



laetus in praesens

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Superquestions for Supercomputers

Avoiding terra flops from misguided dependence on teraflops?

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Introduction

Precedents and complementary initiatives

Reservations

Cognitive implications?

Higher order questions: quality vs. quantity?

Potentially relevant superquestions

Clustering superquestions in terms of WH-questions

Refining and reconfiguring the set of superquestions

Possibilities of artificial intelligence

Conclusions

References

Introduction

This is a reflection on the press release announcing that *Supercomputers ramp up to tackle global societal problems* (Science and Technology Facilities Council, 17 November 2010). It argues that **supercomputers** of the future, capable of rapidly crunching vast amounts of data way beyond the existing capabilities of current technology, will spearhead the development of new drugs, new sources of energy and environmental monitoring. It indicates that:

- the Fujitsu **Open Petascale Libraries** project (OPL) is a global collaborative initiative created to develop a publicly available mathematical library that will facilitate the development of the software required to run on next-generation petascale supercomputers, capable of performing quadrillions of calculations per second. These are typically measured technically in terms of **FLOPS** (an abbreviation for the computing term *floating point operations per second*, teraflops being 10^{12} flops, and petaflops being 10^{15}).
- petascale computers are capable of quickly performing large-scale and advanced computations that cannot be solved using normal computers. As such, they are vital tools for solving the important issues facing society, including improved healthcare, the development of new medicines, materials, strategies for environmental disaster prevention as well as for basic scientific research including the origin of matter and the history of the universe.

In claiming to focus on "global societal problems" and the "important issues facing society", the initiative follows in a long tradition of approaches to global simulation and world modelling (**Balaton Group**, **Society for Modeling and Simulation International**, **Sentient World Simulation**, **Joint Simulation System**, and the European **FuturICT** project). These all raise questions like **who defines what are the "global societal problems" and the "important issues facing society"** -- and to the satisfaction of whom? How is such definition achieved? Which problems are included in any such definition -- or excluded (possibly without consideration)? When is such definition undertaken -- and where and why?

The concern here is the nature of the questions for which such computing power is being developed, as well as the manner in which questions some would consider relevant to "global societal problems" are likely to be omitted from such exploration. The point is well made by the example of a particular dimension from climate change considerations by the **IPCC** in its *Fourth Assessment Report* (H.-H Rogner, et al., *Introduction. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*) it is stated that:

The **Kaya identity** (Kaya, 1990) is a decomposition that expresses the level of energy related CO₂ emissions as the product of four indicators: (1) carbon intensity (CO₂ emissions per unit of total primary energy supply (TPES)), (2) energy intensity (TPES per unit of GDP), (3) gross domestic product per capita (GDP/cap) and (4) population....

The challenge - an absolute reduction of global GHG emissions - is daunting. It presupposes a reduction of energy and carbon

intensities at a faster rate than income and population growth taken together. Admittedly, there are many possible combinations of the four Kaya identity components, **but with the scope and legitimacy of population control subject to ongoing debate, the remaining two technology-oriented factors, energy and carbon intensities, have to bear the main burden....** [emphasis added]

No further reference is made to this factor by IPCC.

The concern here is the nature of the "superquestions" meriting answers -- in the light of the engagement of those who would want them answered, and who may well be called upon as tax payers to finance the development of supercomputers and their use.

It follows from earlier interest in questions and what may be readily neglected (*Generating a Million Questions from UIA Databases: Problems, Strategies, Values*, 2006; *Global Strategic Implications of the Unsaid: from myth-making towards a wisdom society*, 2003; *Unknown Undoing: challenge of incomprehensibility of systemic neglect*, 2008). The challenge with respect to governance has been previously summarized in a somewhat analogous checklist (*Governing Civilization through Civilizing Governance: global challenge for a turbulent future*, 2008) to which the "superquestions" highlighted here are tentatively linked.

Precedents and complementary initiatives

A listing of the most powerful, known (non-distributed) computers in the world, necessarily including "supercomputers", is maintained by the **TOP500** project. Currently the **Tianhe-1A** supercomputer in China at the National Supercomputing Center is ranked as the fastest at 2.566 petaFLOPS, or over 2½ quadrillion floating point operations per second. The concern here is however as much with the intended use of such devices.

The Joint Simulation System was initiated in 1995 (Kari Pugh and Collie Johnson, *Building a Simulation World to Match the Real World; The Joint Simulation System*, January-February 1999, p.2; James W. Hollenbach and William L. Alexander, *Executing the DOD Modelling and Simulation Strategy: making simulation systems of systems a reality*, 1997).

This has seemingly now morphed, via the **Total Information Awareness** program, into the **Sentient World Simulation** (SWS) and is intended as a "synthetic mirror of the real world with automated continuous calibration with respect to current real-world information" with a node representing "every man, woman and child" -- presumably including those responsible for the SWS itself. "**Sophisticated physics**" were integrated into the simulation in 2007. Regrettably, as might be expected, this is being undertaken entirely in the interests of a US strategic defence strategy on behalf of the US Department of Defense (Mark Baard, *Sentient World: war games on the grandest scale -- Sim Strife*, *The Register*, 23 June 2007).

Understandably SWS will necessarily acquire a bias of defensiveness, as argued with respect to **ECHELON** with which SWS would presumably be functionally integrated (*From ECHELON to NOLEHCE: enabling a strategic conversion to a faith-based global brain*, 2007). Of interest is how it might be integrated with:

- the strategic methodology of a recent study by the RAND Corporation's National Security Division (Paul K. Davis, *et al.*, *Enhancing Strategic Planning with Massive Scenario Generation Theory and Experiments*, 2007).
- the recognition of the possibilities of "**crowdsourcing**", community-based design or **distributed participatory design**

The **FuturICT Knowledge Accelerator** is a previously unseen multidisciplinary international scientific endeavour with focus on techno-socio-economic-environmental systems. Its focus is on "unleashing the power of information for a sustainable future". FuturICT is a response to the European **Flagship call**. It intends to unify hundreds of the best scientists in Europe in a 10 year 1 billion EUR program to explore social life on earth and everything it relates to. It proposes to produce historic breakthroughs and provide powerful new ways to manage challenges that make the modern world so difficult to predict, including the financial crisis. The three intended achievements of the FuturICT flagship will be the establishment of:

1. a Living Earth Simulator (global-scale simulation of techno-socio-economic systems),
2. Crisis Observatories (for financial instabilities, scarcity of resources, emerging risks and conflicts, epidemics, etc.), and
3. an Innovation Accelerator (identifying innovations early on, evaluating them across disciplines and supporting co-creation projects between different scientific disciplines, business, and governance).

Aside from individual supercomputers, the increasing power of **distributed computer networks** is potentially of greater significance -- most obviously in the case of search engine facilities, social networking and intelligence/surveillance systems (see the *Wikipedia List of distributed computing projects*). Of relevance to the following argument is the extent to which these elicit, through **volunteer distributed computing**, the engagement of volunteers connected through their personal computers (see the *Wikipedia List of volunteer distributed computing projects*). A striking example in the case of the security services is offered by Tom Burghardt (*FBI Wiretapping of Internet Users -- "All Your Data Belongs to Us": a seamless global surveillance web*, *Global Research*, 21 November 2010). The existence of the **Secret Internet Protocol Router Network** (Siprnet), a system of interconnected computer networks used by the US Department of Defense and the US Department of State to transmit classified information, has been highlighted by the current release via WikiLeaks of data stored on it (Julian Borger and David Leigh, *Siprnet: where America stores its secret cables*, *The Guardian*, 29 November 2010).

There have been many variant simulations of world dynamics -- dating from that originally promoted by the Club of Rome. *The Limits to Growth* had been based on the **World3** model, a computer simulation model of interactions between population, industrial growth, food production and limits in the **ecosystems** of the Earth (*Club of Rome Reports and Bifurcations: a 40-year overview*, 2010). Curiously these have tended to fragment into specialized models, notably climate models and economic models. As shown by Graham Turner (*A Comparison of the Limits to Growth with Thirty Years of Reality*, CSIRO 2007), the original study provoked many criticisms which falsely stated its conclusions in order to discredit it.

