



laetus in praesens

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Complexification of Globalization and Toroidal Transformation topological implications of invagination and gastrulation in embryogenesis

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Annex B of *Engendering Invagination and Gastrulation of Globalization* (2010)

Introduction

This Annex develops details of the arguments summarized in the [main paper](#) (where [references](#) are located). There the following arguments are then used as a basis for exploring the:

- [Morphogenesis of globalization: enabling topological transformation](#)
- [Enactivating "gastrulation" of "globalization"](#)
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- [From global to helicoidal -- from pi to phi?](#)

Globalization: from "invagination" to "gastrulation"

Given the widespread appropriation of "invagination" by postmodernists, as noted above, this is taken as a primary thread in the following discussion of gastrulation -- of which biological invagination is a significant process. However it is appropriate to recognize that it is but one of the modes of gastrulation (as discussed below). Furthermore it is also appropriate to note the manner in which postmodernists appear to have restricted their appropriation to "invagination" as a particular initial part of gastrulation as a phase in embryogenesis -- from which subsequent phases might offer a richer panoply of insights of relevance to globalization.

Globalization and invagination: Despite the nature and focus of the literature search, the references to invagination are not framed in relation to the process of globalization. It might be assumed that Derrida had no interest in the matter and had offered no pointers in this respect. However, an entry in the *Science Encyclopedia (Globalization in Asia: Habermas and Derrida in China)* notes with regard to a tour by Derrida in China in September 2001:

Chinese intellectuals discussed his "specters of Marx" theory that still holds transformational possibilities. Although Chinese Marxist scholars primarily view globalization as an economic moment in the continuing internationalization of capitalist modes of production, they are also concerned with cultural consequences. Derrida's multicultural approach to law, language, and society

might help the Chinese form a New International that addresses the homogenization of global economics by way of a participatory response of cultural difference and diversity. China can be in globalization without completely being of globalization. Chinese scholars look for universal value in globalization beyond obvious hegemonic implications. Derrida agrees that there are many confusing debates around globalization because of "a certain transparency and with the appearance of liberal exchange"... while forms of monopoly march forward. China's awareness of these trends and continued participation in the discourse on globalization can profit from European philosophers (including postmodernists) as a complement to North American thinkers.

Citing the reflections of Derrida (*Globalization, Peace, and Cosmopolitanism*, 2002), Victor Li (*Elliptical Interruptions Or, Why Derrida Prefers Mondialisation to Globalization, CR: The New Centennial Review*, 2007) offers a very useful summary of Derrida's concerns in relation to the language used:

It is precisely against globalization's "logic of completeness" and "eco-politics of the whole or the all" that Derrida poses two elliptical interruptions: first, that globalization does not translate as *mondialisation*, and second, that *mondialisation* in its European and Christian filiation undergoes an autoimmune, autodeconstructive process that opens it out to the event that cannot be calculated, programmed, or predicted in advance.

As both academic and political activist, it is Gayatri Chakravorty Spivak (*A Critique of Postcolonial Reason: toward a history of the vanishing present*, 1999; *The Post-Colonial Critic: interviews, strategies, dialogues*, 1990) who has seemingly been most articulate from a deconstructionist perspective with regard to globalization. Indeed the "vanishing present" is understood by her through a reweaving of the social text of "globalization". However there is seemingly little trace of efforts to relate it to the process of invagination on which she has explicitly written (as cited above). The process is not mentioned in the summary of her work by Stephen Morton (*Gayatri Chakravorty Spivak*, 2003).

Playfully it is appropriate to suggest, given the questionable conflation of connotations regarding "invagination", that Spivak's preoccupation with the "post-colonial" calls for similar licence (cf. *Enacting Transformative Integral Thinking through Playful Elegance*, 2010). Coincidentally, in that spirit, the "colon" is a feature of the human anatomy forming a major part of the digestive tract and therefore a late consequence of invagination and the gastrulation process. The "colonial" connotation is certainly consistent with imperial exploitation -- understood as a "digestive" process and consequent on the formation of enclaves ("pockets") in distant lands. More intriguing are the "post-colonial" connotations and their relation to those of "invagination" -- whether in an anatomical or a global context. Such "pockets" may be understood in terms of: diplomatic enclaves, military bases, "church planting", trading centres, tax-free zones, and the like.

