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Risk-enhancing Cognitive Implications of the Basic Mathematical Operations

ADD, MULTIPLY, DIVIDE and SUBTRACT

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Introduction

This exploration uses the set of basic mathematical operations as a means of providing a mnemonic framework to highlight weaknesses in comprehension tending to accelerate processes of global civilizational collapse, as variously foreseen (Thomas Homer-Dixon, *The Upside of Down: catastrophe, creativity, and the renewal of civilization*, 2006; Jared M. Diamond, *Collapse: How Societies Choose to Fail or Succeed*, 2005; Johan Rockström and Anders Wijkman, *Bankrupting Nature: Denying our Planetary Boundaries*, 2012).

The exploration can be seen as consistent with the work of George Lakoff and Rafael Nuâî?±ez (*Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2001). However, the focus is on associating the much-discussed strategic challenges of the times with the familiar mathematical operations: ADD with problematic forms of growth; MULTIPLY with increasing population; DIVIDE with the tendencies to divisiveness; and SUBTRACT with ensuring less than the whole truth.

The argument concludes with recognition that mathematics offers a multitude of other possibilities, most notably that associated with INTEGRATION -- so obviously a challenge with respect to the many domains of human affairs. However, as recent research has indicated, humans have instinctive capacities in that respect -- well demonstrated in acrobatics and the capacity to catch a ball, with which so many are familiar.

ADD as a disaster enabling process

This mathematical process offers reminders through the following

Acquisition: The form of this ADD process is evident in:

- ***Products***: The acquisition of products characteristic of consumerism, and both appreciated and criticized as such. It has been framed by the slogan "*shop 'til you drop*". The criticism has been framed as anti-consumerism and affluenza. For governments the acquisition of products is notably focused on military equipment.
- ***Wealth***: The acquisition of products can be seen as a symptom of, or surrogate for, the acquisition of wealth by which many are driven
- ***Status***: Potentially independent from the tangibles represented by products and wealth, is the drive for the acquisition of status -- if only in one's own eyes, then framed as self-esteem. It is otherwise apparent in the many approaches to "ranking", whether financial, educational, or otherwise
- ***Followers***: The internet has highlighted the process of acquiring followers through social networking, perhaps labelled as "friends". This extends the tendency to build up a list of contacts or a clientele. This is intimately related to the intense focus on the acquisition of supporters, whether political, religious or otherwise.
- ***Partners***: A primary drive in interpersonal relationships is the acquisition of friends ("elective affinities"), especially sexual partners -- exemplified in some cases by the process of "scoring"..
- ***Family***: Within a family context, considerable emphasis may be placed on adding to the family through engendering one or more

children.

Espcially intriguing is the sense in which assessment of an additive opportunity is marked by a failure to balance the investment and the costs. In this sense there is a notable failure to "ADD up" factors which may indicate that the initiative is not viable. Thus purchases may be made without recognizing the risks of paying off credit. Children may be conceived without previously ADDing up the subsequent costs and the availability of resources. Such considerations would be considered characteristic of prudent family management, management of a farm, or of a small enterprise.

Growth: The acquisition framing overlaps and translates into a variety of preoccupations with growth.

- ***Economic growth***: This is the primary preoccupations of most countries and regions, and of many enterprises within them. The preoccupation has been widely criticized (Bob Lloyd, *The Growth Delusion*, *Sustainability*, 2009, 1, 3, pp. 516-536)
- ***Status***: As with the acquisition of intangibles, the growth in the intangibility of status is subtly related to that of economic growth, typically reinforced by growth in wealth and military power. It is questionably related to increasing the height of skyscrapers ("big is better") -- and its consequent avoidance of consideration other technical possibilities (*From Lateral Thinking to Voluminous Thinking: unexplored options for subterranean habitats in dense urban areas*, 2007).
- ***Followers***: Again following from the acquisition process, growth in numbers of "followers" is a primary preoccupation of political parties and religions.
- ***Family***: Value may well be attached to the growth in the size of a family as indicative of wealth and status -- a "small family" being a matter of regret.
- ***Genitalia***: Considerable attention is given to the "growth" of the size of a penis or breasts, as a key to sexual attraction and performance -- framed through the slogan "*size makes a difference*". Ensuring the growth of such organs, and their functionality, has long been a preoccupation of traditional aides and artifices -- notably enhanced by aphrodisiacs (with severe consequences for endangering many species). Responses to possible growth in size are increasingly addressed surgically by penis enlargement and breast enlargement (breast implant and augmentation mammoplasty). .