On a much more modest scale, but sharing the concern with the use of information to address "global societal problems", is the *Encyclopedia of World Problems and Human Potential*. This is an initiative developed since the 1970s by the [Union of International Associations](#) and [Mankind 2000](#) to interrelate in an online database highly disparate institutional initiatives and concepts. This was notably presented to a meeting of the [Global Brain Group](#) (*Simulating a Global Brain: using networks of international organizations, world problems, strategies, and values*, 2001). This was last funded to develop its biodiversity and multimedia applications through the INFO2000 project of the European Community. It was subsequently positively evaluated for funding through the World Bank INFODEV project in order to augment its application to development.

Reservations

Three fundamental question might be asked, given the resources deployed on the initiatives of the past:

- whether the quality of the questions they are expected to address has been updated at a rate commensurate with the technical capacity of computers.
- how the envisaged applications will account for the disasters which have emerged over the period in which these improvements were made (financial crisis, climate change, environmental degradation, resource depletion, unconstrained population explosion, unprecedented levels of violence and threats of violence)
- whether there is any capacity to respond to the emergence of significance from such simulation and monitoring.

The point of the last question has perhaps been most sharply made by the work of a team of 26 scientists ([Johan Rockstrom](#) and Will Steffen, *Planetary Boundaries: exploring the safe operating space for humanity*, 2009) presented at the Club of Rome General Assembly (Amsterdam, 2009). These boundaries are necessarily environmental constraints and boundary conditions, and the focus was on the degree to which they are already exceeded or in process of being exceeded. In discussion of action to constrain the marked tendency to exceed these boundaries, and the initiatives which might be collectively undertaken, the point has been made that a complementary analysis is necessary (*Recognizing the Psychosocial Boundaries of Remedial Action: constraints on ensuring a safe operating space for humanity*, 2009). A complementary analysis would factor in remedial capacity in the light of the disastrously inadequate track record of collective action, namely the probability that any advocated collective action could be effectively undertaken -- even if agreement was reached on what needed to be done.

In an interview prior to the [UN Climate Change Conference](#) (Cancun, November 2010), Britain's chief scientist [John Beddington](#) indicated little possibility of any agreement (*No hope for climate talks*, *The Australian*, 29 November 2010). Unusually he added: *It's not just climate change... There is also a demographic boom, with world population rising by 70 million a year. We have got major issues with food security interacting with climate change.* This is curiously reminiscent of the reflections on the challenge of overpopulation of [John Farrands](#), former Head of the Australian Department of Science and the Environment (*Don't Panic, Panic: the use and abuse of science to create fear*, 1993).

Whilst supercomputers may indeed significantly enhance "environmental monitoring" (as claimed above), **the need for the attention to "superquestions" can be brought into focus by asking whether the capacity for collective response at Cancun would be any greater if the predicted temperature rise from global warming was 1 °C per decade, or even 1 °C per year -- rather than between 1.1 to 6.4 °C during the 21st century, as currently estimated.**

An appropriate reservation is the tendency for claims to be made for the relevance of sophisticated technology to a wide range of "motherhood" issues which few consider it appropriate to questions. Examples include:

- environmental monitoring: recognizing that there is little proven capacity to act on data predicting disastrous developments, as significantly indicated by the UN Climate Change Conference (*Insights for the Future from the Change of Climate in Copenhagen*, 2010)
- meteorological models: whilst technically interesting, it remains unclear what effective use can be made of such models given the level of disaster and loss of life associated with hurricanes and tornados (almost on a monthly basis)
- health: recognizing that this is a standard claim made by the pharmaceutical industry to justify its endeavours whilst investing heavily in the deprecation of alternatives. The [flu pandemic of 2009](#), and the response to it, is indicative of the controversy associated with such claims
- security: recognizing that the past period has seen a claimed increase in threat levels with little indication of how security services can act sensitively in response to real threats, rather than to those promoted to justify their budget demands
- nuclear reaction simulations, avoiding the need for potentially dangerous tests
- finance: despite considerable application of sophisticated models to global finance, the financial crisis was neither adequately predicted nor framed such as to suggest preventive action, nor capable of elaborating remedial action capable of eliciting confidence
- collective intelligence: despite use of crowdsourcing via social networking facilities, the capacity to respond effectively to emergencies such as the Gulf oil spill was significantly marked by delays and the failure to process such intelligence (*Enabling Collective Intelligence in Response to Emergencies*, 2010)

The health and financial crises, borrowing metaphors from each sector, serve to indicate many constraints as discussed separately (*Remedies to Global Crisis: "Allopathic" or "Homeopathic"? Metaphorical complementarity of "conventional" and "alternative" models*, 2009). Difficulties are further exacerbated by the degree to which irrational or nonrational criteria are now a major factor in global decision-making (*Cultivating Global Strategic Fantasies of Choice: learnings from Islamic Al-Qaida and the Republican Tea Party movement*, 2010).

The capacity to monitor conditions with ever greater precision, and to predict their cumulative effects, is typically understood as 90% of

solving any problem -- in the light of technical problems. However practice indicates that it might be better understood as 10% of any remedial response in the case of psychosocial problems. In that case 90% of the challenge lies in focusing attention, eliciting resources and ensuring their effective application.

Cognitive implications?

As discussed separately (*Psychosocial energy through a metaphorical technology*, 2007) in relation to transformation between epistemological modes, various authors refer to technology seen as metaphor (Robert Romanyszyn, *Technology as Symptom and Dream*, Routledge, 1989; David Weinberger, *Technology as Metaphor*, 2000; Jason Ohler, *Seeing Technology Through Metaphor*, 2005; Tamo Chattopadhyay, *Technology as a Metaphor: mechanics of power in the global development marketplace*, 2005; Jason Balck, at al, *The Metaphors of Emerging Technologies*, 2006). There is also a case for seeing metaphor as a form of technology (cf Digital Humanities, *Metaphor as Technology: critical thinking through understanding metaphor*). The significance of the use of metaphor in this context is well stated by Maurice Yolles (*Knowledge Cybernetics: a new metaphor for social collectives*, 2005):

Having defined the metaphorical nature of knowledge cybernetics, there is a question of whether any of the metaphorical models provided have any practical value. Whether they do depends on how one sees the nature of metaphors. They are not simple comparitors, and for Brown (2003) they provide a very important way of creating a basis for new knowledge. We do not say that the models give here are true, indeed we cannot say this because of their constructivist nature. They are simply representations that will have to be evaluated and believed if there is evidence that they are practically useful to explain and perhaps to diagnose and intervene in situations that we see.

It may then be asked what might humanity be engaged in enabling "unconsciously" in its quest for every faster computing power. Some questionable aspects may be seen in terms of the association of national identity with the ever increasing cost of ever-taller buildings and other processes (John Ralston Saul, *The Unconscious Civilization*, 1995). To the extent that an "unconscious civilization" offers signals to the conscious world through the key terms associated with this quest, some attention could be given to those applied to current supercomputers -- as is done in the selection of new commercial brands:

- "teraflops" offer unfortunate mnemonic associations to "terra flops", as the crisis of crises already widely experienced and anticipated. It is curious, and remarkably unfortunate (given the disastrous development of climate change negotiations), that the German Climate Computing Centre (DKRZ) has titled its newsletter as *Terra-FLOPS*.
- "petaflops" offers an equally unfortunate association (especially in French), to *flatulism* -- notoriously publicized by *Le Pétomane*, famous for his remarkable control of the abdominal muscles, enabling him to fart at will. Again it could be argued that the increasing level of willful global emissions of hot air might be usefully indicated with such a prefix (*Sins of Hot Air Emission, Omission, Commission and Promission*, 2009), especially given *Le Pétomane's* demonstrated musical capacity (*Conversion of Global Hot Air Emissions to Music*, 2009). A nuclear disaster could be very appropriately described (in French) using the term *péter* -- with consequences perhaps to be appropriately associated with the contrasting English use of "peter out", meaning to dwindle away to nothing.

