



laetus in praesens

Alternative view of segmented documents via Kairos

27 May 2013 | Draft

Credibility of Psychosocial Analogues of Feynman Diagrams

Cognitive engagement with challenging visualization

-- / --

Progressive recognition of the cognitive significance of visualization
Elucidating the general principles of diagrammatics and visualization
Social networking as offering a degree of formalization of complex relationships
Multi-loop causal implications encompassed by Feynman diagrams
Implication of the exemplary irrelevance of Feynman diagrams as employed
Unconventional explorations of the psychosocial relevance of Feynman diagrams
Implications of Feynman diagrams in terms of other cultural perspectives
Cognitive embodiment in time in contrast to extra-temporal explanation

Annex to *Potential of Feynman Diagrams for Challenging Psychosocial Relationships?*
Comprehending the neglect of an unexplored possibility (2013) where bibliographical [References](#) are located

Progressive recognition of the cognitive significance of visualization

It is remarkable that in both natural and social sciences there has been a marked tendency over many decades to deprecate (as an indication of intellectual inadequacy) may use of visual representation -- otherwise to be framed as a complement (or substitute) for verbal presentations or text. This tendency continues to be evident in documents for administration and governance. Tables may be included, and simple graphs may be annexed, but there is little question of use of any form of cognitive map.

Equally curious, despite the decades of analysis of social networks and their visualization by the relevant social sciences, there is little effort to represent such networks so as to elicit more appropriate social interaction. There is little evidence of experiments to that end, although a pioneering exception meriting recognition is that of cyberneticians [Stafford Beer](#) and [Gordon Pask](#) within the context of a meeting of the Society for General Systems Research (*Metaconferencing: Discovering people / viewpoint networks in conferences*, 1980).

The possibility is most evident following the very recent explosion of social networking via the internet and web. Despite the availability of software and suitable devices, little effort has as yet been made to represent the networks of individuals and groups as a catalyst to the development of their quality and efficacy. Despite their names, the *World Map of Social Networks* (2012) and the *Global Map of Social Networking* (2011) are aids to marketing not maps visualizing network connectivity. Seemingly there is little perceived need on the part of potential users and clients. It is to be assumed that far more use is made of such visualization by the security services -- although it is not apparent that this is done in order to enhance the quality of order they purport to safeguard.

Although of relatively limited effect on the above tendencies, efforts have of course been made to highlight the merits of visual representation, as evident on the web site [Information is Beautiful](#), the book of that name ([David McCandless](#), *Information is Beautiful*, 2010), and others (Martin Toseland and Simon Toseland, *Infographica: the world as you have never seen it before*, 2012; Lee LeFever, *The Art of Explanation: making your ideas, products, and services easier to understand*, 2012; David Sibbet, *Visual Leaders: new tools for visioning, management, and organization change*, 2013). Efforts have been made to use [graphic facilitation](#) in group dialogue. A pioneer in that respect has been [Edward Tufte](#) (*The Visual Display of Quantitative Information*, 2001; *Visual Explanations: images and quantities, evidence and narrative*, 1997; *Visual and Statistical Thinking: displays of evidence for making decisions*, 1997; *Envisioning Information*, 1990).

It cannot however be said that global decision-making and summity is significantly influenced by diagrammatic representations. There is a notable preference for static reporting of global issues, as separately discussed (*Dynamic Transformation of Static Reporting of Global Processes: suggestions for process-oriented titles of global issue reports*, 2013). This is despite striking innovation in "turning statistics into knowledge" -- with the slogan "unveiling the beauty of statistics for a fact based world" -- as been offered by the [Gapminder](#) initiative, within the context of the [OECD Global Project on Measuring the Progress of Societies](#). The [Global Sensemaking](#) network is

especially sensitive to such potential.

It is therefore appropriate to note various studies drawing attention to the cognitive significance of visualization, notably those citing the demonstrated role of the Feynman diagrams for the development of physics ([Martinus Veltman](#), *Diagrammatica: the path to Feynman Diagrams*, 2001; [Letitia Meynell](#), *Why Feynman Diagrams Represent. International Studies in the Philosophy of Science*, 2008).

The matter is specifically addressed by [Ari Gross](#) (*Pictures and Pedagogy: the role of diagrams in Feynman's early lectures, Studies in History and Philosophy of Science Part B*, 2012; *Feynman Diagrams and Visual Reasoning*, 2008). In the latter he notes that they occupy a fascinating place in scientific practice: **they are neither physical theories nor symbolic mathematics**, but simple, versatile "paper tools" which have become a near-essential component of contemporary subatomic physics. Gross examines the role they play in the reasoning of physicists:

... I characterize two distinct ways in which Feynman diagrams are used: as images capable of radically facilitating calculations by mediating between theoretical characterizations of a subatomic event and its associated mathematical description, and as powerful heuristic tools used to generally enhance one's understanding of either a particular interaction or of the nature of subatomic physics in general. Referring to these uses as "formal" and "informal" diagrammatic reasoning, I explicate the relationship between Feynman diagrams and other scientific concepts, such as physical theories and symbolic mathematics, and highlight the importance of visual reasoning in scientific practice.

Of exceptional relevance to the use of visualization with respect to global strategy is the recent presidential address to the American Political Science Association by [Henry E. Brady](#) (*The Art of Political Science: spatial diagrams as iconic and revelatory, Perspectives on Politics*, June 2011):

Spatial diagrams of politics could and should be iconic for political science in much the same way as supply-and-demand curves are in economics. Many fundamental problems of political science can be connected with them, and many different concepts -- such as ideological constraint, cross-pressures, framing, agenda-setting, political competition, voting systems, and party systems, to name just a few -- can be illuminated through spatial diagrams. Spatial diagrams raise questions and provide insights. They suggest political maneuvers, possible realignments, and political problems. They provide us with revealing images that aid memory and facilitate analysis. They are a powerful way to think about politics, and we could not do better than to feature them in our textbooks, to use them in our research, and to exhibit them as our brand -- as our distinctive way of thinking about how the world works

Brady offers a useful list of examples, notably indicating Feynman diagrams, and referring to his own earlier argument ([Henry E. Brady and David Collier](#), *Rethinking Social Inquiry: diverse tools, shared standards*, 2010) and that of [Mary S. Morgan and Margaret Morrison](#) (*Models as Mediators: perspectives on natural and social science*, 1999):

... There are also many other examples: [Minkowski's space-time diagrams](#) explaining special relativity theory, [Francis Ysidro Edgeworth's](#) two-person exchange box demonstrating the distribution of resources and the possibilities for exchange in a two-person economy, [phylogenetic trees](#) in biology, [vector diagrams](#) in physics and mathematics, [chemical structure diagrams](#), [phase diagrams](#) in thermodynamics, Feynman diagrams in particle physics, [free body diagrams](#) in physics, [extensive form games](#) in social science, Niels Bohr's [model of the atom](#), [Venn diagrams](#) in mathematics, and [IS-LM curves](#) in macroeconomics. These pictures are, in effect, "models" of phenomena which provide useful tools for thinking about reality.

Other schematic images which merit consideration for their cognitive value include:

- system diagrams and wiring/circuit diagrams
- organization charts and kinship networks
- mappings of social networks and communications maps (as of web connectivity)
- concept maps, semantic maps and mind maps
- forms of map or mnemonic aid elaborated by religions, such as mandalas or prayer beads ([Designing Cultural Rosaries and Meaning Malas to Sustain Associations within the Pattern that Connects](#), 2000)
- representations of stages on learning pathways, as with the set of Zen [ox-herding images](#)

As a mathematician formally specializing in quantum field theory, quantum gravity, n-categories, [John Carlos Baez](#) (*Network Theory, Azimuth*, March 2011) expresses a wish for a new branch of "green mathematics -- that would interact with biology and ecology just as fruitfully as traditional mathematics interacts with physics". Although he does not specifically discuss psychosocial dynamics, he presents a useful survey of a variety of systemic diagrams -- including Feynman diagrams -- with an indication of how mathematicians might fruitfully seek underlying commonalities. He notes, for example, the [Systems Biology Graphical Notation \(SBGN\)](#) made up of 3 different languages, representing different visions of biological systems. Each language involves a comprehensive set of symbols with precise semantics, together with detailed syntactic rules how maps are to be interpreted.