Attention Deficit Disorder (ADD): Previous recognition of attention deficit disorder, and its abbreviation ADD, has now been reframed as the "predominantly inattentive" variant of three subtypes of attention-deficit hyperactivity disorder (ADHD). Whilst there is extensive commentary on its obvious symptoms, especially in the case of children, there is relatively little concern for its wider implications in psychosocial processes -- most notably the capacity for sustained attention to any challenging strategic issue. As widely noted, any media coverage of events -- especially those with challenging implications for the vulnerability of civilization -- is well-described as being a "nine day wonder". Any communication in that regard is readily forgotten -- meriting analysis in terms of collective memory ((*Societal Learning and the Erosion of Collective Memory: a critique of the Club of Rome Report: No Limits to Learning*, 1980).

The situation is more obvious in advertising and marketing concerns for ensuring sustained attention to the contents of a message -- before passing to some alternative source of information or infotainment. This is clear in terms of channel surfing (zapping and zipping) to avoid certain message content. As noted by Alvin Toffler (*The Third Wave*, 1980):

> On a personal level, we are all besieged and blitzed by fragments of imagery, contradictory or unrelated, that shake up our old ideas and come shooting at us in the form of broken or disembodied "blips". We live, in fact, in a "blip culture"... Instead of receiving long, related "strings" of ideas, organised or synthesised for us, we are increasingly exposed to short, modular blips of information -- ads, commands, theories, shreds of news, truncated bits and blobs that refuse to fit neatly into our pre-existing mental files. (6, pp. 181-182)

The emerging phenomenon of Twitter raises numerous issues regarding the interplay between the rapid addition of issues and the capacity for sustained discussion of any of them -- under the ever increasing pressure of the frenetic quest for ADDitional input and the potential distraction it offers, usefully understood as mass distraction (*Destructive Weapons of Mass Distraction vs Distractive Weapons of Mass Destruction*, 2003). It is in the appetite for new information that the mathematical operation of ADD becomes evident as "hyperactive consumption" of new experience. The implications of the online modality for enhancing stupidity have been explored by Nicholas Carr (*The Shallows: What the Internet Is Doing to Our Brains*, 2011) and developed by Alex Soojung Kim Pang (*Distraction Addiction*, Little Brown, 2013).

This merits exploration in terms of a psychosocial need for what might be provocatively framed as minimizing the "time to orgasmic catharsis " in the pursuit of happiness -- understood in terms of humour, interest, astonishment or awe, variously meriting a form of cognitive "ejaculation" (*Re-Emergence of the Language of the Birds through Twitter? Harmonising the configuration of pattern-breaking interjections and expletives*, 2010). Controversially, terrorism itself has been explored in such terms by Mark Jurgensmeyer (*Terror in the Mind of God: the global rise of religious violence*, 2001). Does tourism merit consideration from this perspective -- as the unconstrained urge to ADD impressions and capture them photographically?

MULTIPLY as a disaster enabling process

This may be understood as a systematization of the the ADD process. As such MULTIPLY can be explored as a syndrome of unconstrained ADD processes and their possibly exponential acceleration.

It might then be asked at what rate "acquisition" is increasing, as with "growth" -- and whether such multiplication of the ADD process is sustainable on a planet variously constrained in terms of resources. The challenge is especially problematic in the light of attention deficit disorder and the erosion of collective memory -- potentially constrained in its ability to encompass the dynamics of complex systems for the requisite time to comprehend them, devise responses and ensure their sustainable implementation..