Potentially more usefully provocative is the conflation of "teraflops" and "petaflops" through the mnemonics of "**terra peta**", especially given that the global population is estimated to reach anywhere between 5.5 billion and 14,000 million by 2100 (5.5×10^9 to 14×10^9).

However questionable such associations, it is unquestionable that recent use of such technology cannot be said to have constrained the level of disaster associated with the financial crisis triggered in 2008-2009 or the dimensions of the climate change disaster. Potentially more pertinent is the level of risk now enabled by dependence on such technological sophistication. The dangers of [automated trading on electronic financial markets](#) have already been made evident. One form is termed [high-frequency trading](#). In the U.S., high-frequency trading firms represent 2% of the approximately 20,000 firms operating today, but account for 73% of all equity trading volume.

Higher order questions: quality vs. quantity?

The above-mentioned "simulation of a global brain" was primarily understood as an exercise in "global modelling" (*Simulating a Global Brain: using networks of international organizations, world problems, strategies, and values*, 2001). In reviewing the outcome of this project, which took the form of an *Encyclopedia of World Problems and Human Potential*, a contrast was made with the equation-focused, number crunching of conventional global models -- with which supercomputers are typically associated (*Global modelling perspective*, 1995):

As noted in that review, global or world modelling may be understood as the attempt to represent rigorously the economic, political, social, demographic and/or ecological issues and their interdependencies on a global scale. The models map these relationships as explicit mathematical equations which may be "run" forward in time to study their dynamic behaviour. They can thus be used to simulate future developments under a variety of conditions. Such modelling may be considered as the most sophisticated approach to dealing systematically with the nature of, and solution to, world problems.

But, as also noted, following the appropriation of the term "global modelling" by those designing models based on mathematical equations, it might be assumed that no other forms of "modelling" of the global problematique are possible. Interesting models of systems can also be explored using analog methods. It is interesting to note that a number of disciplines use other kinds of models in order to grasp the nature of complex systems. In the case of chemistry, molecular structures made up of many thousands of atoms are displayed graphically under conditions where the real complexities of the system do not lend themselves to mathematical analysis. The review highlights various *Weaknesses of an equation-based perspective*.

The question to be asked with respect to future use of supercomputers is whether they can enable "qualitative" exploration in contrast with "quantitative" exploration -- and what this might imply. Two possibilities merit consideration, in contrast to "number crunching", where the alternative objective is to give primacy to enabling **widespread** "comprehension" of complexity rather than deriving analytical "solutions" which are meaningless to all but a **small elite** (typically protective of their special understanding):

- **topological research**: elaboration of ever more complex forms exploiting the capacity of the human mind to respond to complex patterns and to associate meaning with them, possibly conflated with a sense of aesthetics and elegance. The renderings of Lie symmetry groups and the Mandelbrot set may be simply the beginning of exploration in this respect.
- **dynamic representation**: again, given the capacity of the human mind to respond to dynamic patterns, potentially representative of complex systems, the question is whether the capacity to engage with quality of a higher order can be enhanced. Other than visualization, the role of **sonification** is significant in this respect -- especially given its recent use with the output of the Large Hadron Collider. To what extent can the human mind engage meaningfully with complex wave forms, given that this is one way of understanding the functioning of the human brain?

Of course mathematically these may indeed be dependent on "equations" and "number crunching". The outcomes sought however -- and the nature of the cognitive engagement with them -- are quite distinct and imply additional constraints on conventional approaches.

The issue is how questions of a higher qualitative order might be framed as a focus for exploration. Pointers may be offered by the insights of other cultures, as suggested by the work of Susantha Goonatilake (*Toward a Global Science: mining civilizational knowledge*, 1999) as discussed separately (*Enhancing the Quality of Knowing through Integration of East-West metaphors*, 2000). Those fundamental to the culture of China offer a point of departure (*9-fold Higher Order Patterning of Tao Te Ching Insights*, 2006).

The complexity of global psychosocial civilization can notably suggest the need to engage with higher (or more fundamental) orders of "twistedness" (*Engaging with Questions of Higher Order: cognitive vigilance required for higher degrees of twistedness*, 2004). Of related interest is the degree of complementarity between such questions of a higher order and the clues to such exploration offered by mathematics (*Functional Complementarity of Higher Order Questions: psycho-social sustainability modelled by coordinated movement*, 2004). Again "qualitative" has potential cognitive implications (*Cognitive Feel for Cognitive Catastrophes: Question Conformality*, 2006; *Conformality of 7 WH-questions to 7 Elementary Catastrophes: an exploration of potential psychosocial implications*, 2006).

The challenge in deriving "answers" from use of supercomputers is whether they are comprehensible and to whom? Clearly global models, since the time of *Limits to Growth* (1972), cannot be said to have engaged attention fruitfully (*Club of Rome Reports and Bifurcations: a 40-year overview*, 2010). The problem in relation to the marvels discovered by mathematics is that again they are comprehensible to only the very few, possibly requiring years for any complex "proof" to be verified by a team of mathematicians (*Dynamics of Symmetry Group Theorizing: comprehension of psycho-social implication*, 2008). The issue has proven particularly acute in relation to the financial crisis of 2008-2009 and the vulnerability arising from limited comprehension of a risk-assessment formula, in that case the **Gaussian copula** (*Uncritical Strategic Dependence on Little-known Metrics: the Gaussian Copula, the Kaya Identity, and what else?*, 2009).

Do the results to be derived from supercomputers call for a form of potentially questionable "hypercomprehension", capable of enabling initiatives insensitive to their own blindspots (*Hyperaction through Hypercomprehension and Hyperdrive: necessary complement to hypertext proliferation in hypersociety*, 2006)? What are the "superquestions" that could correct for such tendencies and how is their requisite complexity to be ensured with out disabling the capacity for many to comprehend them?

Potentially relevant superquestions

The following set of questions is necessarily far from comprehensive or appropriately articulated. It emerges from a particular set of biases but in so doing makes the point that there is a need for an information context in which questions can be articulated for consideration. A major limitation of supercomputer initiatives is that their institutional context takes little consideration of its own possible blindspots, whatever the level of computer sophistication. This engenders a form of groupthink which characterized the intelligence failure of 9/11 as notably lacking in imagination (*Groupthink: the Search for Archaeoraptor as a Metaphoric Tale*, 2002).

It is appropriate to note that reference is made to "superquestions" by Paul Dekker (*Optimal Inquisitive Discourse*, 2007), in a section on *Superquestions and 'Mention Some'*, within the context of a discussion on the nature of questions in dynamic semantics. Dekker remarks:

...it is important to distinguish the decision problem which an agent faces, which is inherently indexical and subjective, and the objective question which she actually asks....So while it normally does not make sense that people directly express their decision problem...we may realize that the objective questions they actually ask... can originate from such subjective decision problems. I believe this distinction between subjective decision problems and factual questions, and their relation, together with some pragmatic reasoning, also throws light on the so-called 'mention some' problem. (p. 98)

Mathematicians have responded with enthusiasm to a set of intractable problems -- identified in *Wikipedia* (*List of unsolved problems in mathematics*) -- raising fundamental issues regarding the nature of "proof", both more generally and specifically as an acceptable **mathematical proof**. The current relevance of the adequacy of proof is highlighted by the domain in which proof can be offered regarding the existence of entities such as Al-Qaida (*Reality and existence*, 2010) in a world characterized by both "reality" and "fantasy" (*Cultivating Global Strategic Fantasies of Choice*, 2010). In addition to the field of mathematics, *Wikipedia* offers lists of **unsolved problems by discipline: Biology · Chemistry · Computer science · Economics · History · Linguistics · Neuroscience · Philosophy · Physics · Statistics**. Presented in this way, **the unsolved problems of governance, the future of the planet, and the challenges of a higher quality of meaningful life, do not emerge very clearly from this primarily "academic" perspective.**

What can be said about the unsolved problems of mathematics **as a set** -- and of those of other disciplines? And, cognitively and with the inclusions of other disciplines, what do those sets imply, namely as a **set of sets**?