Elucidating the general principles of diagrammatics and visualization

The implications of visual modelling are the subject of a variety of approaches, as indicated by the following::

- [Daniela M. Bailer-Jones: Scientific Models in Philosophy of Science](#) (2009)

- D. C. Gooding: *Visualizing Scientific Inference* (Topics in Cognitive Science, 2010)
- Nivedita R. Kadaba, Pourang P. Irani, and Jason Leboe: *Visualizing Causal Semantics using Animations* (IEEE Transactions on Visualization and Computer Graphics. 2007)
- Lorenzo Magnani, Walter Carnielli and Claudio Pizzi: *Model-Based Reasoning in Science and Technology: abduction, logic, and computational discovery* (2010)
- Christopher Pincock: *Mathematics and Scientific Representation* (2012)
- J. Larkin and H. A. Simon: *Why a diagram is (sometimes) worth ten thousand words* (Cognitive Science, 1987)

Questions have been fruitfully raised as to the underlying principles that enhance the value of diagrammatic representation, as by Ahti-Veikko Pietarinen (*Is There A General Diagram Concept?*), by Derek Carbera (*Distinctions, Systems, Relationships, Perspectives: the simple rules of complex conceptual systems*), and by Fyodor V. Tkachov (*Theory of Asymptotic Operation: a summary of basic principles*, 1998).

A valuable summary of the issues and the literature is provided in a succinct slide presentation by Zenon Kulpa (*What is diagrammatics?* 2008) who cites:

- R. Arnheim: *Visual Thinking* (1969)
- B. V. Funt: *Problem-solving with diagrammatic representations* (1980)
- S.-J. Shin: *The Logical Status of Diagrams* (1994)
- J. Glasgow, N. H. Narayanan, B. Chandrasekaran (Eds.): *Diagrammatic Reasoning: Computational and Cognitive Perspectives* (1995)
- M. Greaves: *The Philosophical Status of Diagrams* (2001).
- M. Jamnik: *Mathematical Reasoning with Diagrams: from intuition to automation* (2001)

Kulpa usefully contrasts propositional representation (Fregean or sentential) and analogical representation (direct or homomorphic) with diagrammatic representation as being analogical and graphical. He summarizes three diagrammatic reasoning modes: discrete diagrams, qualitative (structural), and quantitative (continuous). He also offers an analysis of the "anti-diagram attitude" in mathematics and the arguments against their use.

In his presentation, Kulpa cites:

Richard P. Feynman: It is not easy to use the geometrical method to discover things, but the elegance of the demonstrations after the discoveries are made is really very great (*The Motion of Planets Around the Sun*, 1964)

Tristan Needham: ...while it often takes more imagination and effort to find a picture than to do a calculation, the picture will always reward you by bringing you nearer to the Truth. (*Visual Complex Analysis*, 1997)

L. Goldstone, David Landy, and Lionel C. Brunel. *Improving Perception to Make Distant Connections Closer*. *Frontiers in Psychology*, 2011):

One of the challenges for perceptually grounded accounts of high-level cognition is to explain how people make connections and draw inferences between situations that superficially have little in common. Evidence suggests that people draw these connections even without having explicit, verbalizable knowledge of their bases. Instead, the connections are based on sub-symbolic representations that are grounded in perception, action, and space. One reason why people are able to spontaneously see relations between situations that initially appear to be unrelated is that their eventual perceptions are not restricted to initial appearances. Training and strategic deployment allow our perceptual processes to deliver outputs that would have otherwise required abstract or formal reasoning.

Citing a variety of research, the authors continue:

We believe that creating perceptual tools like Venn and Feynman diagrams can be understood as deeply related to creating physical tools that extend our sensory organs.... A powerful new spatial representation changes how things look just as surely as a microscope does. Compelling examples have been empirically described for how diagrams help thinking by promoting new ways of perceiving. Providing a static diagram may help people see what two seemingly dissimilar instantiations of a "convergence schema" share... and if a dynamic animation showing convergence is provided, then even greater transfer is achievable... [This] points to a suite of desirable properties of diagrams that allow them to serve as effective "cognitive prostheses": (1) they combine globally homogeneous with locally heterogeneous representations of concepts, (2) they integrate alternative perspectives, (3) they allow for expressions to be easily manipulated, and (4) they support compact and uniform procedures.

Such arguments complement the work of George Lakoff and Rafael Nuñez (*Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2001; *The Cognitive Foundations of Mathematics: the role of conceptual metaphor*. In: Campbell, J. I. D. (Ed.) *Handbook of Mathematical Cognition*, 2005) has framed and elaborated by Chris Fields (*Metaphorical Motion in Mathematical Reasoning: Further evidence for pre-motor implementation of structure mapping in abstract domains*, *Cognitive Processing*, 2013):

The theory of computation and category theory both employ arrow-based notations that suggest that the basic metaphor "state changes are like motions" plays a fundamental role in all mathematical reasoning involving formal manipulations. If this is correct,

structure-mapping inferences implemented by the pre-motor action-planning system can be expected to be involved in solving any mathematics problems not solvable by table look-ups and number-line manipulations alone. Available functional imaging studies of multi-digit arithmetic, algebra, geometry and calculus problem solving are consistent with this expectation

The argument can be related to the process of **concept mapping**. Citing Giuseppe Ritella and Kai Hakkarainen (*Instrument Genesis in Technology-mediated Learning: from double stimulation to expansive knowledge practices*, 2012), John Cripps Clark (*Researching Concept Mapping Using Cultural Historical Activity Theory: collaboration and activity in the zone of proximal development*, 2012) argues:

Concept mapping also act as an external memory field which externalises, crystallizes and objectifies concepts in the same way as Feynman diagrams... Like concept maps, Feynman diagrams are examples of the way "writing and visualization allow human beings to establish a theoretic culture based on gradually accumulating the external symbolic storage systems".

Ritella and Hakkarainen focus on the socio-cultural foundations of technology-mediated collaborative learning:

Toward that end, we discuss the role of artifacts in knowledge-creating inquiry... We argue that epistemic mediation triggers expanded inquiry and plays a crucial role in knowledge-creating learning; such mediation involves using... technologies to create epistemic artifacts for crystallizing cognitive processes, re-mediating subsequent activity, and building an evolving body of knowledge. Productive integration of [such] technologies as instruments of learning and instruction is a developmental process: it requires iterative efforts across extended periods of time. Going through such a process of instrument genesis requires transforming a cognitive-cultural operating system of activity, thus 'reformatting' the brain and the mind. Because of the required profound personal and social transformations, one sees that innovative knowledge-building practices emerge, socially, through extended expansive learning cycles.

