 5, 15, 35, 70...
binomial coefficients	*		perfect numbers		6, 28...
Carmichael numbers	*		-- hyperperfect numbers	*	
Catalan numbers		1, 2, 5, 14, 42...	-- semiperfect numbers		6, 12, 18, 20, 24, 28, 30, 36, 40...
composite numbers	*		-- superperfect numbers	*	
-- highly composite numbers		1, 2, 4, 6, 12, 24, 36, 48, 60...	polygonal numbers	*	
-- superior highly composite numbers.		2, 6, 12, 60...	-- pentagonal numbers		1, 5, 12, 22, 35, 51, 70, 92...
Cullen numbers		1, 3, 9, 25, 65...	-- square numbers	*	
deficient numbers	*		-- triangular numbers		0, 1, 3, 6, 10, 15, 21, 28, 36, 45, 55, 66, 78, 91, 105...
Erdős–Woods number		16, 22, 34, 36, 46, 56, 64, 66, 70, 76, 78, 86, 88, 92, 94, 96, 100, 106...	-- square triangular numbers		0, 1, 36...
Euler numbers	*		-- trapezoidal numbers	*	
factorial numbers	*		prime numbers	*	
Fibonacci numbers		0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89...	-- home primes	*	
Figurate numbers	*		-- Pythagorean prime numbers		5, 13, 17, 29, 37, 41, 53, 61, 73, 89, 97, 101...
Golomb sequence	*		-- pseudoprime numbers	*	
Gnomon numbers	*		-- semiprime numbers	*	
Happy numbers	*		powerful numbers		1, 4, 8, 9, 16, 25, 27, 32, 36, 49, 64, 72, 81, 100, 108...
Harshad numbers		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 18, 20, 21, 24, 27, 30, 36, 40, 42, 45, 48, 50, 54, 60, 63, 70, 72, 80, 81, 84, 90, 100, 102, 108...	pronic numbers		0, 2, 6, 12, 20, 30, 42, 56, 72, 90...
highly totient number		1, 2, 4, 8, 12, 24, 48, 72...	Recamán's sequence	*	
Jacobsthal numbers		0, 1, 1, 3, 5, 11, 21, 43, 85...	regular paperfolding sequence	*	
Jordan–Pólya numbers		1, 2, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64.	Rudin–Shapiro sequence	*	
juggler sequence	*		Thue–Morse sequence	*	
Kolakoski sequence	*		Triangular pyramidal numbers		1, 4, 10, 20, 35, 56, 84...
Lucas numbers		1, 3, 4, 7, 11, 18, 29, 47, 76...	Tribonacci numbers	*	0, 1, 1, 2, 4, 7, 13, 24, 44, 81...
Lucky numbers		1, 3, 7, 9, 13, 15, 21, 25, 31...	Ulam numbers		1, 2, 3, 4, 6, 8, 11, 13, 16, 18...
Markov numbers		1, 2, 5, 13, 29, 34, 89...	Wedderburn–Etherington numbers	*	0, 1, 1, 1, 2, 3, 6, 11, 23, 46...
Mersenne numbers		1, 3, 7, 15, 31, 63...	weird numbers		70...
Motzkin numbers	*	1, 1, 2, 4, 9, 21, 51...	Wolstenholme number	*	
octahedral numbers		1, 6, 19, 44, 85...	Woodall numbers		1, 7, 23, 63...
Padovan numbers	*				

Some of the numbers indicated above are clustered in the following Euler diagram. In both presentations, and the bar charts above, the prominence of numbers highlighted in the earlier paper with respect to both dramatic situations and strategy would seem to justify a far more sophisticated exploration of memorable numbers as they determine pattern recognition and organization.

Euler diagram numbers with many divisors



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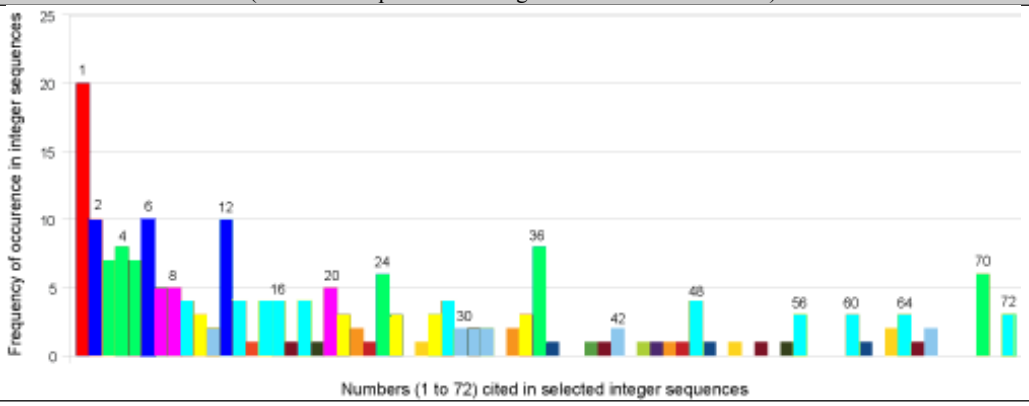
The exploration can be taken further through plotting numbers cited against the the frequency of occurrence of those numbers in the integer sequences above, as illustrated in the following. This necessarily excludes some series for which no numbers were indicated above, as well as those series in which a given number occurs more than once (typically 1). The occurrence bars have been coloured to offer a contrast between those of distinctive occurrence. The original "plus-or-minus 2" argument of Miller (1956) suggests that this could be applied to that colouring convention (used in making those distinctions on a periodic table below).

Frequency of occurrence of numbers (1 to 72) in selected integer sequences
(asterisked sequences in listing above have been excluded)



The results are consistent with those of Milikowski and Elshout (1995) as cited above, except for the doubled numbers (e.g. 44, 77, 22). Of relevance to this argument is that further detail is offered on other numbers larger than 20 and the role they may well play in memorability. They suggest that it is a high proportion of those termed "highly abundant" (in the Euler diagram above) which are potentially the most memoraable in relation to strategic articulation.

Clearly a more rigorous selection of integer sequences could be made for such an exercise, extending the pattern above to include larger numbers -- especially to identify those sequences which are of greater relevance to the issue of memorability, possibly excluding sequences which distort any such insight.

With respect to the articulation of strategies, it is interesting to note that 30 (as for the UNDHR) occurs with lesser frequency than 36 (the focus of the earlier paper on "dramatic situations"). The efficacy and viability of the articulation of other declarations of human rights (in terms of inclusions and omissions) also invites reflection in relation to the above pattern:

- the 18 articles of the *European Convention on Human Rights*,
- the 53 articles of the *Arab Charter on Human Rights*,
- the 82 articles of the *American Convention on Human Rights*.
- the 62 articles of the *African Charter of Human and Peoples' Rights*
- the 40 articles of the *ASEAN Human Rights Declaration*

It is unclear whether the *Declaration Toward a Global Ethic*, as promoted by the Parliament of the World's Religions, invites similar reflection.

The recognition by mathematicians that numbers can be metaphorically distinguished by "flavours" (as with the flavours of particle physics) is acknowledged in a diagram of less relevance to this argument (Charles R. Greathouse, *Flavors of Numbers*, *Math Forums*, 9 May 2013).

Other than as noted above (with respect to passwords, telephone numbers, and license plates), ironically there is little reference by mathematicians to "memorable numbers", especially as they might frame strategic initiatives (*What Makes a Number Memorable Mathematically? Suggestions*, *Math StackExchange*, 2019). By contrast, for mathematicians, the focus is on memorable equations (Marcus du Sautoy, *Learn to Love the Equation*, *The Guardian*, 9 May 2005). The author argues that the thought process needed to

master a mathematical formula is a skill that can empower anyone.

Learn to "love the strategy" in order to change the world?

- Adam Mann: *9 equations that changed the world* (*Live Science*, 22 December 2021;
- Maurizio Sluijmers: *10 Mathematical Equations That Changed The World* (*Medium*, 26 June 2020)
- Christopher McFadden: *10 of the Most Important Equations in History* (*Interesting Engineering*, 3 August 2019)
- Andy Kiersz: *The 17 equations that changed the course of history* (*Business Insider*, 13 March 2014)
- Ian Stewart: *17 Equations That Changed The World* (2013)

The curious consensus with regard to recognition of a 17-fold pattern invites speculation with regard to identification of the 17-fold pattern of the UN's Sustainable Development Goals, as explored separately (*Global dialogue via a 17-fold pattern of Sustainable Development Goals?* 2021; *Role of the 17-fold "wallpaper group" in ordering SDGs?* 2021). These note the little-recognized 17-fold constraint on what might be termed "cognitive tiling patterns", curiously exemplified by the 17-fold "wallpaper group" known to mathemticians. Of potential relevance, as discussed there, is also the *Higher dimensional coherence of SDGs implied by a set of 17 4-dimensional polyhedra?*). Such speculation is of course meaningless when ot is asserted that the UN's set of goals was quite arbitrary and in now way subject to cognitive constraints, whether conscious or unconscious.

Memorability and periodicity

With respect to music (rhyme and rhythm), rote learning (use of prayer beads), and symmetry, it is evident that periodicity is a contributing factor to memorability. This is also evident in commemorative ritual, especially as practiced by religion, whether the canonical hours of Christianity, the 5-fold *sala* of Islamic prayer, or the 3-fold pattern of Jewish prayer. Annual periodicity is evident in the liturgical calendar of Christianity, and the analogous rhythms in other religions.