More questionable is the tendency of the major religions to encourage large families. This commitment to MULTIPLY may be seen as fundamentally reinforced by the divine injunction common to the Abrahamic religions. The cynical would argue that this is an easy policy whereby the numbers of the faithful can be increased with little investment in missionary activity. But the faithful are reassured by holy scripture and notably, for the people of the Book, by the key phrase "be fruitful and multiply" (*Genesis 1:28*), as separately discussed (*"Be Fruitful and Multiply" the most tragic translation error?* 1995).

Many -- if not most -- strategic problems, on which attention is focused, derive fairly directly from increasing population numbers (food, water, land, housing, pollution, unemployment, energy, etc). In this sense these problems may be understood as deriving from fan injunction upheld as sacred (*Root Irresponsibility for Major World Problems the unexamined role of Abrahamic faiths in sustaining unrestrained population growth*, 2007; *Begetting: challenges and responsibilities of overpopulation*, 2007).

Of relevance to this exercise, "population" can be considered in a more general sense as a statistical population -- namely any set of entities concerning which statistical inferences may be drawn. Just as the human population is multiplying in a seemingly unconstrained manner, the connections amongst people, and between concepts and preoccupations, is also multiplying. Increasingly there is the realization of the overwhelming sense in which "everthing is comnnected to everything". This renders ever more complex the challenge of managing change and engaging in initiatives without unforeseen problematic consequences. Cognitively, it is the sense of "overwhelming", recognized as "information overload", which has implications systemically analogous to those of overpopulation.

The cognitive resources available for consideration of any form of governance are demonstrably inadequate to the challenge. In the case of the final challenges faced by the Roman Empire, the matter can be analyzed in terms of energy resources, as has been done by Thomas Homer-Dixon (*The Upside of Down: catastrophe, creativity, and the renewal of civilization*, 2006). A similar argument can be made in terms of information and the capacity to generate and disseminate it as required by the challenges. Whilst technical facilities of vast capacity have indeed been developed to this end -- as exemplified by web/internet facilities -- missing is recognition of the challenge for individual and collective comprehension of relevant information as the connectivity and implications continue to multiply.

DIVIDE as a disaster enabling process

The problematic aspects of the DIVIDE process are evident in the division within and between a variety of domains.

Academic disciplines: In this case the issue is exemplified by ever-increasing specialization and the unresolved challenges of effective interdisciplinary relationships, especially between non-contiguous domains of knowledge. This was a theme extensively discussed in relation to the Integrative Knowledge Project. The situation is exacerbated by deprecation of one discipline by another (Andrew Ross (Ed.), *Science Wars*, 1996; Paul R. Gross and Norman Levitt, *Higher Superstition: the academic left and its quarrels with science*, 1994). This is often taken to extremes, as exemplified by the case of the Sokal Affair (Alan D. Sokal and Jean Bricmont, *Fashionable Nonsense: postmodern intellectuals' abuse of science*, 1998;

Ethnic groups: The well-recognized issue of divisions between ethnic groups -- and the distinctions cultivated through the DIVIDE process -- calls for little comment.

Social classes: Again, the operation of the DIVIDE process in the case of the relation between social classes requires little comment.

Political ideologies: The operation of the DIVIDE process is central to the shorter and longer term dynamics between political parties -- even to be seen as expressed through physical violence, as within some parliaments

Religions: The consequences of the DIVIDE process in the case of religions is especially evident as a trigger for bloody conflict over centuries. Efforts to remedy the situation through interfaith dialogues can be seen as essentially tokenistic -- irrespective of the good faith with which they may be undertaken by some.

Economic inequality: The DIVIDE process is of course most evident in the cultivation of income inequality and the associated "gap" -- and the rationalizations propagated to justify it.

Capacities: Distinctions are regularly made between the "brilliant" and the "ignorant", or between the "competent" and the "incompetent". This is ironically evident in the relative distinctions made according to intelligence quotient between clusters corresponding to particular percentiles of the population -- leading to the formation of various of "high IQ societies" which reinforce this distinction. It is not apparent that those of the highest IQ are contributing significantly to resolution of the problems of the world, as opposed to exacerbating the problems resulting from the DIVIDE process (Thomas Homer-Dixon, *The Ingenuity Gap: how can we solve the problems of the future?* 2000).