Social networking as offering a degree of formalization of complex relationships

It could be considered extraordinary the manner in which internet communication has rendered explicit the variety of psychosocial exchanges -- whether challenging or otherwise. This has been explored to a degree with respect to content (Tim Finin, Li Ding, Lina Zhou and Anupam Joshi, *Social Networking on the Semantic Web*)

People are engaged in (and exposed to) such communication on an increasingly continuous basis. Especially striking are such phenomena as:

- selection and solicitation of desirable communication
- filtration of the less desirable and rejection of the totally undesirable communications
- adaptation to information overload through restricting exposure
- devising communications capable of attracting indifferent others, or "penetrating" that indifference
- encountering and engaging in complementary processes of flaming and diplomatically withholding critical comment (the "unsaid")
- adapting responsiveness from knee-jerk to extensive (if not permanent) delay -- possibly with an element of deliberate or unconscious neglect
- encountering and engaging in processes of referral ("retweeting"), "following", sabotage and hacking
- alternating selectively between substantive communication and phatic communication (whether sympathetic or antipathetic)

How many such processes can be distinguished and characterised?

It is within this context that emerge the questions of:

- how valued insight is recognized, accessed (despite copyright and paywalls), and communicated to others
- whether and how to attract others to "play in one's sandpit", and how to respond to invitations to play in their's
- how the energy (economic viability) of the process is sustained
- how cognitive processes are affected in the longer term by sustain usage
- how the system of communication can be exploited from a higher/meta level (energy, influence, "tax", etc)

Of related interest is the manner in which the above processes are further developed and formalized in support of the transactions of the financial community and its speculative engagement with risk. This renders explicit, to a degree, the fundamental role of confidence as the ultimate intangible -- and how it plays out over time.

These patterns of interaction -- and transfers of information -- call for representation in a manner analogous to those of Feynman diagrams. Systemically it might be asked to what degree the patterns are isomorphic or instances of a more general pattern. Ironically, but incidentally, the processes within Feynman diagrams are commonly labelled with Greek letters -- recalling the use of "**the Greeks**" to distinguish conditions of engagement with financial risk.

Although (again somewhat ironically) there appears to have been no consideration of the relevance of any analogue to Feynman diagrams with respect to electronic communication, it is appropriate to note consideration of their relevance with respect to the closely related concern with consumer research -- itself increasingly focused on exploiting online profiles elaborated in the course of social networking . (noosphere***)

The general thrust of Feynman's argument is a celebration of uncertainty. The claim that ignorance and uncertainty are not something to be ashamed of, but quite the opposite - an exciting problem fresh to be solved - is quite refreshing.... Sherlock Holmes knew what he was talking about when he said "Eliminate all other factors, and the one which remains must be the truth." Slowly building on established knowledge, confirming and disproving different strands by experiment (trial and error, if you like), is the way knowledge is furthered....

Whilst recognizing that Feynman, of course, is concerned primarily with things that can be measured and evaluated quantitatively, O'Neill notes cites his argument that it is not only measurable aspects which are important:

But if a thing is not scientific, if it cannot be subjected to the test of observation, this does not mean that it is dead, or wrong, or stupid. We are not trying to argue that science is somehow good and that other things are somehow not good. Scientists take all those things that can be analysed by observation, and thus the things called science are found out. But there are some things left out, for which the method does not work. This does not mean that those things are unimportant. They are, in fact, in many ways the most important. In any decision for action, when you have to make up your mind what to do, there is always a "should" involved, and this cannot be worked out from "if I do this, what will happen?" alone. You say "Sure, you see what will happen, and then you decide whether you want it to happen or not." But that is the step the scientist cannot take. You can figure out what is going to happen, but then you have to decide whether you like it that way or not....

...doubt and uncertainty [are] important. I believe that [they] are of very great value, and extend beyond the sciences. I believe that to solve any problem that has never been solved before, you have to leave the door to the unknown ajar. You have to permit the possibility that you do not have it exactly right. Otherwise, if you have made up your mind already, you might not solve it.

With respect to consumer research, O'Neill then concludes that what Feynman is saying is that even from a scientist's point of view, instinctive judgement is not to be sniffed at. He suggests that there are a lot of parallels between the two -- to be summed up as "common sense".

Multi-loop causal implications encompassed by Feynman diagrams

Feynman diagrams are valued for their capacity to encompass multi-loop causal implications (Andrey Grozin, *Lectures on QED and QCD: practical calculation and renormalization of one- and multi-loop Feynman diagrams*, 2007). As noted by Nivedita R. Kadaba, et al. *Visualizing Causal Semantics using Animations*, *IEEE Transactions on Visualization and Computer Graphics*, 2007):

Causal graphs constitute the most common representation of cause-and-effect relationships. These are directed acyclic graphs, in which vertices denote variable features of a phenomenon and edges denote a direct causal claim between these features... These graphs have appeared in many forms: Feynman diagrams in physics..., Lombardi diagrams to explain secret deals and suspect relations..., and influence diagrams to represent the essential elements of a decision problem such as decisions, uncertainties, and objectives, and how they influence each other.... In all these variations, the causal graphs replace long verbose descriptions or complex mathematical formulations that describe events with their causes and effects.

The increasing precision of experimental data in many areas of elementary particle physics requires an equally precise theoretical description. In particular, radiative corrections, described by one- and multi-loop Feynman diagrams, have to be considered (Chei Sian Lee, Mary Beth Watson-Manheim and Arkalgud Ramaprasad, *Exploring the Relationship between Communication Risk Perception and Communication Portfolio*, *IEEE Transactions on Professional Communication*, 2007).

The visual representation of recognized causal loops between problems and strategies has been a major theme of the EU funded development of the databases of the *Encyclopedia of World Problems and Human Development*, as separately described (*Feedback Loops Interlinking World Problems and Global Strategies*, 2000). There is then the tantalizing cognitive question of how any form of causal loop is comprehended and as to how insights from the Feynman approach might enrich the strategic approach to the highly interconnected problems of society -- forming complex loops as the document indicates (and rendered visually).

Implication of the exemplary irrelevance of Feynman diagrams as employed

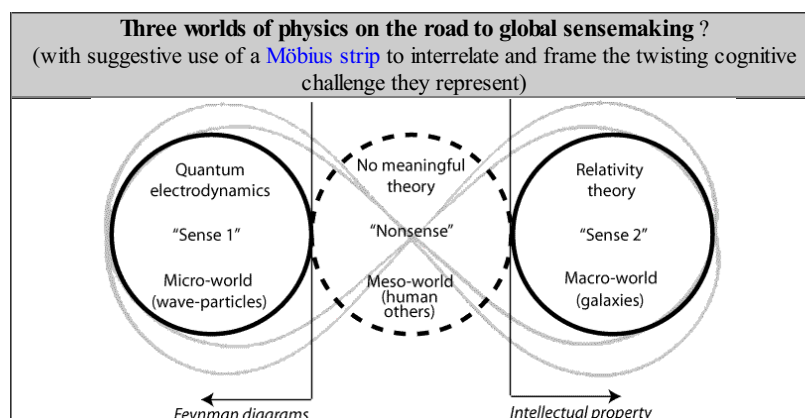
Physics, in its desperate quest for a Theory of Everything, is in the curious situation of providing a "framework for nonsense". In its attentions to the micro-world of fundamental particles, it is reasonably satisfied with its explanation in terms of quantum electrodynamics. With respect to the macro-world of the universe within which the inhabited globe is embedded, physics is reasonably satisfied with its explanations in terms of relativity theory.

As yet unable to reconcile the two explanations, it is assumed that the Theory of Everything (when discovered) will however encompass the experiential reality of humans inhabiting the globe and cultivating such explanations -- inviting their unconditional belief thenceforth. However, at this time, understandings by humans of their daily reality on this meso-world are essentially nonsensical and unmeaningful - to physics, which has proven to be totally incapable of factoring in those dimensions. Correspondingly, the articulations of physics, regarding the extremes with which it is preoccupied, are incomprehensible and meaningless to all but a few -- who expect unquestioning confidence from the tax payers from whom their funding is elicited.