Similar periodicity is evident in governance, from electoral cycles to reporting cycles -- possibly in relation to particular issues. Many institutions and organizations engage in periodic conferences. This is a process significant to the reinforcement of their sense of collective identity -- effectively an act of remembrance. Periodicity is especially relevant with respect to the daily news cycle.

As noted separately (*Periodicity and memorability through cycles and waves*, 2018), it is perhaps curious that efforts to represent and comprehend periodicity tend to take the form of periodic tables in 2D. As noted in an associated document (*Periodic engendering of distinctive otherness*, 2018), various tools are offered to facilitate rendering such tables memorable, most notably in the case of the periodic table of the elements.

To the extent that these represent arrays of othernesses, one could look in vain for a periodic tables of othernesses -- of relevance to their governance, and the challenge of anti-otherness. As suggested with respect to *Hyperreality and anti-otherness* (2018), both the periodicity and memorability can be understood as deriving from wave effects and the facility with which consciousness engages with them, most obviously in music and song.

The periodic table of elements offers a particular challenge in that many alternatives to the standard presentation have been proposed and explored, with some of quit extraordinary form:

- *Alternative periodic tables* (*Wikipedia*)
- *Representing the Periodic Table in Different Ways* (Michigan State University Alumni Association Knowledge Network)
- *Chemistry: New Periodic Table of The Elements* (2008)
- Nick Norman: *Periodic Table: scientists propose a new way of ordering the elements* (*The Conversation*, 28 November 2020)

The nature of the challenge for mathematicians is usefully highlighted in mathematical terms by Denis H. Rouvray and R. Bruce King (*The Mathematics of the Periodic Table,* 2005).

Presented as a suitably provocative interactive site by *Wired*, *The Periodic Table of Periodic Tables* (2018) notes that the web offers hundreds of periodic tables and many collections of periodic tables (Mark R Leach, *The INTERNET Database of Periodic Tables*, *Chemogenesis*). It does not however appear to include any "periodic table of numbers" (*Nu* in the *Wired* compilation?). Indeed the question was asked on the *Mathematics StackExchange* in the form: *Is there a best way to organize numbers so that it identifies the most traits within each number?* (*Is there a "periodic table" for numbers?* 2018). The question was answered in the negative; there is seemingly no such table. Responses are now closed although links are offered to sites of potential relevance, including the following:

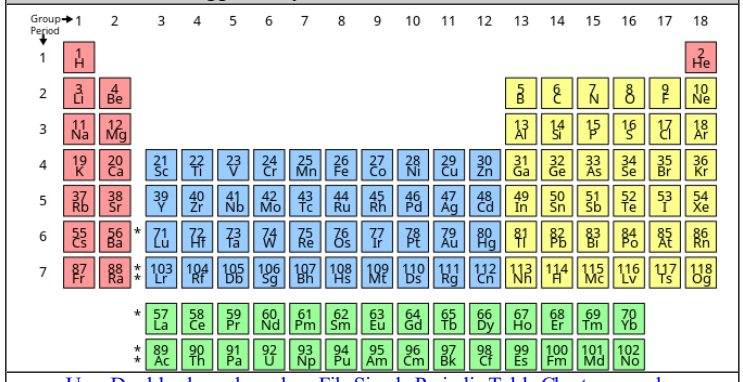
- *Properties of the First 5000 Integers* (by Robert Munafo) which gives for most numbers the classical sequence for which the number is generated with the lowest "cost", defined as the sum of a sequence's complexity score (scoring details) and a value of N for which A_N equals the number (Robert Munafo, *Notable Properties of Specific Numbers*)
- *The Database of Number Correlations* (*The Virtue Science Philosophy*)

Inspired by such patterns, possibilities meriting exploration in relation to memorability include: *Periodic Pattern of Human Knowing* (2009) and *Tuning a Periodic Table of Religions, Epistemologies and Spirituality -- including the sciences and other belief systems* (2007).

The study by Milikowski and Elshout (*What makes a number easy to remember? British Journal of Psychology*, 1995), noted above, concluded that degrees of memorability could be ranked firstly by single digit numbers, then by teen numbers (10-19), then by doubled numbers (e.g. 44, 77, 22), then by numbers which factor (appearing in the multiplication tables), followed by other numbers. It is somewhat curious to note that the form of the *Periodic table of elements* could be seen as indicative of this, given the relative memorability of elements in the first four periods.

This is suggestive of an approach to a *Periodic table of memorability* -- especially in the light of the surprising forms of the alternatives proposed. As a process of scientific pattern recognition, elaboration of the form of the standard table could then be seen as indicative of the elaboration of a periodic table of memorability. The various interpretations of the table of elements as manifestations of periodicity suggest the possibility of applying analogous distinctions to the qualities and properties of numbers as they may be of relevance to memorability.

Periodic table of memorability
as suggested by the Periodic table of elements?



Periodic pattern language as a mnemonic aid to distinguishing strategic styles?

Metaphor: With the focus in this argument on human cognitive engagement with patterns of numbers, whether recognized by human mathematicians or otherwise, the arguments of George Lakoff and Rafael E. Núñez are of particular relevance (*Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2000). One indication is offered by the generalization of the periodic table by Edward Haskell (*Full Circle: the moral force of unified science*, 1972).

Of particular relevance in inviting greater speculation regarding underling periodic patterns -- distinguished by the Royal Institution as the best science book ever written -- is the work by Primo Levi (*The Periodic Table*, 1975). Patterned on analogies between the elements and a variety of human types, it develops a mode of imagining reality that is striking in its fusion of physical, chemical and moral truths. It remains a focus of continuing reflection:

- Tim Radford: *In his element: looking back on Primo Levi's The Periodic Table* (*Nature*, 28 January 2019)
- Tim Radford: *The Periodic Table: Primo Levi's elementals of life, suffering and death* (*The Guardian*, 9 October 2009)
- Alvin H. Rosenfield: *Elements of a Life: the Periodic Table* (*The New York Times*, 23 December 1984).
- Patrick T Reardon: *"The Periodic Table" by Primo Levi* (4 September 2019)
- Philip Ball: *The Other Periodic Table* (*Chemistry World*, 24 June 2019)

For the latter, chemistry is treated by Levi as a metaphor for human relations -- "a trick not tried since Goethe's 1809 novel *Elective Affinities*".

Of relevance is the role of metaphor in physics as argued with respect to the appreciation of light by Einstein (**). For Hanna Pulaczewska (*Aspects of Metaphor in Physics: examples and case studies*, 2011):

> By means of a broad definition of metaphor as a lexical, semantic, and conceptual phenomenon, metaphor is identified at various levels of physics discourse: in metatheory and methodology; in the sociology of the origin and evolution of science; in theory and conceptualization, including physics models; in education; and finally in linguistic expression, including terminology. Whereas historians and theoreticians of science reduce the question of metaphor in physics to the question of the role of scientific models, where one area of physics provides concepts and structures for another area, the perspective adopted here is that of cognitive semantics. The study inquires into the way in which concept-formation and terminology in physics avails itself of the metaphoric bent immanent in everyday language, conceptualizing abstract ideas in spatial terms, inanimate things as intelligent, measurable phenomena in terms of the visual. Attention is also given to the way in which metaphoric processes make it possible to integrate new knowledge into old and sometimes obsolete structures rather than eliminating those structures altogether.

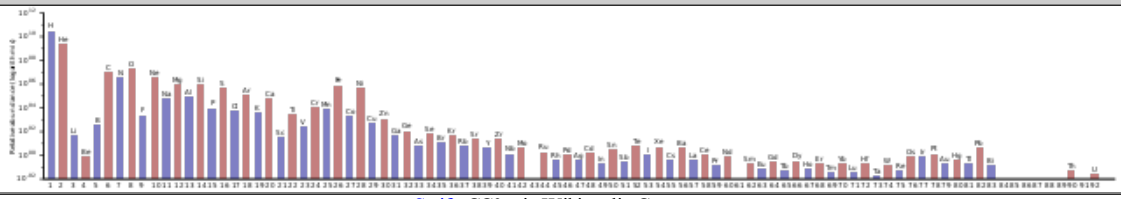
Pattern language: The question such initiatives raise is whether the periodic pattern of elements is indicative of an insightfully articulated pattern language through which the elements of global strategy might be fruitfully ordered. Rather than deprecating the possibility as an instance of psychosocial science "envy" of the natural sciences, is it the case that human cognitive organization might well take a form of which the periodic table is one instance. The frustration with its organization (as indicated above in the quests for alternatives) is then comparable to the frustration that is obvious with respect to the organization of global strategy and its governance. Is there a case for recognizing that strategies may have a "deep structure" comparable with the well understood deep structure of atoms distinguishing their periodicity?