The argument here is for the formulation of analogous checklists of "intractable problems" -- "superquestions" to which the power of supercomputers could be applied. What is then implied by "problem", "question", "solution" and "proof"? What makes a problem or a question "interesting"? Framed in this way, what is to be understood as an "intractable question"? With respect to governance, do such questions and problems correspond to what is described in the literature as "wicked"?

By what means may they be approached -- by analogy with the approach of mathematicians to the unsolved problems for which supercomputer computers may be used to supply a form of brute-force "proof" questioned by some mathematicians? How have "intractable problems" emerged in various domains, most notably in the field of mathematics -- where they have acquired iconic status ([Fermat's Last Theorem](#), [P versus NP](#), etc)? What questions might be said to have acquired "iconic status" in relation to governance and meaningful quality of life? What might constitute a "meaningful proof" in a non-academic context -- meaningful to those who supposedly mandate democratic "global strategy-making" and fund the use of supercomputers?

In contrast to the set of unsolved "academic" problems, **a relevant characteristic of the qualitative "superquestions" of concern here is their fundamentally "existential" nature -- whether in terms of issues of survival, thrival or sense of self-fulfilment.** It is of course the case that such questions might well have been formulated and addressed by religions and theology -- notably absent from the *Wikipedia* list. Clues from such non-academic perspectives have been explored elsewhere ([Navigating Alternative Conceptual Realities: clues to the dynamics of enacting new paradigms through movement](#), 2002).

Clustering superquestions in terms of WH-questions

The use of the 7 classic WH-questions is consistent with the method advocated by [Paris Arnopoulos](#) (*Nova Magna Moralia -- physics-ethics-politics: neoclassic concepts for postmodern times*, *Skepsis: a journal of philosophy and interdisciplinary research*, 2002-3) in exploring the possibility of a "neoethics". Following his earlier work, he emphasizes a trilateral pattern of global morality combining physics, politics and ethics: physics because nature is the underlying context of global existence, politics because culture is the highest creation of human evolution, and ethics because it provides the conjunction between the other two. Consequently, neo-macro-morals take into account ecology, ethology and sociology. As he notes, to demonstrate this thesis:

... our method combines the four Aristotelian causes with the W5 (**who, what, where, when, why**) journalistic questions by reformulating his material, formal, efficient and final causes as **what, how, who and why** of ethics. To these, for the sake of completeness, we have added five more questions as to **where, when, whether, whence and how much**. We believe that by answering these questions as correctly as possible, one can explain a subject matter as completely as possible. *[emphasis added]*

These questions were previously used in considering the nature of any New Renaissance ([Missing the New Renaissance?](#) 2010) and in generating and clustering entities in various databases ([Generating a Million Questions from UIA Databases: Problems, Strategies, Values](#), 2006).

The tentative (and **necessarily presumptuous**) approach taken here, is to use as a framework for the identification of such questions an earlier exercise ([Governing Civilization through Civilizing Governance: global challenge for a turbulent future](#), 2008) prepared for the 3rd Annual Conference organized by the [Global Governance Group](#) of the [New School of Athens \(NSOA\)](#): Theme: *Making Global Governance Work: Lessons from the Past. Solutions for the Future* (Athens, 2008). The request was to highlight a set of practical possibilities -- correlating "thinking" with "doing". It is this set which is assumed here to be indicative of a set of underlying problems implying fundamental questions.

As an initial effort, the set of complementary "superquestions" might then be clustered as indicated in the following table 4-part table adapted from [Potential response conventionally presented: "Thinking" and "Doing"](#) (Fig. 2) with [links to explanatory details and documents](#) in that paper ([Governing Civilization through Civilizing Governance](#), 2008), including [discussion](#) of the significance of problematique, resolutique, imaginatique and irresolutique.

Fig. 1a: Resolutique -- Tentative clustering of "Superquestions" in relation to "Superthinking" items				
	Indicative labels	"Superquestions" ?	"Superthinking" ?	Docs
What is "resolution"?	Exploratory simulation (gaming)	What merits "simulation"?	Designing simulations to elicit (unconventional) options, associating them with openly accessible, attractive gaming to elicit cognitive entrainment	[01]
Where is resolution to be sought?		Where is simulation to be undertaken?		
		When will simulation be undertaken?		
		How is simulation to be done?		
		Which simulation is appropriate?		
When is resolution expected?	Sustainable dynamics	Who can develop a simulation?	Exploring unforeseen potentials of complex dynamics of non-linear systems involving multiple actors	[02]
		Why seek simulation?		
		What is a "sustainable dynamic"?		
		Where is a sustainable dynamic to be found?		
		When will sustainable dynamic be achieved?		
How is resolution to be achieved?	Appropriate	How is sustainable dynamic to be achieved?	Identifying organizations of requisite complexity, viability and coherence and	
		Which sustainable dynamic is appropriate?		
		Who can develop a sustainable dynamic?		
		Why seek a sustainable dynamic?		
		What is "appropriate organization"?		
		Where is appropriate organization to be found?		
		When will appropriate organization be achieved?		

<i>Which</i> resolution is appropriate?	organizational architecture	<i>How</i> is appropriate organization to be achieved? <i>Which</i> appropriate organization? <i>Who</i> can develop appropriate organization? <i>Why</i> seek appropriate organization?	ensuring their emergence	[03]
<i>Who</i> can find resolution? <i>Why</i> seek resolution?	Recognition of higher order challenges	<i>What</i> constitutes "higher order"? <i>Where</i> is higher order to be found? <i>When</i> will higher order emerge? <i>How</i> is higher order to be enabled? <i>Which</i> higher order is appropriate? <i>Who</i> can enable higher order? <i>Why</i> seek higher order?	Articulating challenges and possibilities beyond conventional polarization (and demonisation)	[04]

Fig. 1b: Imaginitique -- Tentative clustering of "Superquestions" in relation to "Superthinking" items				
	Indicative labels	"Superquestions" ?	"Superthinking" ?	Docs
<i>What</i> is "imagination"?	Quality and Significance enhancement	<i>What</i> is "qualitative significance"? <i>Where</i> is qualitative significance required? <i>When</i> will qualitative significance be enabled? <i>How</i> is qualitative significance achieved? <i>Which</i> qualitative significance is appropriate? <i>Who</i> can develop qualitative significance? <i>Why</i> seek qualitative significance?	Reframing "quality of life" and "pursuit of happiness"; implications of voluntary simplicity	[05]
<i>Where</i> is imagination to be sought?		Experimental alternatives	<i>What</i> is an "experimental alternative"? <i>Where</i> are experimental alternatives found? <i>When</i> will experimental alternatives be enabled? <i>How</i> is an experimental alternative achieved? <i>Which</i> experimental alternative is appropriate? <i>Who</i> can develop experimental alternatives? <i>Why</i> seek experimental alternatives?	Recognizing and monitoring the viability of the widest spectrum of alternatives, in isolation and as necessary complements in any system
<i>When</i> is imagination expected?	Reframing assumptions (engaging with "nasty questions")		<i>What</i> is a "reframed assumption"? <i>Where</i> are reframed assumptions found? <i>When</i> will reframed assumptions be possible? <i>How</i> is assumption reframing achieved? <i>Which</i> reframed assumption is appropriate? <i>Who</i> can reframe assumptions? <i>Why</i> reframe assumptions?	Cognitive vigilance and critical thinking appropriate to detection of vital insights readily suppressed by spin and advocacy of positive thinking
<i>How</i> is imagination to be achieved?		Self-reflexivity and Internalization	<i>What</i> is a "self-reflexivity"? <i>Where</i> is self-reflexivity enacted? <i>When</i> will self-reflexivity be possible? <i>How</i> is self-reflexivity achieved? <i>Which</i> self-reflexivity is appropriate? <i>Who</i> can develop self-reflexivity? <i>Why</i> seek self-reflexivity?	Identifying the conceptual challenges of cognitive embodiment of "external" reality and its role in psycho-social sustainability
<i>Which</i> imagination is appropriate?				
<i>Who</i> can find imagination?				
<i>Why</i> seek imagination?				