This psychosocial situation can be framed otherwise through the following disparate indications:

- Curiously, neither public "confidence" nor "funding" correspond to any measurements within the methodology of physics -- despite its dependence on them. The former is of course of statistical significance and the latter bears a degree of relationship to the energy enabling research activity, but is questionably related to its psychosocial forms and the problematic forms of disputes between physicists (*Reframing Sustainable Sources of Energy for the Future: the vital role of psychosocial variants*, 2006)
- As the primary enabling discipline for destructive weaponry, physics is dismissive of any social responsibility, as for the risks of nuclear power and its waste disposal. Ironically a major source of funding for physics is the development of new methods of "mass destruction". The position might be framed by extending the famous slogan of the US National Rifle Association: *Nuclear weapons do not kill people, people do*. Richard Feynman achieved his early fame through work on the development of the atomic bomb. He died from a rare form of cancer.
- The Sokal Affair, arising from the hoax perpetrated by physicist Alan Sokal, specifically frames preoccupation with the psychosocial realm as "nonsense" (*Fashionable Nonsense: postmodern intellectuals' abuse of science*, 1998). Curiously he has subsequently deployed an unexpected expertise with respect to a realm otherwise held to be beyond the ken of physicists, or worthy of their consideration (*Beyond the Hoax: science, philosophy, and culture*, 2008). Given recognition that faults found in others may well imply vulnerabilities unrecognized by the fault-finder, the title of the French version of his earlier book may clearly offer an instructive qualification of the claims of physics in this period (Alan D. Sokal and Jean Bricmont, *Impostures Intellectuelles*, 1997).
- The dramatic ongoing debate regarding scientific consensus on climate change has highlighted the questionable meaning of consensus and collective aspirations to it by science (*The Consensus Delusion: mysterious attractor undermining global civilization as currently imagined*, 2011). This has emerged in a period in which a prominent scientist has challenged widespread belief in deity and its problematic implications (Richard Dawkins (*The God Delusion*, 2006)). The period has also seen the global financial community much challenged by loss of collective confidence in its processes -- for good reason. It is therefore significant that a recent survey of quantum physicists established that they did not share a consensus on the nature of quantum electrodynamics and were perplexed by the meaning framed by the models they variously preferred (Sean Carroll, *The Most Embarrassing Graph in Modern Physics*, 17 January 2013)
- Given the categorical statements made by science regarding the psychosocial domain, it is then reasonable to explore the range of knowledge processes thereby neglected (*Knowledge Processes Neglected by Science: insights from the crisis of science and belief*, 2012). These notably include the occasional highly problematic interactions between individual scientists and schools of scientific thought -- typically with implications for interdisciplinary discourse. Statistically these are far less rare than some phenomena to which physicists accord the greatest importance -- each being only too ready to frame a contrasting perspective as an indication of incompetence or worse. Whilst uncomfortably "personal", it becomes valid to ask on what knowledge processes scientists may rely when challenged by interpersonal relations with the other sex -- possibly resulting in multiple marriages and composite families (as in the case of Richard Dawkins). Is there any question that such phenomena might be an indication of being emotionally challenged, or emotionally challenging, in terms of emotional intelligence? How might that be relevant?

The situation from the perspective of physicists might be caricatured as follows. Any preoccupation with the psychodynamics of human engagement with others is then framed as "nonsense", perhaps implicitly recognized by the challenge to "physics" of the humorous account by Feynman himself (Richard P. Feynman and Ralph Leighton. *Surely You're Joking, Mr. Feynman!* 1997).



The above schematic features Feynman diagrams as a conceptual interface with the micro-world -- for people living with others in the meso-world. Curiously, by contrast, the interface with the macro-world of very distant objects in the universe is characterised to a notable degree by a form of human appropriation of the universe through naming in papers, themselves subject to intellectual copyright.

This is reminiscent of psychosocial appropriation of a space at the collective level described by the process of *land nám*, coined by Ananda Coomaraswamy (*The Rg Veda as Land-Nama Book*, 1935), to refer to the Icelandic tradition of claiming ownership of uninhabited spaces through weaving together a metaphor of geography of place into a unique mythic story. This territorial appropriation process, notably practiced by the Navaho and the Vedic Aryans, was further described by Joseph Campbell (*The Inner Reaches of Outer Space: metaphor as myth and religion*, 2002):

Land nám ("land claiming or taking") was [the Norse] technical term for this way of sanctifying a region, converting it thereby into an at once psychologically and metaphysical Holy Land.... *Land nám*, mythologization, has been the universally practiced method to bring this intelligible kingdom to view in the mind's eye. The Promised Land, therefore, is any landscape recognized as mythologically transparent, and the method of acquisition of such territory is not by prosaic physical action, but poetically, by intelligence and the method of art; so that the human being should be dwelling in the two worlds simultaneously of the illuminated moon and the illuminating sun.

It is therefore useful to recall the formative influence that property rights may have had, if only unconsciously, on the elaboration of the theory of relativity and the dynamic relationship between frames of reference (*Einstein's Implicit Theory of Relativity - of Cognitive Property? Unexamined influence of patenting procedures*, 2007).

Given the role it plays in the endeavours of the sciences, and of physics in particular, it is to be suspected that "arrogance" -- and the attribution of relative "ignorance" -- has a mysterious function analogous to gravity in defining cognitive "worlds" and how "right" is defined with respect to their centre of gravity, as well as "self-satisfaction", if not complacency. The mystery extends to the associated process of "attraction" through which adherents to a perspective are sought.

Such issues suggest that, in cultivating its ability to distinguish and characterise variety, physics could usefully recognize the nature of human cognitive constraints -- and "where mathematics comes from", as argued by Lakoff and Nunez (2001). Such recognition could take into account the arguments for self-reference of Douglas Hofstadter (*Gödel, Escher, Bach: an Eternal Golden Braid*, 1979; *I Am a Strange Loop*, 2007) and of Steven Rosen (*Science, Paradox and the Moebius Principle: the evolution of the transcultural approach to wholeness*, 1994). These justify the mnemonic use of the Möbius strip in the above schematic as a means of interweaving the cognitive challenges of the three worlds.

It is difficult to avoid the conclusion that theoretical physics, whether micro or macro, is a vast exercise in irresponsible intellectual escapism. In troubled times it can be seen as the application of brilliance to destabilizing irrelevance. This is sadly highlighted by the inability to adapt any such capacity to the psychosocial dynamics of the Middle East as centered on Jerusalem -- the most mysterious of nexuses. This is all the more pathetic in that many of the most brilliant physicists are themselves of Jewish origin, including Feynman and Einstein, but have proven to be as incapable as ordinary mortals in bringing insight to bear on the matter (*List of Jewish American physicists; List of Jewish mathematicians*).

There is little consideration of the quality of insight required for what physics presumably understands to be a mathematically "trivial" problem, or the opportunities which might be fruitfully explored (*And When the Bombing Stops? Territorial conflict as a challenge to mathematicians*, 2000; *Middle East Peace Potential through Dynamics in Spherical Geometry Engendering connectivity from incommensurable 5-fold and 6-fold conceptual frameworks*, 2012). Curiously, through not understanding, or wanting to understand, the nature of "meaning" -- as exemplified in the case of quantum physics -- physicists prefer to enable the engagement in permanent conflict and the development of instruments of mass destruction.

Inspired by the CERN Large Hadron Collider, as exemplifying a dynamic confrontation of contrasts, there is a case for tentatively exploring configurations such as that above with respect to configurations of symbols through which opposites are related in the meso-word (*Dynamic Interrelationship of Symbols of Coherent Experiential Representation of Nonduality (DISCERN)*, 2008; *Dynamic Exploration of Value Configurations Interrelating traditional cultural symbols through animation*, 2008).