Relative abundance of elements: In the light of the preliminary exercise in the identification of the relative occurrence of numbers in recognized integer sequences (presented above), recognizing the degree to which the chemical elements are organized as a sequence of atomic numbers (as shown above), one approach is comparison of strategic articulations with the relative occurrence of such elements:

- *Abundance of the chemical elements* (*Wikipedia*)
- *Abundance in the Universe of the elements* (*Periodictable*)
- *Abundance in Humans of the elements* (*Periodictable*)

Wikipedia offers the following indication of their relative abundance:

Abundance of chemical elements in the Universe



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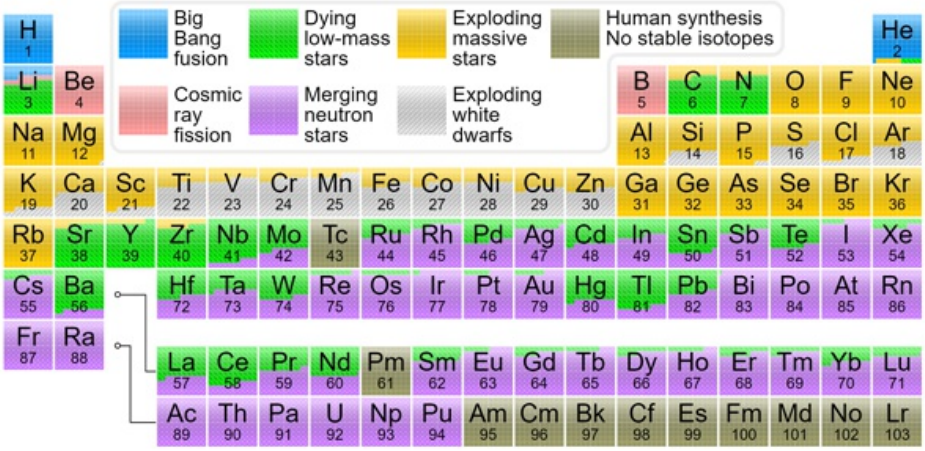
Energy as information -- and vice versa: An intimate fundamental relationship is now recognized between energy and information, whether from the perspective of the philosophy of information or understandings of energy as information, or of information as energy (Arend van Campen, *Governance by Information as Energy*, 20 February 2020; A K Mukhopadhyay and A S Mukhopadhyay, *Visualizing Information as a Dynamic Entity: roadmap of deep science, AI and humanity*, *Psychology and Behavioral Science*, 15 October 2019).

It may then be fruitful to recognize that an atomic number reflects a particular way of organizing information, as evident in the configuration of atomic orbitals whereby the chemical elements are distinguished. There is then an intriguing possibility underlying Miller's "magic number seven" (as cited above) whereby constraints on information processing of humans might be related to the patterns in the periodic table (John, S. Nicolis and Ichiro Tsuda, *Chaotic Dynamics of Information processing: the "magic number seven plus-minus two" revisited*, *Bulletin of Mathematical Biology*, 47, 1985, 3).

Speculative insights: The cognitive argument of Lakoff and Núñez as to *Where Mathematics Comes From* (2000) can be provocatively extended to encompass the process by which the elements are distinguished -- using the following variant of the periodic table. The speculative approach follows from frequent metaphorical use of "universe" in relation to human knowledge, and from recognition of its celebrities as "stars". With respect to the following table, this invites metaphorical recognition of:

- "big bang fusion" as the dramatic encounter between unitary strategic initiatives and dualistic opposition typical of partisan government
- "exploding mass stars" as the explosion of particular worldviews, whether revolutionary or otherwise
- "dying low-mass stars" as strategic insights arising from end-of-life learnings from low uptake initiatives
- "merging neutron stars" as fusion of separate spheres of cultural creativity
- "exploding white dwarfs" as engendered by revolutionary initiatives
- "cosmic ray fission" as a consequence of strategic revelation
- "human synthesis" as evident in unsustainable strategic proposals of low half-life

Metaphorical interpretation of the origin of distinctive elements
using a periodic table showing the cosmological origin of each element



Cmglee, CC BY-SA 3.0, via Wikimedia Commons

The speculative metaphorical recognition of a universe of knowledge -- of "knowledge space" -- is further explored separately (*Towards an Astrophysics of the Knowledge Universe: from astronautics to noonautics?* 2006; *Beyond the Standard Model of Universal Awareness: Being Not Even Wrong?* 2010).

Metaphorical interpretation of contrasting elements: A selection of individual elements feature in *MetaMia: analogy as a teaching tool*. As a pattern language, the properties of the chemical elements (commonly recognized in relation to the organization of the periodic table) merit other consideration as a metaphorical indication of distinctions which could be usefully made between styles of strategic initiative:

- electronegativity: this is the tendency of a given chemical element to attract shared electrons (or electron density) when forming a chemical bond. It is affected by both its atomic number and the distance at which its valence electrons reside from the charged nucleus. In general, the greater the difference in electronegativity between two atoms the more polar the bond that will be formed between them, with the atom having the higher electronegativity being at the negative end of the dipole. Electropositivity is a measure of an element's ability to donate electrons, and therefore form positive ions. This is an attribute of metals, meaning that, in general, the greater the metallic character of an element the greater the electropositivity. While electronegativity increases along periods in the periodic table, and decreases down groups, electropositivity decreases along periods (from left to right) and increases down groups.
    - *How is the common distinction between "negative" and "positive" in relation to strategic initiatives to be understood in this light?*
    - *Controversially, are "negative" strategies typically proactive (even problematically so) in contrast with "positive" strategies -- or is the reverse the case?*

- valency: variously defined, this is a measure of the combining capacity of an element with other atoms when it forms chemical compounds. An element may be understood as having different valencies under different conditions. Versions of the preriodic table distinguish elements by their maximum number of valencies.
    - *Is the recognition of valence by psychology comparable with the distinct valencies of the chemical elements? For psychology, it is the affective quality referring to the intrinsic attractiveness "good"-ness (positive valence) or averseness "bad"-ness (negative valence) of an event, object, or situation (D. Liu, et al. Emotional valence modulates arithmetic strategy execution in priming paradigm, Experimental Brain Research, 239, 2021). However this does not offer the degrees of valency so fundamental to chemistry.*
    - *Are strategies to be distinguished in terms of their relative attractive and repulsive capacities? This would encompass those which are held to be "gruesome but necessary" (Gruesome but Necessary: global governance in the 21st Century? 2011).*
    - *Can strategies be distinguished by their valency, perhaps in the light of the degree to which they conform in practice to the principles they embody -- as with recognition that communism, democracy and religions may all be "good" but typically take problematic forms*? (Claudia Ogrean, *The Valencies of "Value" for the Strategic Management Process*, *Studies in Business and Economics, 11, 2016, 1; R. M. W. Dixon and Alexandra Y. Aikhenvald, Changing Valency: case studies in transivity, 2010). That point is made by the critical remark of Mahatma Gandhi with regard to "western civilization" being a "good idea".*

- oxidation state, or oxidation number, is the hypothetical charge of an atom if all of its bonds to different atoms were fully ionic. It describes the degree of oxidation (loss of electrons) in a chemical compound. The oxidation state may be positive, negative or zero, making oxidation state a useful predictor of charge (*List of oxidation states of the elements*, *Wikipedia*).
    - *Given the manner in which the widely recognized oxidation process of rust is borrowed as a metaphor -- "rusty" -- to refer to erosion of memory, degrees of "rust" or "tarnish" then suggest degrees of forgetfulness. By contrast metaphorical reference is made to the value of "oxygen" (John Tamny, Economic Crisis Is the State's Oxygen, American Institute for Economic Research, 9 March 2020; Calixto V. Chikiamco, What the economy needs is oxygen, Business World, 21 February 2021). Oxidative damage is however associated with neurodegenerative disorders such as Alzheimer's disease (Carmelina Gemma, et al, Oxidative Stress and the Aging Brain, 2007).*
    - *This frames the question as to how strategies "rust" and are forgotten, and how they may be memorably reinvigorated though "oxygen" -- perhaps questionably so (Bill McKibben, Money Is the Oxygen on Which the Fire of Global Warming Burns, The New Yorker, 17 September 2019). With degrees of rust recognized as an indication of structural failure, is the "oxidation of memory" to be explored as an indication of vulnerability to systems failure through forgetfulness (Variety of System Failures Engendered by Negligent Distinctions, 2016)?*

- physical properties:
    - alkali metals (five elements of group 1) with which hydrogen is included. Because of their high reactivity, they are found naturally only in salts and never as free elements. Special measures must be taken for their storage to prevent reaction with air.
        - *This metaphorical exercise invites speculative identification of highly "reactive strategies". Reactive strategies are actions, responses and planned interventions in response to the presentation of identifiable behaviour that challenges (Reactive strategies Positive Behaviour Support features approaches designed to respond to challenging behaviour when it occurs, United Response).*
        - *The key difference between proactive and reactive strategies is that the proactive strategy is avoiding the situation by foreseeing, whereas reactive strategy is responding after an incident has occurred. (Difference Between Proactive and Reactive Strategies 10 June 2019). Of potential interest is the sense in which such reactive strategies may have to be "hidden" or "disguised" in some way, because of that reactivity*
        - *Primo Levi devotes 2 chapters to the metaphorical interpretation of the elements hydrogen and potassium (in periods 1 and 4)*

    - alkaline earth metals (six elements in group 2), described as having very similar properties, namely all shiny, silvery-white, somewhat reactive metals at standard temperature and pressure. Those of lower period are essential to biological life.
        - *That many such elements may be essential to biological life, suggests their analogous value for psychosocial life.*
        - *Are some strategies to be recognized as "shiny, silvery-white" -- as presented for public appreciation and uptake, possibly by the "silver-tongued" (Adam Boone, Marketing Full Disclosure: new and shiny marketing strategies, 20*

April 2017; L. C. Kidder, The Siren Call of the Shiny, For the Love of Teaching, 12 July 2017).