The DIVIDE process is exemplified in the long-recognized social and political strategy: *Divide and rule*. In the summary by *Wikipedia*, divide and rule (or divide and conquer) is the process of gaining and maintaining power by breaking up larger concentrations of power into chunks that individually have less power than the one implementing the strategy. The concept refers to a strategy that breaks up existing power structures and prevents smaller power groups from linking up.

It has been rendered more than obvious as a framework for US foreign policy underlying the NATO engagement with the world affairs: *You're either with us, or against us*. This might be more pointedly rendered as *You're either with US, or against US*. More generally it relates to the whole approach to distinguishing between "us" and "them", as separately discussed (*Us and Them: Relating to Challenging Others: patterns in the shadow dance between "good" and "evil"*, 2009). As described by Wikipedia the phrase is used to depict situations as being polarized and to force witnesses, bystanders, or others unaligned with some form of pre-existing conflict to either become allies of the speaking party or lose favour. The implied consequence of not joining the team effort is to be deemed an enemy. In the case of the US, this has been most obvious with respect to the so-called war on terror which has been used as a preferred strategy to frame global politics unquestionably for the past decade (*Promoting a Singular Global Threat -- Terrorism: Strategy of choice for world*

governance, 2002).

SUBTRACT as a disaster enabling process

The SUBTRACT process offers a reminder of the subtly remarkable tendencies to -- subtext -- hidden agendas commissions (taking a cut)

Withholding facts or a proportion of them: This prevents appreciation of the truth with regard to a wide variety of economic, social and psychological processes. This is now obvious in a variety of domains:

- ***Science***: Various disciplines have been associated with tendencies to suppress facts as anomalously disruptive of preferred theories. Extreme examples include cases of scientific fraud.
- ***Marketing of products***: Corporations have provided numerous examples of misleading advertising and the suppression of information regarding dangers associated with their products, most notably the tobacco industry (Naomi Oreskes and Erik M. Conway, *Merchants of Doubt: how a handful of scientists obscured the truth on issues from tobacco smoke to global warming*, 2010)
- ***Statistics***: It is widely recognized that official statistics are vulnerable to being "massaged" to frame official policies to the advantage of their advocates.
- ***Classified information***: Vast amounts of information are held under various degrees of classification for various periods (as in the case of official archives). As revealed by the release of diplomatic cables via Wikileaks, significant facts are deliberately withheld to ensure strategic advantage.
- ***Secret treaties and agreements***: It is recognized that an array of treaties and agreements between governments are secret, as are many agreements between corporations (possibly associated with the price-fixing arrangements of cartels)
- ***Secret knowledge***: Various groups are believed, and may claim, to have secret knowledge of fundamental significance to the future of civilization. Ironically more evident, however, is the extent of the tendency to SUBTRACT from any presentation of the "whole truth" through a code of silence -- omertà (*Varieties of the "Unsaid" in sustaining psycho-social community*, 2003).
- ***Transparency***: This becomes most evident with respect to financial transparency and undeclared conflicts of interest in the case of those holding some form of public office. It is the focus of periodic scandals, notably enhanced by unsuspected sexual implications.

Denying facts or a proportion of them: This variant follows from arguments regarding any withholding of information noted in the previous point. It may be a characteristic phase prior to admission that facts have been withheld, especially following formal investigation -- possibly with respect to criminal malfeasance.