Unconventional explorations of the psychosocial relevance of Feynman diagrams

As co-author with Johan Galtung of the aforementioned study of *Peace Mathematics* (2012), Dietrich Fischer (In: Charles Webel and Johan Galtung (Eds.), *Handbook of Peace and Conflict Studies*, 2011) concludes his contribution with the following quote:

Modern science and technology have given humanity the opportunity to overcome age-old problems of hunger, disease and poverty. But they have also made it possible to destroy ourselves. The late physicist Richard Feynman once met a Buddhist monk who told him: 'Humanity possesses a key that can open the gates to heaven. But the same key can also open the gates to hell.' The choice is ours. (*The Future of Peace as a Self-regulating Process*)

Chemical metaphor: Although Galtung and Fischer consider the relevance of graph theory to peace, no other mention is made of Feynman or his diagrams. In considering unconventional relevance, it is however appropriate to note the early suggestion with regard to insights from chemical bonding by Johan Galtung (*Chemical Structure and Social Structure: an essay on structuralism*. In: Mathematical Approaches to International Relations, 1977).

One development of the chemical metaphor is elaborated by Libb Thims (*Human Chemistry*, 2007) and separately summarized (*On the Nature of the Human Chemical Bond*, *Journal of Human Thermodynamics*, 2005) where the author indicates:

To summarize, through these time-averaged processes of 'fundamental' psycho-neuro-thermo-dynamic bonding interactions, however slightly, the character of the matter-particles, or humans, involved are changed. The cumulative action of such minute changes in character, velocity, and activity patterns, is the effective realization of the photon bond in human life as can be measured via energy absorbing and releasing activities. More directly, via PNT bonding (or photonic or 'fundamental' bonding) humans become fixated spatially and temporally, as would be viewed from a distance in space, to form bound state units as families, networks, corporations, etc.; just as quarks are bonded spatially, via gluonic bonding, to form bound state units as; protons and neutrons. From here we have other variations as: 'interpersonal' PNT bondings, 'familial' PNT bondings, 'social' PNT

bondings, 'political' PNT bondings, 'economic' PNT bondings, etc. In this light, networks of individuals, each in his or her own social sphere, connect or 'bond', via photon-mediated exchanges as: financial, emotional, visual, sensual, physical, verbal, etc., to one another to configure formations called relationships, or groups, or companies, etc.

Thims argues that:

People often speak of having either good or bad chemistry together: whereby, according to consensus, the phenomenon of love is a chemical reaction. The new science of human chemistry is the study of these reactions. Historically, human chemistry was founded with the 1809 publication of the classic novella *Elective Affinities*, by German polymath Johann von Goethe, a chemical treatise on the origin of love. Goethe based his human chemistry on Swedish chemist Torbern Bergman's 1775 chemistry textbook *A Dissertation on Elective Attractions*, which itself was founded on Isaac Newton's 1687 supposition that the cause of chemical phenomena may 'all depend upon certain forces by which the particles of bodies, by some causes hitherto unknown, are either mutually impelled towards each other, and cohere in regular figures, or are repelled and recede from one another'; which thus defines life.

Physical metaphor: Use of a physical metaphor as a means of understanding psychosocial social relations has been explored by Paris Arnopoulos (*Sociophysics: cosmos and chaos in nature and culture*, 2005; *Sociophysics: paradigmatic metaphors*, 2003). This is a renewed attempt to combine the latest natural and social science theories and derive significant generalizations for both -- using the powerful physics metaphor as an inertial guidance system to emphasise the underlying similarities between all systems.

Biological metaphor: Hector Sabelli and Gerald H. Thomas (*The Future Quantum Computer: Biotic Complexity*, 2008) summarize their approach in the following terms:

Quantum computing forces a reexamination of logic. We examine its historical roots in logos, the logic of nature, and it is manifested by the laws of physics. A new logic comes out of this inquiry and it is applied to quantum computing. The logical design of computers according to the logic of quantum physics will allow the full use of quantum processes for computation and also adapt our humanly conceived computer logic to the actual logic of nature. The basic principles of quantum physics are homologically repeated in fundamental processes at all levels of organization. Thus, the principles of action, opposition such as charge and spin, chromatic structure, and the creation of novelty, diversity, and complexity can guide logic. Explicit realizations of these ideas are provided

Actually at the quantum level, an entity does not follow a single path, but its behavior depends on all imaginable paths and the value of the actions of each path (Feynman, 1974).

The existence of multiple levels of opposition corresponds to the multiple levels in which we can consider physical processes. A light ray as conceived in geometric optics is actually a wave, manifested in diffraction phenomena, that at a more elementary level is constituted by the multiple paths of action described by Feynman. We may regard these paths as multiple "biotic opposites". The periodic oscillation of radiation correspond to the helical models of opposition commonly advanced in dialectics, while the linear geometric models correspond linear logic. The concept of multiple, elementary biotic opposites is being explored as an alternative to philosophical notions of complementarity.

We thus conceive three levels of opposition: (1) macroscopic logical or mechanical. Paths are linear in the sense of geometric optics. (2) Dialectic or periodic in the sense of waves. Periodic oscillations include among its most important cases period 2 alternation, period 3, and the infinite periodicities it implies. (3) Biotic or creative, which involves multiple components, and generates new ones...

In summary, we outline a new approach that adapts the logic of the computer to the logic of nature as embodied by both quantum computing devices and by natural and human processes. Regarding quantum physics as the fundamental logic of nature demands us to consider its theory as logical principles. To find a logical interpretation to quantum principles may thus not be regarded as a proposal, or a matter of choice, but is a task to be accomplished. While we are far from attaining it, such a goal can be reached. The continuity of evolution requires that the same fundamental forms must be expressed at all levels of organization, so the principles of quantum physics and the principles of rational thinking must be homologous.

Thims fruitfully notes the relevance of [catastrophe theory](#):

Some forms of opposition, including negation, may be modeled by catastrophes. Thom's catastrophes provide a good starting point to go beyond the standard "and" and "or" gates. First, according to Thom's theorem, we need to consider only a few control forms. The limited number of archetypal morphologies that Thom identified is assumed to be universal. Certainly forms are created and constrained by physical factors that also extend across the chemical, biological, social, and psychological domains. We may apply this concept to logical statements. Second, it is good starting point because catastrophe forms appear in the study of choice... Third, Thom (1983) and others have already explored how catastrophes can be used to model active verbs representing actions, as contrasted to Boolean logic that only models the non-active copula "to be." Thom give a constructive and a destructive interpretation to each catastrophe. For instance, the fold represents to begin and to end; the cusp represents to engender or unite and to capture and to break; the butterfly represents to give and to receive, as well as to exfoliate.

Psychoanalysis: Although an exemplar of the "abuse of science" as abhorred by Alan Sokal, the implications of Feynman diagrams have

been fruitfully considered from a psychoanalytical perspective by [Fadi Abou-Rihan](#) (*Relations, The Psychoanalytical Field*, 16 November 2007, and in *Deleuze and Guattari: a psychoanalytic itinerary*, 2008):

Had Heisenberg read Nietzsche? I do not know. However, and notwithstanding his will to abstraction, the physicist recognized that the thing-in-itself, the electron, could not be represented and was hence experientially unknowable in itself. Feynman's diagram is again the schema of an event, of a conditional relation of repulsion between two electrons. We do know that Freud had in fact read Nietzsche and that he had developed a conditional relation of envy and resentment toward the philosopher who, as he somewhere put it, had intuited the conclusions that he had had to spend an entire lifetime observing clinically. We also know that Lacan's conditional relation to the German philosopher was one of admiration: he had read and eulogized his texts as an adolescent and then, after he had completed his medical studies, had been exposed to them once again...