Fig. 1c: Problematique -- Tentative clustering of "Superquestions" in relation to "Superthinking" items				
	Indicative labels	"Superquestions" ?	"Superthinking" ?	Docs
<i>What</i> is a "problem"?	Insight capture	<i>What</i> is "insight capture"? <i>Where</i> is insight capture required? <i>When</i> will insight capture be enabled? <i>How</i> is insight capture achieved? <i>Which</i> insight capture is appropriate? <i>Who</i> can develop insight capture? <i>Why</i> seek insight capture?	Designing open processes for gathering, configuring and disseminating insight -- in anticipation of it proving valuable	[09]
<i>Where</i> is a problem to be sought?		Enabling and Facilitation	<i>What</i> is "enabling facilitation"? <i>Where</i> is enabling facilitation found? <i>When</i> will facilitation be enabled? <i>How</i> is an facilitation achieved? <i>Which</i> facilitation is appropriate? <i>Who</i> can develop enabling facilitation? <i>Why</i> seek enabling facilitation?	Designing processes to identify opportunities for enabling and facilitating innovative, regulatory and "best practice" initiatives
<i>When</i> is a problem expected?	Strategic comprehension and engagement		<i>What</i> is "strategic engagement"? <i>Where</i> is strategic engagement found? <i>When</i> will strategic engagement be possible? <i>How</i> is strategic engagement achieved? <i>Which</i> strategic engagement is appropriate? <i>Who</i> can engage strategically? <i>Why</i> engage strategically?	Identifying nature of coherent strategic representations capable of eliciting appropriate engagement; challenge of comprehension of complexity
<i>How</i> is a problem to be achieved?		Crisis preparedness	<i>What</i> is "crisis preparedness"? <i>Where</i> is crisis preparedness enabled? <i>When</i> will crisis preparedness be enabled? <i>How</i> is crisis preparedness achieved? <i>Which</i> crisis preparedness is appropriate? <i>Who</i> can develop crisis preparedness?	Identifying implications for social systems of the adaptive cycle, resilience and degrading gracefully under conditions of collapse
<i>Which</i> problem is appropriate?				
<i>Who</i> can find a problem?				
<i>Why</i> seek a problem?				

		<i>Why</i> seek crisis preparedness?	
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Fig. 1d: Irresolutique -- Tentative clustering of "Superquestions" in relation to "Superthinking" items				
	Indicative labels	"Superquestions" ?	"Superthinking" ?	Docs
<i>What</i> is "irresolution"?	Credibility ("hearts and minds")	<i>What</i> is "credibility"?	Rethinking destructive loss of confidence (as recognized by the military); meaning of confidence (as modelled by financial system) and eroded by tokenism, secrecy and abuse of faith in authorities	[13]
<i>Where</i> is irresolution to be sought?		<i>Where</i> is credibility required? <i>When</i> will credibility be ensured? <i>How</i> is credibility achieved? <i>Which</i> credibility is appropriate? <i>Who</i> can develop credibility? <i>Why</i> seek credibility?		
<i>When</i> is irresolution expected?	"Access" and Feedback to authorities	<i>What</i> is "appropriate feedback"?	Identifying processes to enable meaningful access to authoritative focal points in highly asymmetric conditions (information overload and underuse)	[14]
<i>How</i> is irresolution to be achieved?		<i>Where</i> is appropriate feedback found? <i>When</i> will appropriate feedback be enabled? <i>How</i> is an appropriate feedback achieved? <i>Which</i> feedback is appropriate? <i>Who</i> can develop appropriate feedback? <i>Why</i> seek appropriate feedback?		
<i>Which</i> irresolution is appropriate?	Participation and Social networking	<i>What</i> is "participative networking"?	Exploring implications of web-enhanced (social) networking for new approaches to governance of requisite complexity	[15]
<i>Who</i> can find irresolution?		<i>Where</i> is participative networking found? <i>When</i> will participative networking be possible? <i>How</i> is participative networking achieved? <i>Which</i> participative networking is appropriate? <i>Who</i> can network participatively? <i>Why</i> engage in participative networking?		
<i>Why</i> seek irresolution?	Dialogue (engaging with otherness)	<i>What</i> is "dialogue"?	Exploring the challenge of "designing in" otherness and disagreement beyond comfort zones (rather than harmonizing them "out")	[16]
		<i>Where</i> is dialogue enabled? <i>When</i> will dialogue be enabled? <i>How</i> is dialogue achieved? <i>Which</i> dialogue is appropriate? <i>Who</i> can develop dialogue? <i>Why</i> seek dialogue?		

Refining and reconfiguring the set of superquestions

As noted above, "questions" have potential cognitive implications of mathematical relevance (*Cognitive Feel for Cognitive Catastrophes: Question Conformality*, 2006; *Conformality of 7 WH-questions to 7 Elementary Catastrophes: an exploration of potential psychosocial implications*, 2006). Will the future find the current categories of "question", "problem" and "solution" or "proof" to be appropriate? What other formulations might be of greater relevance?

The challenge implied above is that of ensuring an iterative process which "confronts" any proposed set of questions with questions which do not appear to be adequately encompassed by that set. In other words the "set" calls reflexively for a design which enables such challenge and evolves as a consequence of it, as discussed separately (*Strategic Embodiment of Time: configuring questions fundamental to change*, 2010). In arguing for the need for a qualitative dimension to superquestions, with which people find it meaningful to engage, it is however also useful to consider more philosophical questions.

One such exercise (*Clustering Questions of Existential Significance*, 2010) clustered 31 questions formulated by *Acarya Shambhushivananda Avadhuta (Eternal Philosophy: Questions and Answers)*. The latter document had been produced for the *College of Neohumanist Studies* (Sweden) of which he is rector, and in which capacity he is chancellor of the global education network *Ananda Marga Gurukula* (AMGK), which runs over 1,200 educational institutions in over 80 countries. The merit of the document for this exercise is the general nature of the questions as they variously relate to any concern with religion or philosophy.

That exercise serves to highlight the question of whether the superquestions are assumed to respond to the world of "reality" or to an imaginal world that might be pejoratively described as "fantasy". It is however a characteristic of contrasting approaches to governance, notably at the national level, that political parties readily uphold their own views as "realistic" and frame those opposed to them as "fantasy" -- as is evident in any parliamentary debate. The above table took account of this dynamic in distinguishing between the superordinate clusters of problematique, resolutique, imaginative and irresolutique (*Imagining the Real Challenge and Realizing the Imaginal Pathway of Sustainable Transformation*, 2007). The interface between reality and fantasy was also central to current challenges of global governance (*Cultivating Global Strategic Fantasies of Choice: learnings from Islamic Al-Qaida and the Republican Tea Party movement*, 2010).

As is implied by understandings of "correspondences", a degree of "fantasy" may be vital to any ability to engage with the complexities confronted by governance. This was highlighted in terms of poetry by biologist *Gregory Bateson (Steps to an Ecology of Mind, 1972)* in explaining why "we are our own metaphor" at a conference on the effects of conscious purpose on human adaptation:

One reason why poetry is important for finding out about the world is because in poetry a set of relationships get mapped onto a level of diversity in us that we don't ordinarily have access to. We bring it out in poetry. We can give to each other in poetry the access to a set of relationships in the other person and in the world that we're not usually conscious of in ourselves. So we need poetry as knowledge about the world and about ourselves, because of this mapping from complexity to complexity.

Clearly there is a case for exploring the relevance of aesthetics and rhythm to formulating superordinate questions -- and for developing the capacity of computers to enable associated insights, as is evident in the visual renderings of complex mathematical objects (Mandelbrot set, Lie group, etc).