- ***Science***: To the extent that any body is recognized as speaking on its behalf, "science" may vigorously deny problematic DIVIDE processes in its handling of knowledge -- even when this may amount to an equivalent of gerrymandering (*Scientific Gerrymandering of Boundaries of Overpopulation Debate: review of The Royal Society report -- People and the Planet*, 2012). This has been recently evident in controversies in the case of climate change data. More generally this has been a theme of the work of Rupert Sheldrake (*The Science Delusion*, 2012), as separately discussed (*Knowledge Processes Neglected by Science: insights from the crisis of science and belief*, 2012).
- ***Marketing of products***: Corporations, as noted above, are extremely vigorous in their denial of any wrongdoing -- irrespective of the degree to which health has been endangered. Attention was dramatically drawn to this process by Rachel Carson (*Silent Spring*, 1962)
- ***Statistics***: Again, the manner in which statistics are "massaged" may either constitute a denial of facts, or give credibility to such denial.
- ***Classified information***: The very "fact" of the classification of indeterminate quantities of information, on an unknown range of subjects, constitutes a form of denial and reinforces that tendency. Dissemination may have the severest consequences, as first made clear in the case of the Pentagon Papers relating to the Vietnam War.
- ***Secret treaties and agreements***: These are necessarily denied, again possibly as a consequence of any provisions for "official secrets"
- ***Secret knowledge***: This is exemplified in the case of the supposed secret knowledge of the Freemasons, and the existential threats to any members who divulge it.
- ***Transparency***: Most cases in which transparency is subsequently called for typically involve a phase of denial of unforeseen levels of corruption. The Libor banking scandal may be seen as one example.

Ignoring facts or a proportion of them: Potentially more problematic, following from the above, is the incapacity to recognize some facts as being of relevance -- consciously or unconsciously treating them as irrelevant. This tendency has been separately discussed (*Map of Systemic Interdependencies None Dares Name: 12-fold challenge of global life and death*, 2011). The situation is exacerbated by the process of "dumbing down" to reduce sensitivity to the possibility of such relevance -- essentially a process of eroding connectivity and any sense of "how the dots are connected". This can be recognized as the cultivation by the DIVIDE process of "sub-understanding", fllowing the argument of Magoroh Maruyama (*Polyocular Vision or Subunderstanding? Organization Studies*, 25, 2004)

Incomprehension of advanced mathematical operations increasing vulnerability to collapse

Mathematics, in collusion with a variety of disciplines, is cultivating ever more complex ways of comprehending society, economics, finance, environmental processes and astrophysical processes. There is a case for recognizing that the comprehension of the offered

frameworks is restricted to the few -- who may well be challenged by the application of these insights in other domains in which they are involved.

Explanation: There is a case for recognizing that processes of "explanation" imply a form of geometrical insight into the "plane" in which, or on which, the processes of "reality" occur. In the absence of "explanation", this assumption can be associated with the much-deprecated "flat earth" mentality. Curiously this has been celebrated in several works by Thomas L. Friedman (*The World Is Flat: a brief history of the twenty-first century*, 2005; *Hot, Flat, and Crowded: why we need a Green Revolution -- and how it can renew America*, 2008) -- a perspective separately criticized (*Irresponsible Dependence on a Flat Earth Mentality -- in response to global governance challenges*, 2008).

In this sense "explanation" suggests the possibility of in some way "getting out of" the plane, or off the plane. The challenge to doing so is offered a fruitful mnemonic twist through the increasing risk of being placed on the "no fly list" created and maintained by the United States government's Terrorist Screening Center. This offers the reflection that many may well be effectively prevented from "flying" -- cognitively speaking -- as in the tradition of many religions restricting the exploration of dimensions by which they felt threatened.

It could be assumed that "ex-planation" ambiguously emphasizes both the planar and the creative potential of "lateral thinking" -- whilst failing to encompass more complex geometries, as separately discussed (*Metaphorical Geometry in Quest of Globality -- in response to global governance challenges*, 2009). The situation is all the more ironic in that mathematics is primarily of interest to mathematicians because of the far higher orders of subtlety it fruitfully explores -- primarily to its own satisfaction.

How does enthusiasm for "ex-planation" accord with the strategic enthusiasm for a "plan" -- better still a "global plan"? Does this suggest that the quest for sustainable global governance through a "plan" might be usefully compared to the challenge of balancing a ball on a flat surface variously subjected to unpredictable movements? Is expenditure by a global civilization of scarce resources on astronautics an unconscious effort to transcend the contradictions of a "flat earth" mentality (cf. John Ralston Saul, *The Unconscious Civilization*, 1995)?