It is rather unfortunate but perhaps not too surprising that envy, resentment, and admiration obscured one of Nietzsche's most fundamental insights: what is to be analysed is not the unconscious as a thing in itself but the relations and the events which constitute it, and that such an analysis must itself figure among these relations and hence be the object of its own analysis. Of course, both Freud and Lacan, each in his own particular way, made extensive clinical use of such relations and events, especially in their transference echoes. Invariably however, that use was motivated by an epistemophilic drive whose principal aim was the "truth" of the analysand's unconscious; the interpretation (Freud) or dialectisation (Lacan) of the transference is relevant only insofar as it makes explicit the analysand's psyche in its wishes, histories, patterns, and frustrations.

The second paragraph is indicative of the challenging knowledge processes whose consideration is neglected by science, as separately discussed (*Knowledge Processes Neglected by Science: insights from the crisis of science and belief*, 2012). Any adaptation of Feynman diagrams as a pattern language could usefully aspire to take such into account.

Consciousness: There is a considerable literature relating to consciousness, variously inspired by the "quantum" metaphor. This includes theories of [quantum mind and quantum consciousness](#), and explorations of [quantum psychology](#) (Brian Flanagan, *Are Perceptual Fields Quantum Fields?*; C. Koch and K. Hepp, *Quantum mechanics in the brain*, *Nature*, 2006; Abninder Litt, et al., *Is the Brain a Quantum Computer?*, *Cognitive Science*, 2006; [Michael Lockwood](#), *Mind, Brain and the Quantum*, 1989; M. C. Pharaoh, *Looking to quantum mechanics for a reductive explanation of the noumenon of consciousness*, 2008; Chris King, *Quantum Cosmology and the Hard Problem of the Conscious Brain*).

Some of this work necessarily includes reference to Feynman.

Mansoor Malik and Maria Hipolito. *Time and its Relationship to Consciousness: an overview*. *Journal of Consciousness Exploration and Research*, 2010) argue:

Time is one of the most fascinating and fundamental concepts in human life. Yet the physical meaning of time is far from understood. Subjective experience of time is equally intriguing and mysterious. Time may be considered an illusion according to modern physics, but its psychological impact cannot be denied. This current paper explores the conception of time in many diverse contemporary fields such as physics, psychology, psychoanalysis, phenomenology, and anthropology. Disorders of time perception and neurophysiology of time is discussed. The idea of time as the creation of conscious mind is considered.

More interestingly, all laws of fundamental physics (i.e., the Dirac equation, Schrödinger's equation, Maxwell's equations, Einstein's field equations of gravity, Feynman diagrams) are time reversible... This is to say that at the most fundamental level, there is no preference for one direction in time (future) over the other direction (past). Physics provides no objective reason to believe that our present is in any way special, or more real than any other instant of time.

In a consideration of the relevance to consciousness, the former CERN physicist, [John S. Hagelin](#) (*Is Consciousness the Unified Field? A Field Theorist's Perspective*, Maharishi International University) notably contrasts electron scattering as represented the classical field behaviour, represented by a "tree" diagram (without a closed loop), with the scattering of light represented by a different class of Feynman diagram involving "loops". Each loop is then associated with one power of Planck's constant.

Erol Basar (*Brain-Body-Mind in the Nebulous Cartesian System: a holistic approach by oscillations*, 2010; also titled *Brain Body Mind Oscillations in Scope of Uncertainty Principle*) proposes an integrative, a new multi-dimensional "Cartesian System", associating processes of physics with those of psychophysiology in two different levels. notably through recognition of the use in brain research of metaphors or principles, such as the use of Feynman diagrams, strategies of quantum mechanics, principles of nonlinear dynamics, entropy and synergetics to interpret their data. The Feynman Diagram and the Monte Carlo Method may open new possibilities not only to predict brain responses but also further understanding of brain functioning.

Aesthetics: music and sonification: It is appropriate to consideration of "unconventional approaches" that Feynman's own interest in art and bongo drumming was much deplored by other physicists as an irrelevancy -- perhaps even to be seen as an "abuse of science". Feynman was notably intrigued by the relation of relation to physics -- proposing use of a drumhead to demonstrate [Chladni vibrational patterns](#) (Jagdish Mehra, *The Beat of a Different Drum: the life and science of Richard Feynman*, 1994).

The value to science of [sonification](#) has been summarized in a report prepared for the US National Science Foundation by the [International Community for Auditory Display](#) (*Sonification Report: status of the field and research agenda*, 1997). It is especially relevant to note its use within the context of the [CERN Large Hadron Collider](#) (LHC) as an aid to pattern recognition -- producing sounds from data while keeping the information intact (*LHCsound: Listening to the God particle*, *New Scientist*, May 2010). The [LHCsound](#) initiative is a growing collaboration of particle physicists, musicians and artists. The aim is to turn the data collected from the ATLAS

experiment at the Large Hadron Collider into music. As indicated by one of the instigators in the *New Scientist* account:

We also have numerous plans for new sonifications -- **crazy ideas like sonifying Feynman diagrams!**

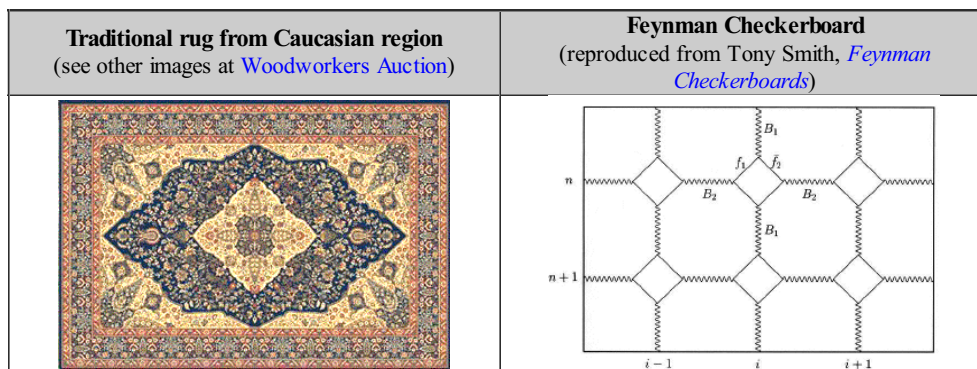
Aesthetics: art and painting: The relation between art and physics has been explored by [Paul Thomas](#) (*Atomism and many worlds*, paper presented at *Colliding Ideas: Art, Society and Physics Symposium*, Melbourne, 2012). He notes:

Feynman stated that photons spin at a rate of fifteen zero's (40 trillion revolutions per second). The paper explores Feynman's diagram and reflects on what happens to the reflected image along the surface of the mirror by making what is invisible visible exploring the possibilities of 'parallel universes' or 'many worlds'. 'Atomism' is an evolving collaborative art Installation with Kevin Raxworthy that investigates silver, the mirror, and quantum theories of light. Feynman in his lecture tells us that light hits a mirror at all points not just at the point of reflection. All points on the surface of the mirror receive and reflect light based on the spin of the photon that is not visible to the viewer. The premise of the work reveals that a light wave does not merely encode all the information about an object but is also independent of an observer. The paper explores how objects in the art work reappear in parallel existences that are reflected in a metaphorical mirrored surface.

Aesthetics: carpet design: Given the development by Christopher Alexander of a pattern language (*A Pattern Language*, 1977), followed by his extensive study of *The Nature of Order* (2003-4), his concern with carpet design is especially relevant to consideration of a feature of Feynman diagrams (*New Concepts in Complexity Theory: an overview of the four books of the Nature of Order with emphasis on the scientific problems which are raised*, 2003; *A Foreshadowing of 21st Century Art: the color and geometry of very early Turkish carpets*, 1993).