Given that the above set is a "mechanical" adaptation of an earlier set, the nature of this iterative process might be fruitfully "tested" in the light of other inputs. Issues which could, for example, be used to challenge the above formulation of superquestions, or superordinate questions, might then include

- **Territory/Property:** Why is no effort made to reframe 2-dimensional understandings of territory? What mathematics could be used to offer interesting solutions? How can property be otherwise "possessed"? (*And When the Bombing Stops? Territorial conflict as a challenge to mathematicians*, 2000)
- **Connectivity and group formation:** Beyond current (essentially simplistic) techniques to facilitate social networking, how might mathematics be used to enable the emergence of higher orders of connectivity and what might that imply for group identity? How can invasive surveillance techniques be adapted to that end? (*From ECHELON to NOLEHCE: enabling a strategic conversion to a faith-based global brain*, 2007; *Group Questing or Twelving*, 1976). Why have more powerful networks not emerged from decades of research into social network analysis? (*Polyhedral Empowerment of Networks through Symmetry: psycho-social implications for organization and global governance*, 2008).
- **Disagreement:** Why has so little emerged from mathematics regarding the possibility of elaborating structures based on disagreement -- beyond the unthinking commitment to agreement (*Using disagreements for superordinate frame configuration*, 1995) Why is a more realistic approach not taken to radical differences in preferences and their psychosocial consequences (*Epistemological Challenge of Cognitive Body Odour: exploring the underside of dialogue*, 2006).
- **Voting systems:** Why is there not more extensive simulation-based research into a richer range of voting systems? Why the dependence on binary voting with all that it reinforces -- "*You're either with us, or against us*" (*Using Research in the Participative Orchestration of Europe*, 2004)
- **Insight solicitation / Filtration systems:** Given the acknowledged degree of information overload and the level of spam, why has it not been possible to design subtler modes of filtering and channelling information than those based on binary "triage"? How can those dependent on unsolicited information as warning feedback, or indications of innovative possibilities, ensure that such signals are not automatically discarded, as has proven so often to be the case? (*Enabling Collective Intelligence in Response to Emergencies*, 2010; *Considering All the Strategic Options -- whilst ignoring alternatives and disclaiming cognitive protectionism*, 2009). What kind of open, participative "solutions" database might be essential to timely gathering and refinement of insights of psychosocial value (*Global Solutions Wiki*, 2009)? How to distinguish between tokenistic feedback solicitation (as highlighted by the BBC *Blue Peter phone-in scandal* in 2006) and those designed to make best use of information?
- **Psychoactive debate:** How best to predict and recognize the existence of questions and problems "too hot to handle", and how best to design processes to handle them? (*Overpopulation Debate as a Psychosocial Hazard: development of safety guidelines from handling other hazardous materials*, 2009)
- **Attractors:** How might it be most appropriate to formulate the nature of attractors in a global knowledge-based society -- especially given the concern with "hearts and minds"? (*Human Values as Strange Attractors: coevolution of classes of governance principles*, 1993). To enable attractors of a higher order to be detected and recognized, what are fruitful mathematical formulations of the attractions of music, play and humour, especially as they relate to the challenges of governance (*A Singable Earth Charter, EU Constitution or Global Ethic?* 2006; *Humour and Play-Fullness: Essential integrative processes in governance, religion and transdisciplinarity*, 2005).
- **Personalization of information:** What insights might be provided by mathematics enabling a higher degree of personalization of information to facilitate cognitive engagement vital to evolution of subtler senses of identity? (*Geometry, Topology and Dynamics of Identity*, 2009; *Requisite Variety to Encompass Multidimensional Identity*, 2009; *Emergence of Cyclical Psycho-social Identity: sustainability as "psychically" defined*, 2007). Given the freedom explored by physics to question the existence of space, time and gravity, what analogous formulations might offer insights in the case of individual identity (*Being What You Want: problematic kataphatic identity vs. potential of apophatic identity?* 2008).
- **Inequality:** Given the increasing evidence and significance of "inequality", are there more fruitful ways of framing "difference" comprehensibly, especially by moving beyond measurement on a linear, quantitative scale? Should such simplistic measures of "inequality" be distinguished from those of "inequality" -- especially in a multidimensional context? (Ron Atkin, *Multidimensional Man; can man live in 3-dimensional space?* 1981).
- **Category reframing:** Why is it that the discipline acknowledged to have the greatest insight into the relationships between categories should be so constrained in developing richer insights into the field of mathematics as a whole? It is curious that mathematics is conventionally ordered as what amounts to a nested laundry list, as yet unable to produce even a "periodic table" of mathematics. What does that imply for a constrained ability to engender some richer organization of human knowledge (*Towards a Periodic Table of Ways of Knowing -- in the light of metaphors of mathematics*, 2009; *Periodic Pattern of Human Life*, 2009). Are the challenges of governance severely constrained in consequence by the manner in which categories are "frozen" (*Framing*

the Global Future by Ignoring Alternatives: unfreezing categories as a vital necessity, 2009)

- **"Google Complexity" vs Google Earth:** Given the widely recognized capacities and value of the *Google Earth* facility, why has it not been possible to develop some form of "*Google Complexity*" to enable navigation, and zooming, through levels of knowledge complexity -- relating local detail to a global context?
- **Ignorance and the unsaid:** How is what is not known by significant constituencies (whether in positions of authority or otherwise) to be integrated into the applications of supercomputers designed to process the known? Expressed otherwise, how are blindspots to be allowed for and the consequences of groupthink when their existence is neglected? The extent, and implications of the "unsaid" are evident at the time of writing with the further dissemination of diplomatic cables by WikiLeaks -- although, more generally, the dimensions and implications of the "unsaid" is necessarily a matter of ignorance (*Global Strategic Implications of the Unsaid: from myth-making towards a wisdom society*, 2003). Of those leaks, the former chief of staff of Tony Blair, Jonathan Powell, asserts that *Human affairs are run on secrecy and confidences (US embassy cables: Leaks happen. But on this industrial scale, whose interests are served? The Guardian*, 30 November 2010). Ignorance may even be "designed in" in a questionable manner of which no account is taken (*Lipoproblems: developing a strategy omitting a key problem*, 2009). Potentially very intriguing is how education might be reconceived to enable realistic strategic nimbleness in conditions of turbulence and information overload -- as minimalistic "cognitive toolkits".
- **Corruption:** However it is conceived, its extent is now widely recognized -- as well as its incidence at the highest level. It is a significant factor -- however euphemistically reframed -- in the funding of many projects. Rather than condemn this reality "unrealistically", it then becomes conceptually interesting how allowance is made for it in the framing of new strategic initiatives. Especially interesting is the extent to which the corruption of others is intimately associated with the existence of "evil"-- as formally recognized by Barack Obama in his Nobel Peace Prize acceptance speech -- but attributed, by those he would tend to characterize as "evil", to the USA itself. What kind of systemic thinking can allow for such incongruities? Does the worldwide *thermohaline circulation* -- large-scale ocean circulation -- suggest how the "superficial" currents of opinion might be related to the invisible "undercurrents"?
- **Dependencies:** The original world dynamics approach of *Limits to Growth* was remarkable for the attention it drew to systemic relationships across a relatively limited number of disparate sectors. This inspired the methodology of the *Encyclopedia of World Problems and Human Potential* through which some 250,000 links were identified between "world problems" as perceived by international constituencies, and an equivalent number of links between the "strategies" with which they identified (*Feedback Loop Analysis in the Encyclopedia Project*, 2000; *Vicious cycles and loops*, 1995; *Strategic ecosystem: Feedback loops and dependent co-arising*, 1995). How can information of this nature be best used to counter the widely prevailing tendency to focus on proximate causes of problems -- as with disasters being blamed on "flooding" with no capacity to focus on the reason for that flooding or the construction in areas vulnerable to flooding? Or with problematic austerity measures being blamed on "the crisis" - - inhibiting any reflection on how it arose and whether it might therefore arise again?
- **Integration / Common / Coordination / Harmonisation:** What insights does mathematics offer into higher orders of integration, possibly integrating more disparate categories rather than suggesting the need for the elimination and exclusion of "anomalies"? What do such higher orders of integration imply for "coordination" and "harmonisation" (*Dynamic Reframing of "Union": Implications for the coherence of knowledge, social organization and personal identity*, 2007) ? What new forms of less conventional "connectivity" might then prove to be significant through "correspondences" (*Theories of Correspondences -- and potential equivalences between them in correlative thinking*, 2007)? Given the unforeseen connectivity discovered through the study of symmetry groups -- notably the *Monster Group* -- what analogies might be hypothesized with respect to psychosocial organization? (*Potential Psychosocial Significance of Monstrous Moonshine: an exceptional form of symmetry as a Rosetta stone for cognitive frameworks*, 2007)?