- transition metals (elements in groups 3 to 12) recognized as atoms with a partially filled inner layer of electrons and having a typical typical chemistry (a large range of complex ions in various oxidation states, coloured complexes, catalytic properties, a degree of paramagnetism, and conductors of electricity)
  - *Are there styles of strategy which merit distinction as "metallic"? With the implication of certainity and concreteness characterized by many commercial contracts, some strategies are indeed recognized as "iron-clad" (R. L. Adams, These Are the Iron-Clad Strategies for Making Money Online, Entrepreneur, 15 December 2016; Ironclad Strategies Review, 1 March 2022).*
  - *Metaphorical reference to "silver", and especially "gold", is also evident with respect to strategy, notably as a "golden opportunities" or the nostalgic quest for a "golden age". Using the terminology of the western tradition of alchemy (cf. John Opsopaus, The Rotation of the Elements, 1995), the much-deprecated conventional understanding of the Magnum Opus -- the transformation of lead into gold -- can then be reframed as the transformation of fixity into cyclicity. In these terms, metaphorically, "gold" is the dynamic through which fixity ("lead") is re-engendered and is thereby malleable as a phase in a process (Reframing the "gold standard" evaluation of human life, 2018).*
  - *Primo Levi devotes 9 chapters, the majority, to the metaphorical interpretation of these elements: titanium, vanadium, chromium, iron, nickel, zinc, silver, gold, mercury (in periods 4, 5 and 6)*

- post-transition metals: these are variously distinguished metallic elements between the transition metals and the chemically weak nonmetallic metalloids. These metals are soft (or brittle), have poor mechanical strength, and usually have melting points lower than those of the transition metals.
  - *Primo Levi devotes 2 chapters to the metaphorical interpretation of these elements: tin and lead (in periods 5 and 6)*

- metalloids: a type of chemical element which has a preponderance of properties in between, or that are a mixture of, those of metals and nonmetals. There is no standard definition of a metalloid and no complete agreement on which elements are metalloids. All six of the elements commonly recognized as metalloids have toxic, dietary or medicinal properties
  - *Styles of strategy are presumably to be distinguished as "toxic", "dietary" or with remedial properties. As with chemical elements, there is every possibility that a clear definition of such strategies would remain elusive -- despite claims to the contrary.*
  - *Primo Levi devotes 1 chapter to the metaphorical interpretation of the element arsenic (in period 4)*

- nonmetals: range from colorless gases to shiny and high melting temperature solids. They are moderately to highly electronegative, tending to attract electrons in chemical reactions and to form acidic compounds. Living organisms are composed almost entirely of the nonmetals hydrogen, oxygen, carbon, and nitrogen
  - *In contrast to the "iron-clad" definitions of "metallic strategies" perceived as of relatively little significance to life, it is appropriate to suspect an array of strategic styles which are essential to psychosocial life as experienced.*
  - *Especially significant would be the tendency of such strategies to take "gaseous" form -- characteristic of the fluidity, uncertainity and insubstantial nature of qualitative life under most conditions. Any strategy would then tend to be ungrounded in contrast to any preference for the metallic array.*
  - *Primo Levi devotes 4 chapters to the metaphorical interpretation of the elements: carbon, nitrogen, phosphorus and sulphur (in periods and 3)*

- halogens: (5 or 6 elements in group 17) which react with metals to produce a wide range of salts, and form acids when bonded to hydrogen. They are the only group that contains elements in three of the main states of matter at standard temperature and pressure.
  - *In their free form these are recognized as toxic, even extremely toxic. There is presumably a range of strategic styles which merit that appreciation in relation to psychosiocial life -- despite their value in combination with other styles.*

- noble gases: (elements in group 18) which are typically inert, odourless, colourless, monatomic gases with very low chemical reactivity.
  - *The "inertness" of strategic articulations of this kind could well be associated with a sense of their complete nature, suggesting that this might be typical of declarations of principles beyond question -- and therefore "inactive" in being disengaged from polarising controversy*
  - *Primo Levi devotes a single introductory chapter to the metaphorical interpretation of the element argon (in period 3)*

- other categories characterized by properties relating to the deep structure of their elements are:
  - lanthanides, namely the 15 metallic chemical elements with atomic numbers 57-71. These elements are often collectively known as the rare-earth elements
  - actinides, namely the 15 metallic chemical elements with atomic numbers 89-103.
- radioactive elements, primarily the elements in group 7 (together with the actinides), with some exceptions in group 6. However all elements may have radioactive isotopes. Many are unstable with periods of decay from seconds to thousands of years.

- *As a qualitative descriptor, radioactive is a focus of commentary (Daniel Fraser, Radioactive Figurative Language, 23 October 2013). Of some relevance to this argument, the Merriam-Webster dictionary offers an extensive commentary on radioactive, noting that: The figurative use of the word now typically carries the meaning of "so divisive or controversial as to require avoidance" (Getting Too Close to 'Radioactive' Its meaning has broadened but not decayed).*
- *Indications of some relevance regarding radioactive decay are offered by MetaMia.*
- *For Tony Myles some personal relationships may be experienced as radioactive (Navigating Radioactive Relationships, LifeTree, 2016)*
- *For Yolanda Gampel:*
  - *The metaphor of radioactivity, transformed into the concept of "radioactive core", emerged in the context of studies on the effects of social traumas, particularly those linked to the Holocaust. Borrowed from the domain of nuclear physics, the term radioactivity helps to metaphorize the monstrous, unexpected, and aberrant effects caused by sociopolitical violence. In the light of two testimonies, we can see that psychic radioactivity can be transformed destructively or creatively. (Different Movements of Transmission: Destructive Radioactive Transmission, Creative Radioactive, Connexions, 106, 2-016, 2).*

It is predicted that the elements of higher atomic number may continue to be added to the periodic table -- with some potentially of much greater stability than those already found, understood as "islands of stability". By analogy, it can be argued that some strategies articulated to a greater degree might also be characterized by stability -- in contrast with others of lesser articulation, perhaps to be recognized as a "flash in the pan", however creative.

Noteworthy with respect to the metaphoric interpretations above is the extent to which their value is anticipated by the registration of corporations and initiatives named with such terms (*Ironclad Strategy*, *Halogenic Strategy, Oxygen Strategy*, etc).

The recognition of styles of strategy can be understood as being at a stage comparable to the early stages in the periodic organization of the chemical elements. The qualities and properties by which they might be ordered are still a matter of confusion and controversy. Missing is any systematic listing as presented by Keith Enevoldsen (*The Elements — Descriptions, Uses and Occurrences*. 2016)

** Use of distinctive geometries as mapping surfaces for value-goals (2017)

Music and aesthetics as mnemonic aids to governance

Rhyme and memorability: Advertising is especially sensitive to the importance of memorability. Considerable skill in design is deployed to ensure this. An obvious example is the development of memorable jungles (Sam Matla, *Catchy Songs: 8 Strategies for Making More Memorable Music*, *Edmprod*, 1 June 2020). This possibility is far from being extensively explored in support of governance strategies (*A Singable Earth Charter, EU Constitution or Global Ethic?* 2006; *Participative Development Process for Singable Declarations*, 2006). How might the articulation of a complex strategy be enhanced by such considerations?

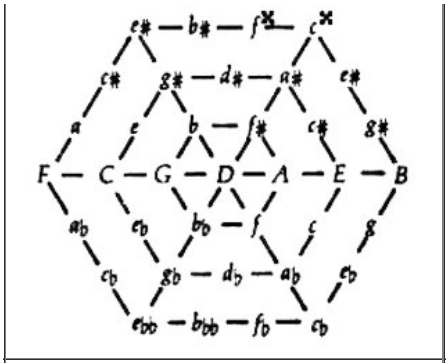
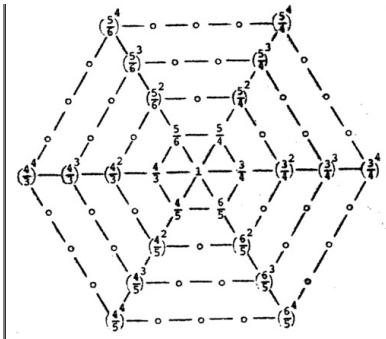
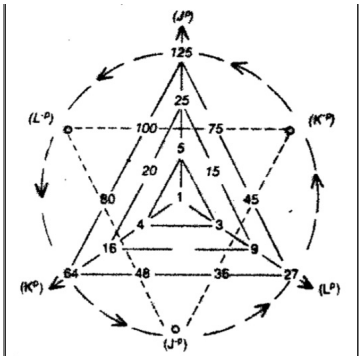
Given the earlier focus on narratives and their dramatic situations, a valuable argument to that end has been presented by A. Negrete (*Remembering Rhythm and Rhyme: memorability of narratives for science communication*, *Geoscience Communication*, 4, 2021):

> Once upon a time, narratives were considered to be a non-reliable way of representing and communicating science. Nowadays, narratives are widely accepted as an accurate way of conveying science; they represent an effective emotional trigger, a lasting memory structure and a powerful aid for learning. To study how memorable different ways of presenting information can be is a fundamental task for science communication in order to evaluate materials that not only need to be understood by the general public but also need to be retained in the long term as a part of the communication process. In this paper, I will give a brief introduction to cognitive psychology and the study of memory in relation to narratives. Evidence from the field of memory studies suggests that narratives represent a good recall device. They can generate emotion, and this in turn is a way of focusing attention, promoting rehearsal in memory and inducing long-term potentiation. Similarly, a story produces semantic links that might assist in storing and retrieving information from memory. Studies suggest that memory span and paired-associate recall have implications in storing and recalling narratives. Evidence also suggests that the use of stories as modelling tools can organise information, provide schemas and allow extrapolation or prediction. Finally, literature in memory suggests that narratives have value as mnemonic devices.