Differentiation: In evoking the most basic mathematical processes, it is appropriate to note that the problematic psychosocial consequences of the DIVIDE process are addressed through the subtleties of differentiation. As a feature of calculus -- as the mathematical study of change -- it is also appropriate to note the potential implications of the so-called calculus of indications based upon a fundamental operation of distinction (George Spencer-Brown, *Laws of Form*, 1969). This has inspired further developments of potential relevance to the problematic aspects of the DIVIDE process (Francisco Varela, *A Calculus for Self-Reference*, *International Journal of General Systems*, 1975; Louis H. Kauffman, *Virtual Logic: symbolic logic and the calculus of indications*, *Cybernetics and Human Knowing*, 1998).

Modelling complexity: There is great enthusiasm for the development of complex mathematical models -- irrespective of any capacity to comprehend them or their implications. This proved to be most disastrous in the case of the subprime mortgage crisis and its consequences for the current global economic crisis, as discussed separately (*Uncritical Strategic Dependence on Little-known Metrics: the Gaussian Copula, the Kaya Identity, and what else?* 2009). So-called financial derivatives, variously comprehensible to all but the few, continue to be packaged and marketed. The peer-to-peer, electronic cash system, Bitcoin --originally associated with a form of online computer game -- is a digital currency now attracting global attention, although its workings again remain necessarily obscure to many. This tendency to rely on democratically incomprehensible models can be considered as one manifestation of the SUBTRACT process -- through which the capacity to comprehend systems in their totality (even their "globality") is effectively reduced (systematically).

Integration: It is most curious that, despite the vulnerability to disaster associated with the implications of the basic mathematical operations -- ADD, MULTIPLY, DIVIDE and SUBTRACT -- there is very little "trickle down" from the heights of mathematics and science to remedy their consequences. Tragically interesting with respect to DIVIDE, and its mathematical development through DIFFERENTIATION, is the incredibly limited ability to adapt the complementary mathematical insights of INTEGRATION -- as one of the fundamental concepts of calculus.

There is no evidence of insights into the relevance of INTEGRATION to the many vexatious issues of social integration, economic integration, racial integration -- or even to those of interdisciplinary integration, or psychological integration. A notable exception is provided by the work of Johan Galtung and Dietrich Fischer (*Peace Mathematics*, 2012).

Pathetically, in a period of bloody conflict, there is no demonstrated ability to explore the relevance of mathematical insights to the resolution of territorial disputes at the centre of such violent conflict -- as separately argued (*Middle East Peace Potential through Dynamics in Spherical Geometry: Engendering connectivity from incommensurable 5-fold and 6-fold conceptual frameworks*, 2012; *And When the Bombing Stops? Territorial conflict as a challenge to mathematicians*, 2000; *Reframing Relationships as a Mathematical Challenge -- Jerusalem: a parody of current inter-faith dialogue*, 1997).

Dynamics: The dynamics of night and day, and of the seasons -- with which most are so familiar -- offer another insight into DIFFERENTIATION, as cultivated so assiduoulsy by those of the Abrahamic religions, inspired by recognition of the light as good, and the separation of light and darkness (*Genesis 1: 4*). How does any simplistic "divisive" interpretation of this phrase conflict with experience on a globe that is both rotating and revolving? Clearly in the periods when the US is "enlightened", both Afghanistand and Iraq are "endarkened" -- and vice versa, of course.

Most curiously, as has been variously remarked, those engaged in a variety of sporting disciplines effectively demonstrate considerable "mathematical" skills in INTEGRATION with respect to movement of the body and the ability -- at its simplest -- to catch a ball (*Baseball Players And Fish Are Naturals At Math and Physics*, *Christian Science Monitor*, 5 September 1995; Karl S. Kruszelnicki, *How to Catch a Ball*, *ABC Science*, 9 August 1999). These skills have now become of concern to NASA with respect to movement of astronauts in orbital space (Michael McBeath, et al. *How Baseball Outfielders Determine where to run to catch fly balls. Science*, 1995;

Edward Aboufadel, *A Mathematician Catches a Baseball*, 1996).