He relates the issues to a geometric approach to computation (*Harmony-Seeking Computations: a science of non-classical dynamics based on the progressive evolution of the larger whole*, *International Journal for Unconventional Computing*, 2009), as discussed separately (*Magic Carpets as Psychoactive System Diagrams*, 2010; *Harmony-Comprehension and Wholeness-Engendering: eliciting psychosocial transformational principles from design*, 2010)

The relevance to Feynman diagrams is to be noted with respect to visual renderings of [Feynman Checkerboards](#) as a means of indicating all possible ways for an electron to go from an initial point to a destination point, with the choice of a particular single configuration being a random quantum choice. the approach has been variously developed (Edward Hanna, *Feynman Checkerboard as a Model of Discrete Space-Time*, 2006).



Aesthetics: dramatic situations: As discussed separately (*Taxonomies of Dramatic Situations*, 2009), the spectrum of dynamics of relationships between "us" and "them" is reflected to a fairly high degree in literary explorations and folk tales. A **fictional plot** is the sequence of interrelated events arranged to form a logical pattern and achieve an intended effect. The classic approach to organizing the dynamics of such plots is that of [Georges Polti](#) (*The Thirty-Six Dramatic Situations*, 1916) who endeavoured to categorize every dramatic situation that might occur in a story or performance -- building on the earlier work of [Carlo Gozzi](#). The taxonomy has been recently criticized by Jon Adams (*Plot Taxonomies and Intentionality*, *Philosophy and Literature*, 32, 1, April 2008) who considers that most of these thirty-six situations are so vague as to admit almost any plotline, and certainly with too many plotlines as to successfully serve as boundaries. This does not preclude recognition of patterns of similarity or the familiarity that many have with such patterns.

The argument to be considered is the stress placed by Feynman on interactions as the key to recognition of patterns -- rather than the "characters" in the drama. Particle physics is embarrassed by the number of [elementary particles](#) it has been obliged to recognize and to endeavour to order -- the *dramatis personae* (*List of particles*, *Wikipedia*). [image]

It is interesting that the numbers recognized in such situations are of an order reminiscent of the cognitive constraint -- the [Dunbar Number](#) -- which is the subject of research with respect to social networking. This is a suggested cognitive limit to the number of people with whom an individual can maintain stable social relationships. However much any such constraint is denied, it may prove to be evident in any human effort to order reality, as previously discussed (*Representation, Comprehension and Communication of Sets: the role of number*, 1978). There is an ironic charm to the possibility that the number of particles physics is able to recognize may bear a resemblance to the number of deities in certain pantheons -- with the relationships between them offering the possibility of representation by Feynman diagrams.

Logic: As argued by John Baez (*Computation and the Periodic Table* In: 24th Annual IEEE Symposium on Logic In Computer Science,

2009. LICS '09):

In physics, Feynman diagrams are used to reason about quantum processes. Similar diagrams can also be used to reason about logic, where they represent proofs, and computation, where they represent programs. With the rise of topological quantum field theory and quantum computation, it became clear that diagrammatic reasoning takes advantage of an extensive network of interlocking analogies between physics, topology, logic and computation.

One controversial attempt to find a unified description of basic interactions at the quantum level is through [Topological GeometroDynamics](#) (TGD), leading to consideration of the possibility of generalizing Feynman diagrams, as discussed by M. Pitkänen ([How to Define Generalized Feynman Diagrams?](#) 2012):

Generalized Feynman diagrams have become the central notion of quantum TGD and one might even say that space-time surfaces can be identified as generalized Feynman diagrams. The challenge is to assign a precise mathematical content for this notion, show their mathematical existence, and develop a machinery for calculating them.

Elsewhere he considers the implication of TGD for psychological and biological systems (M. Pitkänen [TGD Inspired Quantum Theory of Consciousness and of Bio-systems: an overall view](#), 2006). The approach has been critiqued in terms of: *TGD's rather much ado about practically nothing*. This might surely be otherwise assumed to be very appropriate to the nature of fundamental physics ([Topological GeometroDynamics, RationalSkepticism](#), June 2010).

Implications of Feynman diagrams in terms of other cultural perspectives

In framing the cognitive challenge at this time, there is a case for casting the net widely to benefit from any insight -- and to reframe the approach to dealing with "nonsense".

Buddhism: In the quest for a "theory" which encompasses the variety of logical positions, the insights of Buddhist logic merit consideration. There is a classic Buddhist text entitled the *Brahmajala Sutta* ([The All-embracing Net of Views](#)). This appears to be unique in endeavouring to map out as a system the complete set of fundamental viewpoints. It is the first *sutta* in the entire collection of the Buddha's discourses in the Pali *Tripitaka*. There are many citations and interpretations of it (accessible on the web) as being fundamental to the challenges of knowledge.

Its importance stems from its primary objective, namely the exposition of a scheme of 62 cases designed to include all possible views (past and future) on the central concern of speculative thought, the nature of the self in relation to the world (see [review](#)). Its patterning principles bear an intriguing relationship to the 4-phase, 8-phase and 16-phase structure of an exploratory framework designed to transcend simplistic polarization ([Discovering Richer Patterns of Comprehension to Reframe Polarization](#), 1998).

Speculatively -- naturally -- the argument can be taken further in considering how intuitive insights of various cultures have been elaborated and related to the conventions of physics. The long-term interactions between Wolfgang Paul and Carl Jung (discussed below) offer a "respectable" pointer in their direction, if respectability is what is required. The same might be said of those between quantum physicist [David Bohm](#) and [Jiddu Krishnamurti](#) (*Limits of Thought*, 1999) as notably explicated by physicist [F. David Peat](#).

A further pointer is the development of [catastrophe theory](#) and its epistemological significance by topologist [René Thom](#) (*Structural Stability and Morphogenesis*, 1972; *Semio Physics: A Sketch*, 1990). This elicited the sustained deprecation of [Ilya Prigogine](#) and offers a classical example of the dynamics which physicists have been unable to transcend. In Thom's explorations of structural morphogenesis in the "meso-world", he notably ventured into dance and its notation (*La Danse comme Sémiurgie*, 1981 In: *Apologie du Logos*, pp. 118-130).

Physics, with the enthuasiastic support of mathematics, has been remarkable in its elaboration of explanations dependent on more than four "dimensions", whether extended to 10, or to 26 -- or to thousands in the case of the discovery of the Monster Group of symmetry group theory. This is done -- "unblushingly" -- without the slightest formal consideration of the challenges to comprehension and meaningfulness of such explanations -- or their implications for the unresolved complexity of the "meso-world". It is therefore appropriate to note the discussions on the [Imagining the Tenth Dimension](#) website, in support of a book of that name by physicist Rob Bryanton (*Imagining the Tenth Dimension: a new way of thinking about time and space*, 2007).

In discussion of the challenge of [Imagining the Tenth Dimension](#), Rob Bryanton introduces the potential relevance of the *I Ching* by citing its criteria in that Wikipedia profile: *Simplicity* (as the root of the substance), *Variability* (as the use of the substance), and *Persistency* (as the essence of the substance). He then comments:

What if there were an ancient mapping system which boiled down our current position within the multiverse to only six parameters? This takes us, tangentially, to a territory that some readers of this blog won't be comfortable with, but which has enough connections to the big picture ideas we've been playing with that I believe it's worthy of consideration: this ancient system of mapping our reality is called the *I Ching*.

Bryanton precedes this comment with reference to the argument of cosmologist Martin Rees ([Mathematics: the only true universal language](#), *New Scientist*, 15 February 2009), that there are only six basic structures underlying reality. Curiously, from a quite distinct philosophical perspective, [Raymond Abellio](#) distinguishes six fundamental poles (*La Structure absolue*, Gallimard, 1965).