Musicology: Of particular relevance is the work of musicologist Ernest McClain in exploring sets from a traditional perspective (*The Myth of Invariance: the origin of the Gods, Mathematics and Music from the Rg Veda to Plato*, 1976; *The Pythagorean Plato: prelude to the song itself*, 1978) -- as discussed separately (*Requisite variety of "voices" for psychosocial wholth: 6, 8, 12, 20, 30?* 2015). McClain notes that "tone-value" (arrayed in a hexagonal lattice) is the most important limiting number in several sets, particularly in its role as a numerical exponent.

McClain's insights in relation to exponents have been usefully explored and depicted in a thesis from a musical perspective by F. Leighton Wingate (*The Published Writings of Ernest McClain through Spring 1976*, North Texas State University, 1977). Considerations in relation to collective memory have also been presented in a compilation by Bryan Carr and Richard Dumbrill (*Music and Deep Memory: speculations in ancient mathematics, tuning, and tradition in memoriam Ernest McClain*, 2018).

Images indicative of the archaeomusicological insights of Ernest McClain		
37 Tonal values in hexagonal lattice array	Generative matrix	Star-hexagon matrix for Just tuning

		
(Reproduced from Ernest McClain, *Meditations Through the Quran: tonal images in an oral culture*, 1981, p. 95)	Reproduced from F. Leighton Wingate (1977, p. 78)	Reproduced from F. Leighton Wingate (1977, p. 81)

The numbers highlighted in the image on the right feature in the arguments above.

Notation: Although research does not appear to have been extended to the aesthetic representation of sets by mathematicians, there is an indicative approach with respect to the iconicity of notations (Theresa Elise Wege, et al, *Iconicity in Mathematical Notation: commutativity and symmetry*, *Journal of Numerical Cognition*, 6, 2020, 3). This notes the early suggestion that symmetrical signs should be used to convey commutative relations, because they visually resemble the mathematical concept they represent. There would appear to be a case for exploring the "iconicity of strategic representation".

Of somewhat related interest is research based on the assumption that humans can readily recognize (and quickly categorize) some events as being more "memorable" than others. This then frames the question as to whether this skill can be emulated by artificial intelligence (E. Houzé, et al., *What Should I Notice? Using Algorithmic Information Theory to Evaluate the Memorability of Events in Smart Homes*, *Entropy*, 24, 2022, 346).

Sonification: Given the focus above on the periodic table, it is appropriate to note the sonification initiatives most evident in astrophysical data (Valerie Stimac, *Sonification: listening to the haunting sounds of the universe*, *HowStuffWorks*, 17 May 2022).

These now explore the distinctive tone associated with each element (*A Scientist Is Turning Every Element in The Periodic Table Into Music*, *Science Alert*, 25 February 2016; Gianmarco Del Re, *Atom Tone: sonification of spectroscopic atomic data, software+performance*). In the latter case each element generates a unique sound spectrum, which is further transformed and modulated by numbers of the Mendeleev Periodic Table of Elements; the project attempts to convert the chemical and physical logic into musical one.

As might be expected, there are initiatives to sonify some of the 350,000 integer sequences in *The On-Line Encyclopedia of Integer Sequences* (OEIS) established by Neil Sloane, as noted above (Neil J. A. Sloane and Eric Londaits, *The Sound of Sequences*, *Imaginary: open mathematics*; *Sloane's gap: cultural influences in mathematics*, *Aesthetic Complexity*, 22 February 2015: Casey Mongoven, *Sonification of multiple Fibonacci-related sequences*, *Semantic Scholar*, 2013).

The OEIS offers an interactive facility *Listen to a Sequence*, enabling users to enter the classification code of the sequence in order to hear the generated "music". Pairs of sequences may also be plotted (*Plot pairs of sequences in the OEIS*).

It is intriguing to note that the interactive facility of OEIS enables the curious possibility of entering a pattern of atomic numbers from the periodic table -- and listening to them as played by any of 128 instruments (with optional adjustments of other audio parameters). Whilst this would be trivial for periods of elements in sequence, it is potentially significant mnemonically for groups of elements. The following are however **already present and identified as such with extensive commentaries**:

Atomic numbers of periodic table groups as integer sequences -- and their sonification			
Periodic table groups	Integer sequences in OEIS	Periodic table groups	Integer sequences in OEIS
group 1: 1, 3, 11, 19, 37, 55, 87	A134984: commentary; listen	*group 15*: 7, 15, 33, 51, 83, 115	A271995: commentary; listen
group 2: 4, 12, 20, 38, 56, 88	A168281; commentary; listen	*group 16:* 8, 16, 34, 52, 84, 116	A271994: commentary; listen
group 13: 5, 13, 31, 49, 81, 113	A271997: commentary; listen	*group 17*: 9, 17, 35, 53, 85, 117	A097478: commentary; listen
group 14: 6, 14, 32, 50, 82, 114	A271996: commentary; listen	*group 18*: 2, 10, 18, 36, 54, 86, 118	A018227: commentary; listen

The same facility is also offered for the other groups -- omitted here because of the particular consideration required for the transition metals (groups 3 to 12) as they relate to the lanthanides and actinides.

Ironically the integer sequences could even be understood as musical scales. However the question is whether strategies indeed lend themselves to meaningful sonification as noted above (*A Singable Earth Charter, EU Constitution or Global Ethic?* 2006). Significant in that respect is the initiative of Franz Josef Radermacher of the Institute for Applied Knowledge Processing (FAW, Ulm) in association with the Global Marshall Plan Initiative (12 songs of *The Globalization Saga: Balance or Destruction*, 2004).

Rote learning of strategically relevant patterns?

Rote learning is especially prevalent in religion, and may be associated with some remarkable feats of memory, as with memorizing the

Bible, the *Koran*, the *Torah*, or the *Rig Veda*, and the associated controversy:

- *What the Bible says about Learning by Rote* (*Bible Tools*)
- Robert G. Delnay: *Rote Memory* (*Faith Baptist Bible College*, May-June 2000)
- Leilani Charis: *Scripture Memorization Made Possible: moving beyond rote to memorize large portions of the Bible* (2014)
- Jon Bloom: *Bible Memory Brings Reality to Life* (*Desiring God*, 22 October 2021)
- Katrina A. Korb: *The Exodus from Rote Learning: teaching Christian religious education for meaningful learning* (University of Jos, 2009)

However, as noted by *Wikipedia*, it is also widely used in other forms of the mastery of foundational knowledge. Examples of school topics where rote learning is frequently used include phonics in reading, the periodic table in chemistry, multiplication tables in mathematics, anatomy in medicine, cases or statutes in law, basic formulae in any science, etc. By definition, rote learning eschews comprehension, so by itself it is an ineffective tool in mastering any complex subject at an advanced level. For instance, one illustration of rote learning can be observed in preparing quickly for exams, a technique which may be colloquially referred to as "cramming".

From a governance perspective, rote learning may well be evident with respect to universal and regional Declaration of Human Rights, or even the UN's 17 Sustainable Development Goals. In the latter case there is the notable challenge of its articulation into 169 tasks (factoring as 13 x 13).

Given the role of number in theology as noted above, it is especially interesting to note one consequence in practice in relation to memorability. This is evident in the widespread use of prayer beads, as discussed separately (*Designing Cultural Rosaries and Meaning Malas to Sustain Associations within the Pattern that Connects*, 2000). More generally, as "story beads", the technology has a function with respect to memorable narrative (Barbara Barry. *Story Beads: a wearable for distributed and mobile storytelling*. Massachusetts Institute of Technology (Media Lab), 1999).

In the earlier speculative consideration of designs of potential relevance to governance, that exploration cited current prayer usage including:

- The 108 *mala* beads of the Buddhist rosary or more (112 in Japan), although lay persons may use only 30 to 40 -- as with European 'worry beads'.
- The Tibetan variant has 108 plus 3 (separating groups of 27) plus 1 (used like an abacus to count up to 10,800 prayers). The 'wrist mala' is usually made up of 22 beads.
- In Hinduism, the number of beads on a prayer strand varies from 18, 27, 54 to 108 -- but there is always an extra bead inserted -- called the *meru*, to indicate when the chanting cycle (*japa*) is finished (). 108 is also the number of names of Lord Ganesh
- For Muslims the bead-string *(Tasbih* or *Subha*), consists of 33, 66, or 99 beads, and is used for counting devotionally the names of Allah -- a 100th bead terminating the cycle. In Arabic, the word for "rose" (*ward*) is just a vowel away and related by root to the word for "invocation of sacred Names" (*wird*); thus the rose symbolism in the Sufi way (connoting remembrance), and the name of this device in Christianity: "rosary".
- Catholic rosaries have 50 beads, namely 5 groups of 10; Eastern Orthodox may use 100. But the number of beads on a chaplet, or rosary, depends on the number of prayers making up each particular form of devotion (a full rosary consists of one hundred and fifty *Hail Marys*, fifteen *Our Fathers*, and three or four beads corresponding to introductory versicles and the *Glory be to the Father*, etc). Lay people commonly have beads representing a third part of the rosary. Traditionally, 'tenners' were little pocket rosaries of 10 beads, one fifth of the standard five decade rosary; the 'pocket' or 'wrist rosary' or 'tenner', was traditionally a man's prayer bead.
- Anglican prayer beads may comprise four groups of seven beads called Weeks which are divided by four Cruciform beads (the Weeks are a reminder of the days of Creation, the temporal week, the seasons of the Church year, and the seven Sacraments).