"Psychotopology": As noted, various distinctions between "globe", "world" and "*monde*", as made by Derrida, are summarized by Li (*Elliptical Interruptions Or, Why Derrida Prefers Mondialisation to Globalization*, 2007). To these "sphere" must necessarily be added as an underlying pattern. An interesting additional case is offered by "universal", as in Catholic use of the term "universal church" -- the term "catholic" being derived from "universal".

Clearly, although all may be understood as having that geometry, those of concern to Derrida have various psychological and sociopolitical connotations for some. Indeed the sense in which these are related to the tangible physical world may be tenuous -- as with arguments for recognition of a biosphere, an infosphere and a noosphere with which people may variously identify. Derrida objects to a degree of finality and closure associated with "globalization". Arguably this is otherwise true of "world" -- in the sense in which people frame the world in which they live ("business world", "academic world", or a "world unto themselves"), irrespective of how this relates to the form of the planet. In these senses there is a plasticity to the sphere with which these constructs are implicitly associated, although it is appropriate to assume that they tend to the spherical (as does the planet itself). In that sense they can be usefully explored in the light of that geometry -- even in the case of a "universal" church, despite the questions usefully raised about the shape of such a "universe" (especially given current cosmological speculation).

Considered purely as a qualitative psychosocial construct, there is the interesting possibility that people may think of the sphere-world they inhabit as one more congenially considered as "dwelt in", namely on the "inside". This would be consistent with the promotion of globalization as increasing the visibility of each to the other around the world on a 24/7 basis largely unaffected by diurnal cycles -- a possible justification for the provocative title of the much-lauded study by Thomas Friedman (*The World Is Flat: a brief history of the Twenty-First Century*, 2005), criticized previously (*Irresponsible Dependence on a Flat Earth Mentality -- in response to global governance challenges*, 2008). Such a globally cocooned perspective would be consistent with the psychology of inhabitants of a hypothetical Dyson sphere, widely explored in the science fiction from which it originated. More curiously, it is reminiscent of the much-deprecated hollow earth hypothesis -- but understood here as a psychosocial construct.

Metaphorical geometry and topology: In a chapter on *Chaos, Fractals and Deep Structure*, Richard Grossinger, Phoebe Gloeckner and Jillian O'Malley (*Embryogenesis: species, gender, and identity*, 2000) note, in the context of an insightful comment on the arguments of Derrida:

...the powerful abstract forms emerging from chaos are historical; like Plato's original geometric solids, they arrive in human minds at a moment in time, altering everything they contact, including representations of themselves. They are simultaneously here and there. This is the paradox Jacques Derrida addresses in his introduction to Edmund Husserl's *Origin of Geometry*.

All geometries, including those of language and number, have ineluctable historicity. While recognizing the temporal aspect of these idealities, Husserl nonetheless felt they were never entirely reducible to historical or psychological factors. They existed independently of them -- in sheer contradiction....Emergent form is both temporal and atemporal, Aristotelian and Platonic.

Derrida has pushed not only the purport of this discussion but all discourse into a situation where it cannot be taken for granted at the level of its intended meaning and cannot be salvaged from its halflives by an identification of most of its culturally determined subtexts. For instance, he requires that we take into account the meaning of the very act of writing, the sounds and inscriptions that support it historically, the biology of its execution...and the shifting milieus of the consciousness that utters and the consciousness that receives and interprets text. (pp. 321-2)

In previous discussion of metaphorical geometry (*Metaphorical Geometry in Quest of Globality -- in response to global governance challenges*, 2009) reference was made to the account of formal mathematics of Edmund Husserl as summarized by Kenny Easwaran (*Husserl's Conceptions of Formal Mathematics*, 2004) in relation to the thinking of Kurt Gödel:

Edmund Husserl's conception of mathematics was a unique blend of Platonist and formalist ideas. He believed that mathematics had reached a mixed state combining Platonic and formal elements and that both were important for the pursuit of the sciences, as well as for each other. However, he seemed to believe that only the Platonic aspects had significance for his science of phenomenology

Easwaran cites Husserl to the effect that:

"If analogy can be any guide to method, it will act most powerfully if we restrict ourselves to material mathematical disciplines like, for example, geometry and accordingly ask more specifically whether a phenomenology must be, or can be, constituted as a [material] 'geometry' of mental processes.' This usage of the word 'geometry' implies that it is still being used to describe the science of physical space. The metaphorical 'geometry of mental processes' would similarly be a science of existing objects that we can access directly through intuition (*Wesensschau*), and not formally through reasoning and axioms.

Such arguments reinforce the case for reflection on the implications of a topological transition in the "globalization" process to a toroidal form, as noted in the case of biological development (Harald Jockusch and Andreas Dress, *From Sphere to Torus: a topological view of the metazoan body plan*, *Bulletin of Mathematical Biology*, 2003). The latter document forms part of the more general argument by Stuart Pivar (*On the Origin of Form: evolution by self-organization*, 2009). In his introduction to the latter publication, Pivar states:

In the past few years a defining architectural structure that occurs in the embryos of animal phyla has been identified in a series of publications by biologists E. Presnov, V. Isaeva, L. Beloussa, Y. Kraus, E. H. Davidson, H. Jockusch and A. Dress. These discoveries rewrite the understanding of the embryonic membranes that shape the form of the body. The torus model shows that there is a plausible alternative to Natural Selection and Intelligent Design, neither of which explains the evolution of complex form. (p. xii)

Pivar had previously noted in his introduction:

The discipline of topology does not utilize the term multi-torus. Nor does its literature seem to contain any references to "inscribed" tori, that is, the torus within a torus. The recent publication of Jockusch and Dress and several other investigators establish the "multi-toroidal" nature of the embryonic tissue. That this configuration is a torus within a torus is the hypothesis of this author.

In math parlance, these are inscribed tori, or a nest of tori....Natural form takes its character from the inward directed growth of the body borne imprisoned in a shell. The peculiar character of inscribed tori is that the inner cable of the outer torus passes through the inner canal of the inner torus, restraining mutual revolution... This model may reconstruct missing early stages in the observed sequences of cell division or vertebrate embryogenesis. (p. xx)

In a chapter on *The Simulation of Phyletic Form by the Deformation of a Toroidal Surface* (2009), Stuart Pivar concludes that:

... the forms of nature can be simulated by the deformation of the topological figure called the multi-torus. Since the living germ plasm is in the form of a toroidal bilayer, that nature makes use of the algorithm in the creation of form is a plausible solution to the problem of morphogenesis. (p. 36)

Whilst the focus in this discussion is on the transformation to the toroidal form, this is not seen as being necessarily a final vehicle for integrative "globality" -- especially given the more complex forms offered by topologists in symmetry group terms. Giving absolute primacy to the spheroidal -- effectively "deifying" it as framing a central reference point of eternally validity -- is regrettable when that which is expressed **through** any such focus has other topological modes of expression and is more fully understood in terms of the dynamic pattern whereby these are variously expressed in time.

With respect to development through the spheroidal, as in embryogenesis, the much-cited verse of Omar Khayyám is appropriate.

*The Moving Finger writes; and, having writ,
Moves on: nor all thy Piety nor Wit
Shall lure it back to cancel half a Line,
Nor all thy Tears wash out a Word of it. (Rubaiyat)*

Globalization as isomorphic with embryogenesis?: Aside from the topological and systemic correspondences between cells configured as a spheroidal blastosphere and the "global" configuration of psychosocial holons in society (nations, cultures, belief systems, and the like), there is the question of the nature of the fundamental (subconscious) understanding of the common pattern -- at the cellular level of human consciousness.