As implied in the introduction, this suggests the potential of a new kind of attention to the sports in which so many billions are cognitively engaged (George Lakoff and Rafael Nuâ?±ez, *Where Mathematics Comes From: how the embodied mind brings mathematics into being,* 2001; Mark Johnson, *The Meaning of the Body: aesthetics of human understanding*, 2008; Maxine Sheets-Johnstone, *The Primacy of Movement*, 2011).

What is the nature of the "missing link" between sophisticated instinctive comprehension and sophisticated mathematical formalization -- as might be of relevance in practice to "catching the ball" in global governance?

Conclusion

The argument emphasizes the use of the four basic operations as providing a suggestive mnemonic framework for dynamics exacerbating the vulnerabilities of a civilization in quest of sustainability. Their use as metaphors may however be far more fundamental, as implied by the cognitive psychological considerations of George Lakoff and Rafael Nuâ?±ez (*Where Mathematics Comes From: how the embodied mind brings mathematics into being*, 2001). They suggest that mathematical reasoning is fundamentally metaphorical. They describe mathematics as based on four "grounding metaphors" that define basic arithmetic, together with a collection of "linking metaphors" that generate more abstract areas of mathematics from arithmetic. Lakoff is however also well known for his consideration of metaphorical framing of political strategy -- notably his argument that "metaphors can kill". How the cognitive and political concerns combine in the light of the mathematical argument is a matter of continuing debate.

Of particular relevance is the increasing empirical support for Lakoff's argument that mathematical reasoning is "embodied" through being implemented, at least in part, by areas of the parietal cortex also involved in the representation of bodily position, orientation and movement, 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 question is the nature of the further implication of such arguments for the collective.

Curiously the "solution" to the problems of the current global civilization would seem to be, as might be expected, inherent in the processes of ADD, MULTIPLY, DIVIDE and SUBTRACT. Unconstrained as they are individually, and unbalanced as they are together, as cognitive processes they are in effect "designed" to engender instability and collapse.

It is in this sense that the exacerbation of their dysfunctional interplay, as assiduously and unthinkingly reinforced by the Abrahamic religions, does indeed offer a royal road to the early emergence of a new modality -- potentially emergent from the ashes of the old. If that is the only foreseeable possibility, irrespective of the predictable pain (joyously anticipated within those worldviews), there is a case for exploring how best to accelerate the processes.

The argument is well-made by a movement of conservative evangelical Christians (*The Quiverfull: the evangelical Christians opposed to contraception*, *BBC News*, 17 May 2013), reinforced by former US presidential candidate Mitt Romney (and father-of-five) in a recent speech to graduates: *Get married. Have a quiver full of kids if you can*. It was a conscious echo of *Psalm 127*, where children are compared to arrows for war. The psalm is the inspiration for the Quiverfull movement:

> Like arrows in the hands of a warrior are sons born in one's youth. Blessed is the man whose quiver is full of them. They shall not be put to shame when they contend with their enemies in the gate.

The unthinking socio-economic focus on growth at all costs is consistent with further reinforcement of the ADD modality. Much could be done to MULTIPLY the rate of population increase -- with dramatic increase in family size -- understood as inherently beneficial within those worldviews and their appreciation of "family values". The interaction in practice between those worldviews -- so evident from daily media reporting of bloody sectarian violence -- helpfully frames the advantages of reinforcing the DIVIDE modality in a variety of domains. The capacity to ignore the implications of problematic news of systemic neglect -- in desperate tokenistic quest for the "positive" -- is an indication of how the SUBTRACT modality could be further developed more assiduously. The tendency of governance to rely on concealing the problematic, through "spin" and lack of transparency, is an indication of the possibility of enabling early civilizational collapse as being the "final solution" to the dilemmas of governance, as variously discussed separately (*Ungovernability of Sustainable Global Democracy ?* 2011; *Beware of Legality, Accountability, Marketability, Security! Be where the Four Hoarsemen of the Apocalypse are not?* 2012).

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