With respect to enhancing insight into patterns, that earlier argument noted that circlets of beads are typically traversed sequentially as a guide to a specified number of prayers -- a quantitative emphasis within a cycle characterized by 'rote' learning.

More intriguing is the possibility that a design of relevance to governance might also evoke associative links 'across' the circle between non-contiguous insights -- an associative or networking emphasis that could provide a non-linear, integrative complement to the 'cognitive tunnel' of the circumferential cycle. From an aesthetic perspective these associations might be based simply on complementary colours. Clearly when the beads are separated into clusters, there is a complementarity between the clusters.

Presumably beads might be used as mnemonic devices for a succession of verses in an extended poem, where there were poetic associations between the verses independent of that sequence -- just as there may be associations between non-contiguous different prayers. The question is how complex might be made the pattern of associations across the circle. How can a cultural rosary be made to carry a very dense pattern of associations in this way?

Methodology with respect to the questionable role of numbers

There is little interest in investigating the role of number in ordering sets of concepts or principles, despite the unquestioned importance of many such patterns in practice to governance and the ordering of society -- whilst denying their potential importance to widespread comprehensibility and uptake of strategic initiatives. This exercise follows from an earlier exploration across multiple domains (*Representation, Comprehension and Communication of Sets: the Role of Number*, *International Classification*, 5-6, 1978-9; *Patterns of N-foldness: comparison of integrated multi-set concept schemes as forms of presentation*, 1980).

Possible approaches include:

- Use of search engines to detect the extent of use of particular numbers in ordering sets. The results might be filtered

(questionably) to exclude usage primarily inspired by deprecated pseudosciences, irrespective of their uptake in practice. Of interest would be popular preferences for:
    - sets of a given size -- deemed to be irrational -- in contrast with sets authoritatively justified, most obviously by treaties and by peer-reviewed scientific hypotheses (whatever their degree of recognition).
    - particular kinds of numbers, as explored by John Kador in business publication marketing (*Do Odd Numbers Really Work Better than Even Numbers in Book Titles?* 30 August 2014)
- Exploration of the degree to which approximations may prove relevant, grouping neightbouring numbers (as in the above exercise) in the light of the classic study by George Miller (*The Magical Number Seven, Plus or Minus Two: some limits on our capacity for processing information*, *Psychological Review*. 63, 1956, 2),, especially as subsequently reviewed by:
    - John, S. Nicolis and Ichiro Tsuda (*Chaotic Dynamics of Information processing: the "magic number seven plus-minus two" revisited*, *Bulletin of Mathematical Biology*, 47, 1985, 3)
    - Nelson Cowan (*George Miller's Magical Number of Immediate Memory in Retrospect: observations on the faltering progression of science*, *Psychological Review*, 122, 2015, 3)
- Clarification of the degree of cultural bias in recognition of sets of a given size -- in contrast with any universal recognition of set size
- Identification of the uptake/success rate (and durability over time) of recognized sets of a given size by contrast with their failure/rejection rate (forgettability)
- Detection of privileged numbers by frequency of occurrence within the patterns of integer sequences distinguished by mathematicians (as noted above), namely the relative abundance of numbers in integer sequences as a set in its own right:
    - to be undertaken more rigourously with more appropriate criteria for inclusion and exclusion of patterns
    - checking the low frequency integers to determine whether they form part of sequences inappropriately excluded. Of interest, for example, is the low frequency of 14 in the exercise above, despite its fundamental role in the attractive power of 14-fold articulation of Shakespearean sonnets
- Determination of a methodology to clarify qualitative commonalities between sets of a given size (understood in general systems terms), given what might be recognized as quite disparate synonyms in their descriptors of the elements identified in the set.

Of interest in the last case is recognition that any term selected to reconcile disparate synonyms is necessarily questionable from some perspective. Thus terms from a general systems perspective would be held to be meaningless from a dramatic perspective -- and vice versa. The issue is highlighted by qualitative commonalities in the case of the extensive literature on figures of speech and their classification, as argued separately (*Questionable Classification of Figures of Speech -- as fundamental to the need for powerful rhetoric in governance*, 2016).

This issue is especially relevant to any reference to human values -- for which there are few meaningful classifications, despite assumptions to the contrary. One approach, making systematic use of synonyms and antonyms in *Roget's Thesaurus*, reframed the challenge in terms of a limited set of 223 value polarities by which hundreds of disparate qualitative descriptors were clustered (*Classification: Human Values Project*). This set was tentatively further reduced to a 5x9 matrix of 45 value types.

Designing strategic declarations -- memorable or forgettable?

The arguments above frame the question as to whether articulation of a strategic initiative is to be memorable or not -- irrespective of claims made in that regard. This is clearly an important issue in the design of any product marketing campaign. Seemingly this is not recognized to be the case in a governance context -- except where there is indeed a desire for forgettability (*New World Order of Walk-away Wheeling and Dealing: creating strategic dependency and vulnerability through confidence tricks*, 2018).

Ironically, if predictably, there are no references to "unmemorable strategies" nor to "forgettable strategies". The following are however indicative:

- *Strength in numbers: Europe's foreign and defence policy* (Centre for European Reform, 2 September 2012): European governments issued a limp and *forgettable declaration*.
- *All the Laws and Executive Orders Trump Has Signed So Far* (*Vice*, 22 January 2017): *[Proclaiming] May 1, 2017, As Law Day,...* However this usually innocuous and *forgettable declaration* will yet again cause some consternation and odd looks this year because it's coming from Trump.
- *Critique and Crisis. Liberté, Egalité, Fraternité reconsidered* (Revolver Publishing, 2015): ... that *forgettable declaration* of Richard III keeps something...
- *Two Pointless Summits Rolled Into One!* (*No Pasaran*, 2 June 2011): Wait long enough, and a high-minded-sounding bloviating and *forgettable declaration* will be named after your city, village, or hut.
- *Becoming Bridges: The Spirit and Practice of Diversity* (2007): Even those congregations that have made the effort to write a vision statement have sometimes created banal and *forgettable declarations*.
- *Delusions of Grandeur: The United Nations and Global Intervention*, Cato Institute, 1997): The formal results of those VIP segments are negligible : witness the instantly *forgettable declarations* produced .
- *Time to Strike Out?* (*Dublin Review of Books*, 27 May 2021): When noting longer-term issues the Union has instead, again understandably, taken refuge in a series of immediately *forgettable declarations*

By contrast a particular focus is indeed given in references to the design of *memorable strategies* for product marketing purposes. It is however the case that reference is made to *memorable declarations*, typically in relation to the *Declaration of Independence* of the USA -- and presumably to that of many countries. Here the issue is however that their memorability may be primarily associated with their historical associations, rather than with the actual content -- possibly to be distinguished as *memorable events* (John George Edgar, *Memorable Events of Modern History*, 1862).

Given their probable status as legal documents, one approach is through the recognition of *forgettable legislation* (Mercer Law Watson, *Criminal Law Outline*, 2018), framing questions regarding the nature and status of foregttable treaties and international agreements (notably with regard to indigenous peoples):

- *Basein and Beyond* (*The Urban Imagination*): The Portuguese signed... the forgettable Treaty of Bassein (1543), later to become the bustling city of Bombaty/Mumbai, going on to influence the city, the country, and larger geopolitics
- *Memoires* (1917): the now unforgettable treaty in which, at London in 1839, the inviolable neutrality of Belgium was guaranteed by the five Great Powers of Europe.
- Winston Churchill: *The Gathering Storm*, 1948): President Roosevelt and I were taking the decisions and reaching the memorable agreements... for the large-scale manufacture of atomic bombs.

Of relevance to any design of future strategic declarations is the study by Daniel Martin Katz and Michael J Bommarito II (*You Had Me at Hello: how phrasing affects memorability*, *Computational Legal Studies*, 2 April 2012). This notes:

> Understanding the ways in which information achieves widespread public awareness is a research question of significant interest. We consider whether, and how, the way in which the information is phrased -- the choice of words and sentence structure -- can affect this process. To this end, we develop an analysis framework and build a corpus of movie quotes, annotated with memorability information, in which we are able to control for both the speaker and the setting of the quotes. We find significant differences between memorable and non-memorable quotes in several key dimensions.

It is then appropriate to ask how the array of recent international declarations and strategies are to be distinguished in terms of memorability -- or forgettability. Of relevance is then the question as to whether collective memorability can be usefully understood as having a "half-life" by comparison with reference to the half-life of knowledge (Samuel Arbesman, *The Half-Life of Facts: why everything we know has an expiration date,* 2012; *Societal Learning and the Erosion of Collective Memory*, 1980).

That approach can be usefully contrasted with the enduring memorability of works of Shakespeare, for example -- separately explored with respect to the 14-fold organization of his sonnets (*Variety of Rhyming Patterns in Standard 14-line Sonnets*, 2021). Is it to be expected that envisaged strategic declarations with regard to global issues will be equally memorable -- and therefore sustainable? Is there a case for experimental design of declarations (*Structuring Mnemonic Encoding of Development Plans and Ethical Charters using Musical Leitmotivs*, 2001; *Documents relating to Declarations, Principles and Guidelines*, 2001).

Is there a case for an international "*Index of Strategic Memorability -- or Forgettability*"?