How does the deeply encoded human understanding of embryogenesis, by which all emerge, relate to any understanding of the transformative development -- of the "necessary" phases in the transformation of globalization? How might the "global" evolution of human society then be understood as patterned on embryogenesis?

It is surprising to discover that the number of cells forming a blastosphere ranges from 70-150 -- for a wide variety of species. Bearing in mind the psychosocial emphasis here on the "holons" configured "globally", there is the suggestive possibility that a number of that order is indicative of the constraint on the formation of a viable "global" entity -- transcending the individual holon. It is unclear what are the factors contributing to that constraint. In the case of the blastosphere, they are held to be biomechanical. In the case of any psychosocial "holon", typically they might include various constraints within such a context on communication capacity (attention span, memory, etc), capacity to sustain mutuality or complementarity, and the like (*Societal Learning and the Erosion of Collective Memory*, 1980). These would include the capacity to relate to a larger sense of identity -- combined with limits on the capacity to distinguish and remember the variety of "holons" so assembled.

Dunbar number: The number of blastosphere cells would seem to be related in some way to [Dunbar's number](#) understood as a theoretical cognitive limit to the number of people with whom a person can maintain stable social relationship ([Robin Dunbar, *Grooming, Gossip, and the Evolution of Language*](#), 1998; R. A. Hill and R. I. M. Dunbar, *Social Network Size in Humans*, *Human Nature*, 14, 2003, 1, pp. 53-72). Understood in terms of [human bonding](#), these are relationships in which an individual knows (to some degree) who each person is and how each person relates to every other person -- notably through a degree of "social grooming". Numbers larger than this generally require more restrictive rules, laws, and enforced norms to maintain a stable, cohesive group. With respect to development, Dunbar relates the size to development of the neocortex (R. I. M. Dunbar, *Neocortex Size as a Constraint on Group Size in Primates*, *Journal of Human Evolution* 22, 1992, pp. 469-493; L. Barrett, R. I. M. Dunbar, and J. E. Lycett, *Human Evolutionary Psychology*, 2002).

The suggestion is that the number lies between 100 and 230, although a commonly used value is 150, further clarified in relation to guild sizes in online communities by Christopher Allen ([The Dunbar Number as a Limit to Group Sizes](#), *Life with Alacrity*, 10 March 2004). More provocatively it might be stated as the number up to which people find it "meaningful" to "count" -- as in kinship networks. However some form of "conceptual grooming" may also define the size of intellectual communities ([Dynamically Gated Conceptual Communities](#), 2004). Allen concludes:

This all leads me to hypothesize that the optimal size for active group members for creative and technical groups -- as opposed to exclusively survival-oriented groups, such as villages -- hovers somewhere between 25-80, but is best around 45-50. Anything more than this and the group has to spend too much time "grooming" to keep group cohesion, rather than focusing on why the people want to spend the effort on that group in the first place -- say to deliver a software product, learn a technology, promote a meme, or have fun playing a game. Anything less than this and you risk losing critical mass because you don't have requisite variety.

One set of examples, highlighting an experiential constraint on such stability, is the preferred limitation on membership of closed, elite "clubs" to numbers in that range (or less): [Club of Rome](#) (100), [Académie française](#) (40), [Club of Madrid](#) (68), [Club of Budapest](#) (61+61).

With respect to the dynamics of social groups, Dunbar's number has been widely popularized by [Malcolm Gladwell \(*The Tipping Point: how little things can make a big difference*, 2000\)](#). [Tipping points](#) are understood as "the levels at which the momentum for change becomes unstoppable." It may be understood as "the moment of critical mass, the threshold, the boiling point." A related concept was applied to the study of anarchy, politics, and the tragedy of the commons by Dennis Fox (*Psychology, Ideology, Utopia, and the Commons*, *American Psychologist*, 40, 1985, pp. 48-58). [Antony Jay \(*Corporation Man*, 1972\)](#) identified size limitations for organizations: "ten group" of 3-12 (work group, project group, task force); "camp" of 20-60 (work group plus those dependent upon their activity or servicing their requirements); "tribe" of 300-1000 (identity group, mutual recognition); "kingdom" of 5,000-60,000 (administrative, social, cultural or military coherence); "empire" of 100,000+.