Possibilities of artificial intelligence

The potential of supercomputers and distributed computation networks raises the question as to the role of artificial intelligence in relation to any superordinate questions. The prospects outlined in 2000 by Bruce G. Buchanan, as president of the (then) *American Association for Artificial Intelligence*, imply a possibility of engaging with such questions (*Creativity at the Meta-level*, 2000). It might even be asked whether "meta-level creativity" corresponds to a "superordinate creativity" at which the nature of "problem", "question", "solution/proof" and "interest" are integrated in a form of cognitive fusion.

At the time of writing, the termination of a project exploiting artificial intelligence was reported in *The Economist* (*No command, and control*, 27 November 2011). The 5-year project, *ALADDIN* (Autonomous Learning Agents for Decentralised Data and Information Networks) was a multidisciplinary research programme undertaken within the framework of the Decentralised Data and Information Systems (DDIS) Strategic Capability Partnership between BAE Systems and the University of Southampton (Nicholas R. Jennings, *ALADDIN End of Project Report*, 2010). It was jointly funded by BAE Systems and the Engineering and Physical Sciences Research Council (EPSRC).

The project was concerned with developing mechanisms, architectures, and techniques to deal with the dynamic and uncertain nature of distributed and decentralised intelligent systems. Disaster management was the chosen as the application domain given that the world faces an urgent need for better means to deal with such situations where a number of actors have to coordinate their activities when facing significant degrees of uncertainty and where the context is very dynamic. The project took a total systems view on information

and knowledge fusion and considered feedback between sensing, decision making and acting in such a system.

As noted by *The Economist*, disasters are similar to battlefields in their degree of confusion and complexity, and in the consequent unreliability and incompleteness of the information available:

What works for disaster relief should therefore also work for conflict. BAE Systems has said that it plans to use some of the results from ALADDIN to improve military logistics, communications and combat-management systems... ALADDIN, and systems like it, should help them keep afloat by automating some of the data analysis and the management of robots. Among BAE Systems' plans, for example, is the co-operative control of drones, which would allow a pilot in a jet to fly with a squadron of the robot aircraft on surveillance or combat missions.

The potential with respect to such well-defined command and control situations applications may well highlight the weaknesses with respect to the kind of situations highlighted by the "superordinate questions" above. This could be well-illustrated by the example cited by *The Economist* with respect to the use of intelligent agents:

In the case of an earthquake, for instance, the agents bid among themselves to allocate ambulances. This may seem callous, but the bids are based on data about how ill the casualties are at different places. In essence, what is going on is a sophisticated form of triage designed to make best use of the ambulances available. No human egos get in the way. Instead, the groups operating the ambulances loan them to each other on the basis of the bids. The result does seem to be a better allocation of resources than people would make by themselves. In simulations run without the auction, some of the ambulances were left standing idle.

The key issue relates to the phrase "*No human egos get in the way*". The question is how, as currently envisaged, ALADDIN and systems like it, can integrate intelligent agents (like drones) with human beings (frequently framed as "drones") -- the latter having a variety of tendencies to challenge systems of command and control and the views of others. The clever title of *The Economist* summary, "*No command, and control*" suggests a paradox rather than a resolution.

Despite the creative optimism of Buchanan, the above-mentioned "superordinate" dimensions would appear to be effectively (if not creatively) designed out of artificial intelligence initiatives. As a fruitful example of meta-level creativity, he notes:

In haiku poetry, perhaps the most creative person was the person a few centuries ago who changed an art form called *hokku* into an art form called *haiku* by adding one more constraint on the semantics:

Hokku Syntax:

1. 3 lines
2. Lines one and three = 5 syllables
3. Line two = 7 syllables

Hokku Semantics:

4. Poem suggestive or epigrammatic

Haiku constraint:

5. The need to refer in some way to one of the seasons, often very obliquely

Framed in such terms, one might ask what are the creative constraints that could be usefully imposed on the use of supercomputers in the quest for solutions to "global societal problems" and the "important issues facing society"? The cognitive challenge of *haiku* is not itself without its strategic significance (*Ensuring Strategic Resilience through Haiku Patterns: reframing the scope of the "martial arts" in response to strategic threats*, 2006). As noted at various points above, a key issue would seem to be the manner in which complexity is encompassed to enable cognitive engagement with it. In the case of haiku this is achieved by referring to "one of the seasons". This is reminiscent of a previously suggested mapping of "reality" and "fantasy" in relation to data, information and knowledge in order to indicate the viable cognitive environment where they intersect (*Integrative relationship between reality and fantasy?* 2010).

Conclusions

It would appear that there is a form of "disconnect" between the applications for which supercomputers are currently envisaged and the "superordinate questions" which might ensure their relevance to "global societal problems" and the "important issues facing society" -- to the issues with which human beings are ultimately concerned. The capacity to consider such superquestions has in effect been carefully designed out as with the challenges faced by individuals and collectivities in engaging with complexity..

"Excessive complexity": It is typically argued that so many of the challenges of governance inhibiting effective response to global challenges are "too complex" to be amenable to the quantitative power of supercomputers -- despite the decades of research on complex systems dynamics. As with the exclusion of the population factor from the response to climate change framed by the above-mentioned Kaya Identity, "simpler" problems are then selected for attention in what amounts to an exercise in conceptual gerrymandering. In terms of the larger systemic challenges, might this be described as "keyhole science"? The problems and questions that are "too complex" for mathematicians are then left to the capacities of those "of more limited intelligence" in positions of authority -- with minimal computer support. In the case of climate change, this will in all likelihood result in the recommendation and implementation of geo-engineering solutions of the most questionable technical simplicity -- since these lend themselves to exploration with the kinds of models amenable to supercomputer calculation (*Geo-engineering Oversight Agency for Thermal Stabilization (GOATS)*, 2008).

Surprise: Despite the widespread use of computers for economic and financial modelling, clearly the methodology is fundamentally defective in relation to the case for superquestions. The point may be succinctly made through the now famous question of the Queen of England to the assembled faculty of the [London School of Economics](#) with regard to the financial crisis: *Why did nobody notice it?* (*The*

[Queen asks why no one saw the credit crunch coming](#), *The Telegraph*, 5 November 2008). The LSE director of research responded: *At every stage, someone was relying on somebody else and everyone thought they were doing the right thing.*

However, the point to be made is that neither the superordinate question nor that response are appropriately integrated into the models for which supercomputers are currently designed. The pattern of the response can be usefully elaborated further (*Responsibility for Global Governance Who? Where? When? How? Why? Which? What?* 2008). Given the proven strategic expertise of [computers in chess](#), a strategic distinction might be fruitfully made, using chess metaphors, between:

- the Queen's superordinate "move": To what other challenges of governance, such as overpopulation, might such a superquestion be fruitfully addressed, as variously highlighted ([Karen A. Cerulo](#), *Never Saw It Coming: cultural challenges to envisioning the worst*, 2006; [Nassim Nicholas Taleb](#), *The Black Swan: the impact of the highly improbable*, 2007)
- the Knight's "move": Traditionally held to symbolize power in multidirectional movement and the use of intelligence information in the formulation of strategy and countermeasures. For that reason it figured on the crest of the US Army [312th Military Intelligence Battalion](#), known as the "Silent Warriors". In the context of the financial and other crises of governance, as illustrated by the response above of the LSE director, it effectively symbolizes fast footwork in advantageously reframing strategic situations. Perhaps appropriately, "[knight's move thinking](#)" (asyndesis or *entgleisen*) also refers pejoratively to a pathological pattern of discourse characterized by only remotely related ideas.

It might be asked **how many teraFLOPS (and misguided dependency on their results) are required to increase the risk of a "terra flop" -- a global crisis of the form increasingly anticipated --** in contrast with the number required to avoid the kind of "flop" which characterizes so many current global plans.