Possibilities of this nature have been considered separately (*Reframing the Dynamics of Engaging with Otherness: Triadic correspondences between Topology, Kama Sutra and I Ching*, 2011). Reversing the challenge of explanation, the question might be framed in terms of what widely meaningful coding system could "hold" and "carry" the diversity of a complex set of patterns of relationship with otherness, and the possibility of engaging with it. This was discussed separately with respect to extended periods of time (*Engaging Macrohistory through the Present Moment*, 2004; *Minding the Future: thought experiment on presenting new information*, 1980).

Yet more speculatively, in the light of the probable role of cognitive constraints in distinguishing meaningful patterns in the engagement with complexity, there is a case for considering whether the 62 classically "dynamic positions" of the *Kama Sutra* could be compared in any way -- as an "embodied encoding" -- to the characteristics of Feynman diagrams as a pattern language.

In this mode, partly inspired by Feynman's work on the [path integral formulation](#) of quantum mechanics (crucial to the subsequent development of theoretical physics), [Arnold Mindell](#) (*Path Awareness: in the teachings of Don Juan, Richard Feynman and Lao Tse*, 2007) explores the connections between these seemingly disparate initiatives. As a psychologist, Mindell looks to nature and physics for a model of relationships between matter, particles, and movement and how they interact, in order to align psychological inner work to mirror the way all things involving matter and energy perform.

Of considerable potential relevance with respect to any form of "path awareness", and its "integration", is the widespread popular fascination with ball sports within which "[passing patterns](#)" (discussed separately) can be recognized, appreciated, emulated, and studied. It could be argued that this fascination derives from an unconscious recognition of analogous patterns in the psychosocial realm. The challenge is to relate the two -- potentially by using passing patterns to encode and embody those which might otherwise be represented by Feynman diagrams.

As variously emphasized above, there is every possibility that the degree of intimate familiarity of people with the pattern language, of which Feynman diagrams may come to be recognized as an instance, could be compared with Monsieur Jourdain's much-cited phrase in [Molière's *Le Bourgeois Gentilhomme*](#) -- who had long been speaking in "prose" without "recognizing" it:

Par ma foi! il y a plus de quarante ans que je dis de la prose sans que j'en susse rien, et je vous suis le plus obligé du monde de m'avoir appris cela.

Cognitive embodiment in time in contrast to extra-temporal explanation

There is an extensive literature regarding the dangers of simplistic consideration of the detached objectivity of "explanation" and the problematic nature of "subjectivity" (Max Deutscher, *Subjecting and Objecting: an essay in objectivity*, 1983). The issue is recongized to a degree in the challenging role of the observer with respect to fundamental physics. The processes involved are "riddled" with paradox and a challenge to the coherence of comprehension and its locus (*¿ Defining the objective ∞ Refining the subjective ?!: Explaining reality ∞ Embodying realization*, 2011).

The issue is significantly highlighted in the work of George Lakoff and his collaborators (*Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2001; *Women, Fire, and Dangerous Things: what categories reveal about the mind*, 1997; *Philosophy In The Flesh: the embodied mind and its challenge to Western thought*, 1999), as further elaborated by [Chris Fields](#) (*Metaphorical Motion in Mathematical Reasoning: further evidence for pre-motor implementation of structure mapping in abstract domains*, *Cognitive Processing*, 2013). The issues relate to that of [social constructionism](#), namely how social phenomena or objects of consciousness develop in social contexts ([Peter L. Berger](#) and [Thomas Luckmann](#), *The Social Construction of Reality: a treatise in the sociology of knowledge*, 1967; [Paul Watzlawick](#), *The Invented Reality: how do we know what we believe we know?* 1984).

Of further relevance to this argument is the case variously made for a focus on experience in the present moment -- in the now, as by [Peter Russell](#) (*The White Hole in Time: our future evolution and the meaning of now*, 1993; *Light, Consciousness, and the White Hole in Time*, 2009) and by [Eckhart Tolle](#) (*The Power of Now: a guide to spiritual enlightenment*, 1999). The argument can be developed in terms of "presenting" the future (*Presenting the Future: an alternative to dependence on human sacrifice through global pyramid selling schemes*, 2001).

Much has been made by physicists of the paradoxical implications of time reversal in Feynman diagrams. This clearly has cognitive an philosophical -- if not metaphysical -- implications for the comprehension of their representational power.

In the case developed here for their use as a pattern language, a key issue is how cognitive any pattern or set of patterns is internalized and integrated into consciousness and behaviour. The challenge is implicit in understandings of the embodied mind. Indications of the process are offered by other examples of use of pattern language. Especially relevant are the patterns used for dance movements, most notably the [Labanotation](#) used in [Laban Movement Analysis](#) (LMA). This is a method and language for describing, visualizing, interpreting, and documenting all varieties of human movement. It is employed by dancers, actors, musicians, athletes, physical and occupational therapists, and in other disciplines. Of relevance to this argument, the Möbius strip used throughout Laban Movement Analysis as a representation of the theme of "Inner and Outer"

As suggested by engagement in dance, cognitive patterns can be considered as implying virtual or metaphorical movement (cf. [Chris Fields](#), *Metaphorical Motion in Mathematical Reasoning: further evidence for pre-motor implementation of structure mapping in abstract domains*, *Cognitive Processing*, 2013). This is consistent with the arguments of [Mark Johnson](#) (*The Meaning of the Body: aesthetics of human understanding*, 2008; *The Body in the Mind: the bodily basis of meaning, imagination, and reason*, 1987) and of [Maxine Sheets-Johnstone](#) (*The Primacy of Movement*, 2011; *Movement and Mirror Neurons: a challenging and choice conversation*, *Phenomenology and the Cognitive Sciences*, 2012).

With respect to the value of Feynman diagrams as a pattern language, is the process of embodiment better understood in emotional terms? This is likely to be especially apparent in [transactional analysis](#) and the experiential sense of the patterns in which people can engage. This understanding was first developed by [Eric Berne](#) (*Games People Play: the Psychology of Human Relations*, 1964). Simply knowing of the transactional pattern is radically different from its meaningful internalization. Skill in that respect may be significantly dependent on [emotional intelligence](#) as articulated by [Daniel Goleman](#) (*Emotional Intelligence: why it can matter more than IQ*, 1997; *Working with Emotional Intelligence*, 1998; *Social Intelligence: the new science of social relationships*, 2006)

A description of learning to play music by Leah Brammer (*Ability Development and Pattern Recognition*, *Core Suzuki Piano Studio*), cites an account by Daniel Goleman (1998) of a study of executives at fifteen large companies:

Just one cognitive ability distinguished star performers from average: pattern recognition, the 'big picture' thinking that allows leaders to pick out meaningful trends from a welter of information around them and to think strategically far into the future.

Brammer's description continues:

When Suzuki students memorize the aural patterns and connect them physically and mentally they are internalizing patterns in a very different way from students who learn to read symbols and depend on the visual cue to "know" which notes to play. So, in addition to developing the ability to recognize patterns, music study develops the ability to understand the relationships between those patterns, and to be able to create from this level of understanding.... students are learning ... the similarities and differences of these patterns for the phrases in a piece, and also the form of the whole piece. They can play many different pieces. As they internalize the patterns, they are working on the quality of the sound and how to use the body to get the best sound. This way, the knowledge from the repetitions becomes ability and the implicit learning about the patterns becomes actualized. This is important to note, because it is the self-discovery and experience of playing the patterns that develops the ability.

What level of complexity to render explicit with the expectation of its meaningful comprehension? How does the question relate to the case of marketing financial derivatives and other cases involving "small print"

NB: The development of the argument continues in the [main paper](#), where the bibliographical [References](#) are located.



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

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