Towards memorable strategic architecture -- and its appreciation

Influential architecture? Appreciation has long been accorded to memorable architecture, most obviously in the form of cathedrals, mosques and temples even from a secular perspective (Marina Yoeva, *20 Most Impressive Cathedrals Around the World*, *The Travel*, 3 August 2018; Elizabeth Stamp, The World's Most Beautiful Mosques , , Rizzoli 15 December 2017; Sarah DiMarco, *The 12 Most Beautiful Temples in the World*, *The Verandah*, 16 October 2020). The future may see as curious that equivalent appreciation is not accorded to strategic architecture in a period of crises -- beautiful strategies? beautiful declarations? beautiful treaties? -- except as artifices of public relations and propaganda.

Considerable research has focused on what renders such architecture beautiful and impressive, given the attraction they exert in any urban environment and their influential role as a central symbol for cultures, as extensively described by *Wikipedia* (*Architecture of cathedrals and great churches*). A degree of comparison may of course be made with constitutions, and with declarations of independence and human rights -- as beautiful expressions of human culture.

There are indeed references to "beautiful constitutions" and even to those deemed "most beautiful" with that of the USA cited as such, notably by Americans. This is far from being equivalent to the much wider appreciation of architecture upheld as beautiful.

- *Which are some of the most important and beautiful constitutions in the world and why?* (*Quora*).
- Joseph O'Mara: *How charitable companies can achieve a 'beautiful' constitution: practical tips and helpful processes* (*LegalWise*, 1 November 2018)
- Edeh Samuel Chukwuemeka: *9 Essential Characteristics of a Good Constitution* (*Bscholarly*, 24 July 2020)

There is seemingly little interest in the design of memorable strategic architecture -- even at global summits whose outcome is deemed so vital to the future of humanity. The lack of such interest may even be considered normal when a global strategy is held to be the outcome of what amounts to "horse-trading", as was alleged to be the case with the UN's 17 Sustainable Development Goals, identified by *The Economist* as a "mess" (*Systemic Coherence of the UN's 17 SDGs as a Global Dream: rather than merely an arbitrary outcome of political horse-trading*, 2021; *The 169 Commandments: the proposed sustainable development goals would be worse than useless*, *The Economist*, 28 March 2015).

Rather than any "design", the focus is on disparate stakeholders bringing their respective "bricks" to be incorporated into a construct whose coherence derives primarily from their presentation as a list. What more could be sought or expected?

Definitional confusion? The current situation is all the more remarkable given the widespread recognition of the emergence of a knowledge-based global civilization, dependent to the highest degree on the organization of information -- even as an ultimate expression of human achievement. From that perspective, use of architecture as a metaphor has engendered many references to knowledge architecture and organizational architecture. A sense of information architecture is fundamental to the organization of computer memory -- especially that of supercomputers.

There is however a degree of confusion associated with claims for the nature of "knowledge architecture" in contrast with "information architecture" and "organization architecture". In the absence of interest in other sectors, these derive in part from initiatives to establish their critical relevance to the operation of for-profit corporations. Insights typically conflate any architectural dimension with "knowledge management", thereby ignoring implications for forms of organization with other preoccupations, ironically including the architecture of conferences on "knowledge organization". definitions are especially significant in terms of what they omit:

- *Knowledge architecture: an overview* Science Direct
- David Meza *Knowledge Architecture, Defined* May 19, 2018
- Terry Franklin *Knowledge Architecture: The Path to Better Decisions* Towards Data Science, 16 July 2019
- S. Earley: *Don't neglect the foundation: how organizations can build their knowledge architecture and processes for long-term sustainability* , in *Successes and Failures of Knowledge Management*, 2016

For *Wikipedia*:

- information architecture is the structural design of shared information environments; the art and science of organizing and labelling websites, intranets, online communities and software to support usability and findability; and an emerging community of practice focused on bringing principles of design, architecture and information science to the digital landscape.
- organizational architecture of an organization (as a metaphor) provides the framework through which an organization aims to realize its core qualities as specified in its vision statement. It provides the infrastructure into which business processes are deployed and ensures that the organization's core qualities are realized across the business processes deployed within the organization. In this way, organizations aim to consistently realize their core qualities across the services they offer to their clients.

Curiously neglected by *Wikipedia*, it is only recently that the focus on "knowledge architecture" has taken book form (Denise Bedford, *Knowledge Architectures: structures and semantics* Routledge, 2021). There the focus is articulated as:

> Incorrect architecture reduces organizational agility Not having the correct architecture slows the ability to get to the correct information. It prevents systems from being easily integrated and slows down the adaptability of those systems. Adaptability and agility are what is required in the hypercompetitive marketplace; adding friction to the process in the form of brittle integrations, manual transformations and integrations, and information disconnects creates a competitive disadvantage. The organization that adapts most quickly to changes in the marketplace, competition, and customer needs, and gets products and services out to market more quickly is the winner. A faster information metabolism means a more competitive and successful organization. The key to this speed and agility is having a foundational architecture and evolving that architecture in a coherent, controlled fashion. Many organizations embark on KM initiatives without understanding the role of a harmonized, integrated content and knowledge architecture.

Strategic use of architectural metaphors: By contrast with any disciplined approach, of particular interest is the manner by which architectural metaphors have been borrowed in the articulation of some major strategic initiatives (Kojin Karatani, *Architecture as Metaphor Language, Number, Money*, 1995). This is most evident in the identification of strategic "pillars", as discussed separately (*Coherent Value Frameworks: pillar-ization, polarization and polyhedral frames of reference*, 2008). As noted by *Wikipedia*:

> Pillarisation is the politico-denominational segregation of a society, or the separation of a society into groups by religion and associated political beliefs. These societies were (and in some areas, still are) "vertically" divided into two or more groups known as pillars (Dutch: zuilen). The best-known examples of this have historically occurred in the Netherlands and Belgium. Each pillar may have their own social institutions and social organizations. These may include their own newspapers, broadcasting organisations, political parties, trade unions, farmers' associations, banks, stores, schools, hospitals, universities, scouting organisations and sports clubs. Such segregation means that many people have little or no personal contact with members from other pillars.

Such borrowing does not extend to the design process by which cathedrals, mosques and temples embody "beauty" to a high degree. Given the typically secular approach to governance strategies, notably excluded is the potential relevance of sacred geometry with which such design has been extensively associated -- even in societies embodying their highest values in religion. This might be considered ironic, given the extent to which global strategic architecture is itself perceived as embodying the highest human values.

Architecture and mathematics: Given the crises by which governance is confronted, the situation is all the more ironic in the light of the insight into the intimate relationship between mathematics and architecture, as extensively discussed by *Wikipedia* (Marianne Freiberger, *Perfect Buildings: the maths of modern architecture*, *Plus magazine*, 1 March 2007). Perfect strategies, constitutions or declarations? Despite systematic avoidance of such considerations -- even their deprecation -- the universal quest for harmony in governance is universally acclaimed (Alexey Stakhov and Olsen Olsen, *The Mathematics of Harmony: from Euclid to contemporary mathematics and computer science*, 2009).

This dimension is notably explored at the intersection of mathematics and the arts:

- *Nexus Network Journal: Architecture and Mathematics*
- International Society of the Arts, Mathematics, and Architecture

Especially noteworthy, beyond the long-standing preoccupations of Christianity, are the many studies of patterns embodied in memorable Islamic architecture, especially from a mathematical perspective:

- Keith Critchlow: *Islamic Patterns: an analytical and cosmological approach* (1976)

- Marcus du Sautoy: *Symmetry: a journey into the patterns of nature* (2008)

Knowledge cybernetics: Beyond rhetorical assertions regarding the knowledge-based nature of global civilization, it remains curious that in a time of crisis that so little attention is accorded to the insights of cybernetics as they relate to the control of any system. Curiously the cathedral metaphor featured in an award-winning paper on second-order cybernetics by Kathleen Forsythe (*Cathedrals in the Mind: the architecture of metaphor in understanding learning*, *Cybernetics and Systems '86*, January 1986).

Early insights with respect to governance in general are recognized in the work of Stafford Beer as a pioneer of management cybernetics and associated with the development of viable system theory (*Platform for Change*, 1978; *Brain of the Firm*, 1981; *Beyond Dispute: the invention of team synergist*, 1994).

More recently the perspective explicitly features in the studies of Maurice Yolles (*Organisations as Complex Systems: an introduction to knowledge cybernetics*, 2006; *Meta cybernetics: towards a general theory of higher order cybernetics*, *Systems*, 2021)

Strategic architecture by numbers and numerical cognition?

Architecture by numbers? Architectural theory continues to evoke active and criticial debate (Kate Nesbitt, *Theorizing a New Agenda for Architecture: anthology of architectural theory, 1965-95*, 1996; K. Michael Hays, *Constructing a New Agenda: Architectural Theory 1993-2009*, 2010). Given his focus on the theory of architecture, the insights of Michael Hays are potentially of great relevance to knowledge architecture (*Architecture by Numbers*, *Praxis: Journal of Writing + Building*, 7, 2005). Hays introduces his perspective as follows:

> Architecture is fundamentally involved with numbers. From the very beginnings of architectural theory, as it emerged out of Pythagorean Platonic philosophies of harmony and proportion, architecture has been understood as a fulcrum between the material world of things and their construction and the transcendent mathematics of the cosmos itself. In the spring of 2004, I curated a show for the Whitney Museum of American Art at Altria called architecture by numbers. The premise of the show was simple: to juxtapose examples of contemporary practices that regard architecture's ongoing involvement with numbers as more fundamental than architecture's involvement with building

Hays offers a critical comment on the current deprecation of the theoretical perspective which it might be assumed is relevant to any insight into strategic archotecture as indicated above. Specifically he notes:

> The current dogma seems to be that the complexity of the purely practical demands on architecture and the undeniable cleverness of architects' responses to those demands, exhaust the cultural interest in architecture in our own time. We are "after theory", the conventional locution goes. With the ability to process massive amounts of information and push it through sophisticated graphic software, we no longer have need of the slow and cumbersome ideas and abstractions that theory traffics in. The massive movements and sheer speed of the world system make theoretical supplements to real-time technocracy no more than ornaments, detours, and perversions of real progress and immediacy of effect.