Reformulation: Given the case made for supercomputer capacity, it is useful to explore the argument of physicist [Peter Rowlands](#) in a domain where such capacity is currently required (*Removing redundancy in relativistic quantum mechanics*, 2005):

Essentially, **the problem arises from the use of an intrinsically 2-dimensional mathematical structure to represent a 3-dimensional reality**; we can, for example, show that the problem is immediately solved and the singularity removed when the intrinsically 3-dimensional quaternions are introduced. Exactly, the same kind of reasoning can be applied to relativistic quantum mechanics, where **problems emerge from the imposition of a matrix representation**. Relativistic quantum mechanics as represented by the Dirac equation and quantum field theory produces at least one type of singularity that appears to be an artefact of the system - the infrared divergence. It also leads to infinities that have to be removed by renormalization, even in the ideal case of free particles where there is apparently no real source for the divergent terms. In addition, there appears to be a great deal of redundancy. For example, **QCD calculations using Feynman diagrams derived from the standard gamma matrix representation require ten million calculations** for a six gluon interaction, whereas **the alternative algebraic approach using twistor space... reduces the calculations required to only six**. Even with this method, it is clear that redundancies are still visible; so the question we should ask is whether it is possible to find a coordinate system for the fermionic state which removes redundancy entirely. *[emphasis added]*

It might then be asked whether the governance problems that are alleged to be "too complex" are a consequence of their formulation using the 2-dimensional matrices (characteristic of the input/output charts of spreadsheets), as is typically the case -- and is notably the case in the 4-fold figure above. Formulated otherwise, the impossible "millions" of calculations might be reduced "to only six" -- a theme explored separately (*Geometry of Thinking for Sustainable Global Governance*, 2009; *Metaphorical Geometry in Quest of Globality*, 2009), notably in terms of the implications for identity and engagement (*Geometry, Topology and Dynamics of Identity*, 2009; *Topology of Valuing: dynamics of collective engagement with polyhedral value configurations*, 2008). **How might the tentative list of superquestions be better formulated, perhaps as "superordinate questions", to render them amenable to sophisticated analysis -- with output suitably constrained to be widely comprehensible?**

Avoidance of innovation: Of relevance to the general theme of this argument is that an earlier paper of Peter Rowlands, submitted to the [arXiv](#) open archive for physics, was suppressed by the administrators as being "inappropriate" and "of no interest" to users -- and without further explanation (see paper trail at: *The Suppression of Dr. Rowlands' Quantum Physics Paper*). Rowlands' comment on the process is relevant to the control of innovation in a global knowledge society -- but in this case raises questions relevant to the mindset governing investment in supercomputers:

However, it was novel and original in its approach, which, of course, is the whole reason for doing research in the first place. The [arXiv](#) is not a journal with specific stated policies for inclusion. It claims to represent the whole of physics, and it does not say anywhere that it will refuse to publish papers that fall outside the narrow interests of its moderators. This covert censorship is even more insidious in the light of [arXiv's](#) pretended policy of being open.

Physics would seem to remain insensitive to a problem of knowledge management recognizable in governance. This insensitivity notoriously engendered assertions such as the following:

- *Heavier-than-air flying machines are impossible.* (Lord Kelvin, president, Royal Society, 1895).
- *There is nothing new to be discovered in physics now. All that remains is more and more precise measurement* (Lord Kelvin).
- *Flight by machines heavier than air is unpractical and insignificant, if not utterly impossible.* (Simon Newcomb, 1902).
- *Space travel is bunk* (Sir Harold Spencer Jones, Astronomer Royal of Britain, 1957, two weeks before the launch of Sputnik)

This is curious in the light of the widely-cited assertion by Niels Bohr that innovative theories in fundamental physics need to be "[crazy enough](#)". Worse still is the possibility that the future will judge the mathematics and physics of today -- convinced as it is of the need for

supercomputers -- as being "not even wrong". More curiously, to an entry on the *Status of Superstring and M-theory* (in a blog entitled *Not Even Wrong*, 13 December 2008), [Samuel Prime](#) responds:

You wonder if the enormous advancements in physics (and science) are prompting researchers to delve into, speculate, and think about superquestions and more adventurous ideas that, by nature, go beyond the currently accepted methods of science. It's hard to imagine science not evolving in its methods.... We are hitting the boundaries of experiment. (More specifically, experiment that can be humanly done.) These many superquestions and supercuriosities show that we are more curious by questions that now seem untestable by our current state of abilities, at least to a high degree of certainty.

What questions might the future consider it appropriate to have been formulated now? The point to be stressed is that such "interesting questions" are of a kind that needs to be used to refine "superquestions" -- if the same mindset is not to be used to define the (above-mentioned) "global societal problems", and the "important issues facing society", for which supercomputers are assumed to enable solutions. It is unfortunate that in practice the greater the sophistication of analysis, as enabled by supercomputers, the less the relevance to the practical challenges of governance and sustaining its credibility.

Unconventional pattern exploration: Following his widely-cited work on a pattern language and his subsequent work on order in nature, [Christopher Alexander](#) has suggested a program of research of great potential relevance to governance (*New Concepts in Complexity Theory: an overview of the four books of the Nature of Order with emphasis on the scientific problems which are raised*, 2003; *Harmony-Seeking Computations: a science of non-classical dynamics based on the progressive evolution of the larger whole*, *International Journal for Unconventional Computing (IJUC)*, 5, 2009). Its implications, notably in the light of "superquestions", are discussed separately (*Harmony-Comprehension and Wholeness-Engendering: eliciting psychosocial transformational principles from design*, 2010).

Through enhancing human pattern recognition capacity, whether through geometry or dynamic rhythm, is it the case that **superquestions do not need supercomputers** -- provided the capacity of the human brain is appropriately enabled to formulate and engage with superquestions? Is the issue rather how to reframe the "coordinate system" which currently introduces redundant singularities? In this respect it is appropriate to look for a mnemonic reframing of FLOPS:

- **FLOPS:** currently an abbreviation for the computing term: *floating point operations per second*... perhaps to...
- **FLOPS:** potentially an abbreviation for a governance term: *floating perspective operacy per (sub)system*

The mnemonic highlights the need to encompass multiple perspectives (effectively "floating" between them), enabling appropriate action (**operacy**) in their associated (sub)systems.

Enabling collective intelligence: It is striking, at the time of writing, that individual tax payers (via dubious governmental intermediaries) are being called upon to bail out various "developed" countries (Ireland, following Greece, potentially to be followed by Portugal, Spain and Belgium) -- after previously bailing out banks and corporations "too big to fail". Most curiously no one has been effectively held responsible for such extreme mismanagement and there is every sign that "business as usual" is expected to continue -- appropriately rewarded by bonuses acknowledged to be obscene, awarded to those taking the most extreme risks (*Extreme Financial Risk-taking as Extremism -- subject to anti-terrorism legislation?*, 2009). Mismanagement with impunity has become the primary characteristic of governance at the highest level (*Emergence of a Global Misleadership Council: misleading as vital to governance of the future?* 2007).

The academic community has been significantly complicit in this process, whilst disclaiming any responsibility whatsoever. It is therefore appropriate to ask whether that mindset will ensure appropriate use of supercomputers -- to remedy, rather than exacerbate, the challenge for the population at large in continuing to bail out systemic stupidity, the antithesis of collective intelligence.

The set of tentative superquestions might be usefully understood as derivative of a more fundamental, superordinate question for a global knowledge-based society. This might be framed as **how does the rapidly developing computing power, distributed or otherwise, enable integrative dialogue capable of enabling the emergence of collective intelligence.**

A danger is that techno-enthusiasm considers this as already to be an inherent characteristic of current web interactivity, social networking and the like, when these have as yet to demonstrate a quantum leap in capacity to respond coherently to emerging crises -- as demonstrated on a minor scale by the Gulf oil spill (*Enabling Collective Intelligence in Response to Emergencies*, 2010) and, at the time of writing by the situation in Haiti.

"Purpose, culture, process, and people replace strategy, structure, and systems as our superordinate questions."
James Champy, *Reengineering Management: mandate for new leadership*. 1995

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