Although valuable in intimating a more fruitful perspective, unfortunately his focus does not extend explicitly to what might be understood as knowledge architecture:

> I mean something different from theory that guides and controls design practice. I intend rather the more fundamental, but also more limited activity of conceptualizing experiences that are irreducibly architectural- experiences that belong to none other than architectural objects or events in general and to numerary organizations or patterns in particular. This entails that architecture be understood as both an enabling condition and a restraint on thought and action...

In clarifying this perspective, Hays suggests use of the infinitive "*to architect*" in order to indicate the desire he attributes to artists-architects engaged otherwise with number:

> To architect then, comes to mean something different from to make or even to plan -- different because the categories produced in architecting cannot be objects in their own right. To architect means rather to seek after architecture as a specific mode of knowledge to perform presently a specific activity for the purpose of prolonging or continuing the practice historically authorized as architecture, but which cannot now be done in the same way; to select from among other possible practices (dancing, writing, filming, designing, etc.) this particular course of action; to set it next to other systems; to intend architecture; to desire architecture.

Numerical cognition? Of potential relevance as a source of insight into the role of number in relation to governance is the open-access *Journal of Numerical Cognition*. This is the official journal of the Mathematical Cognition and Learning Society. The clarification of its purpose as a forum for the focused discussion of research intonumerical cognition was made by the introductory editorial by John Towse (*Finding a Voice for Numerical Cognition*, 1, 2015, 1). As stated:

> ... the Journal aims to be inclusive, and takes numerical cognition to encompass for example all branches of mathematics (including spatial reasoning), and welcomes research for its quality, regardless of whether its origins are in (Cognitive) Psychology, Education, Anthropology, or other disciplines...

The editorial notes that there simply are no existing specialized journals that cater to numerical cognition and the psychology of mathematics, noting that the journal *Mathematical Cognition* published several volumes from 1995 to 2000 before ceasing to exist.

So framed a perusal of the recent volumes on numerical cognition makes it clear that a significant interest for researchers lies in the challenges of educating students with regard to numeracy. The point implied by the argument above is that potentially far more critical are the issues of numerical cognition of those associated with governance and the articulation of strategy. The point can be emphasized otherwise by the current significance associated with cognitive architecture as a theory about the structure of the human mind and to a computational instantiation of such a theory in the fields of artificial intelligence (AI) and computational cognitive science.

Architectural and mathematical self-reflexivity? Mathematics does indeed offer considerable theoretical insight into reflexivity. It is less evident how this insight relates to the practice of mathematics and the preoccupations of mathematicians. Such questions are also relevant to the systems-oriented disciplines:

- Hibak Mohamud: *Reflections on Systems Theory: the role of self and reflexivity* (*Edpsy*, 19 October 2021)
- D. W. Pellegrini: *Applied systemic theory and educational psychology: Can the twain ever meet?* (*Educational Psychology in Practice*, 25, 2009, 3).
- Bogdan Popoveniuc: *Self Reflexivity: the ultimate end of knowledge* (*Procedia - Social and Behavioral Sciences*, 163, 2014)

Provocatively it could be said that the argument above identifies an array of perspectives which tend in practice to ignore each other and the degree to which they are part of the problem of governance. This is yet another example of inter-sectoral and inter-disciplinary fragmentation -- reinforcing the perceptions of the irrelevance of other perspectives.

In this sense, ironically, it is how they might be fruitfully configured together -- a design challenge mirroring that of governance at this time, given the manner in which otherness is widely deprecated. Whereas the argument above draws attention to recognition of "beautiful" cathedrals, mosques and temples, and their impressive design, the question is whether the disparate perspectives highlighted above together pose the question of the design of a "temple of knowledge". How might those perspectives be meaningfully interrelated -- preserving their disciplinary identities and distinctive orientations?

To that end, one example of interest is application of the mathematics of Voronoi diagrams, as elegantly proposed by Sa'id Kori (*Design of Knowledge Temple in Jerusalem*). However, whilst this does indeed address issues of building architecture, it in no way addresses those of knowledge architecture -- or those posed by Jerusalem itself (*Jerusalem as a Symbolic Singularity: comprehending the dynamics of hyperreality as a challenge to conventional two-state reality*, 2017).

Such a proposal can be usefully contrasted with the recognition by a mathematician, Marcus du Sautoy, of the manner in which all 17 symmetry patterns of the "wallpaper group" (noted above) appear in the remarkable Moorish palace of the Alhambra, long appreciated for its beauty (*Symmetry: a journey into the patterns of nature*, 2008; *The Alhambra, symmetries and the beauty of mathematics*, 2010).

The Alhambra is one of the most famous monuments of Islamic architecture -- preserved by Spain as a monument to the triumph of Christianity (Robert Irwin, *The Alhambra*, 2011). How such palatial elegance and complexity was held to be of significance to governance invites reflection -- especially in the present period when priority is given to analogous investments, if only to impress (Lara Eve Eggleton; *Re-envisioning the Alhambra: readings of architecture and ornament from medieval to modern*, University of Leeds, 2011).

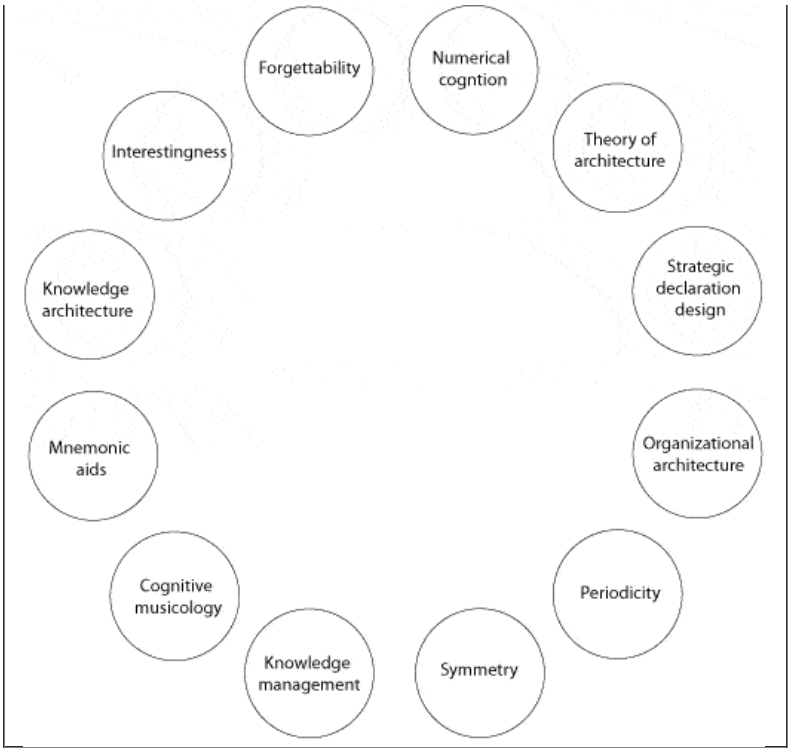
Rather than a temple or a palace, for whom is an architectural complex like the Alhambra understood as a memory theatre, as explored in the widely cited work by Frances Yates (*The Art of Memory*, 1966)? Such insight features in more recent initiatives:

- Simon Critchley: *Memory Theater* (Other Press, 2015)
- Allen Foresta: *Memory Theater Revisited: a purpose-built playhouse for the performance of teaching, learning, kowledge creation, and kowledge retrieval, too* (Gottesman Libraries, 30 April 2019)
- Peter Matussek: *The Renaissance of the Theater of Memory* (*Poetics and Politics of Memory*, 2001)
- Robert Edgar: *Animating the Memory Theatre* (2012)
- Joseph El Khouri: *Inside a Memory Theatre* (*Tharunka, XL-5*, 7 August 1973).
- *Giulio Camillo's Memory Theatre* (*Agencement*. 11 February 2013)

Yates draws attention to the method of loci, namely a method of memorizing information by placing each item to be remembered at a point along an imaginary journey through what is also termed a memory palace -- for which there are now many references.

Assuming a requirement for self-reflexivity in the quest for memorable strategic design of relevance to governance, there is a case for recognizing that any fruitful configuration of the dimensions and disciplines highlighted above may strangely parallel the architecture of beautiful cathedrals, mosques and temples as they are now envisaged -- a form of temple of knowledge in virtual reality. The argument may be simplistically presented through the following animation -- especially indicative of the dynamics between disciplines and perspectives which are typically indifferent to each other in practice, whilst purportedly aspiring to interdisciplinarity.

Self-reflexive design of a temple of knowledge of relevance to giovernnce Animation suggestive of phases in the configuration of the disparate requisite perspectives



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