As discussed in the main paper, might "[shells of globality](#)" correspond in some way to the "magic numbers" of protons and neutrons constituting "[islands of stability](#)" -- with those currently recognized being 2, 8, 20, 28, 50, 82, 126 -- and some hypothesized up to 300+? (see further [discussion in Annex C](#)). The extensive representation of possible isotopes, suggests a means of analyzing and representing possible stable configurations of groups of different size (see the [Wikipedia Table of nuclides](#) and [Table of nuclides combined](#)). Especially intriguing is the possibility that such stability arises from some form of balance between emphasis on "positive", "negative" and "neutrally" charged initiatives, potentially understood in cybernetic terms ([Being Positive and Avoiding Negativity: management challenge of positive vs negative](#), 2005; [Barbara Ehrenreich, *Bright-sided: how the relentless promotion of positive thinking has undermined America*](#), 2009). Of related interest is the recent MIT research on the value of a balance between male and female in groups ([Collective Intelligence: number of women in group linked to effectiveness in solving difficult problems](#), *ScienceDaily*, 2 October 2010).

"Invagination" is then a self-reflexive moment at which any global configuration effectively "puts itself to the question" ([Consciously Self-reflexive Global Initiatives: Renaissance zones, complex adaptive systems, and third order organizations](#), 2007). With respect to this argument, "people" could be generalized to "holons". It might also be understood as the number people can "count" -- where this implies a degree of confidence within a comfort zone yet to be clarified, as with "invisible colleges" and "mutual citation pacts" amongst academics

(Markus Gmür, *Co-citation Analysis and the Search for Invisible Colleges: a methodological evaluation*, *Scientometrics*, 57, 2003, 1, pp.27-57; Roger K. Blashfield, *Feighner et al., Invisible Colleges, and the Matthew Effect*, *Schizophrenia Bulletin*, 8, 1982, 1).

"Global" configuration: The question here is how the transformation of any such "global" entity then occurs -- under what pressures -- and how this might be tentatively modelled by the much-studied dynamics of embryogenesis and gastrulation. Of course configurations of "holons" that might be considered "global", and under some developmental pressure for transformation (as a result of their progressive "globalization"), could include the sets of:

- countries: currently the number of [internationally recognized sovereign states](#) is 193; in addition, 10 [other states](#) have *de facto* sovereignty or independence, but are not widely recognized diplomatically by other states. There is continuing debate as to how [nations](#) and [nation states](#) are to be defined.
- categories of knowing and action:
 - **disciplines:** as the set of conventional modes of knowing, [academic discipline](#) are readily confused at one extreme with the number of subject areas, and at the other with the number of [university faculties](#). Although associated with a burgeoning number of distinguished subject areas, the number of faculties typically remains of the order of 10 (extended through associated institutes) -- a case of systemic promotion of a universe organized in terms of human cognitive capacity?

As noted by the *Education Encyclopedia*, the number of disciplines and how they are to be clustered and classified, is a matter of continuing debate and controversy. While they may share a common ethos, specifically a respect for knowledge and intellectual inquiry, differences between them are vast, so much so in fact that discipline has been referred to as the major source of fragmentation in academe (see *Academic Disciplines - Disciplines and the Structure of Higher Education, Discipline Classification Systems, Discipline Differences*). Whilst avoiding enumeration, the *Wikipedia list of academic disciplines* suggests that a viable clustering might number in the Dunbar range

- **human preoccupations:** In order to explore an integrative relationship between human preoccupations expressed internationally, an experimental approach was undertaken based on the integrative pattern of the periodic table of elements (*Functional Classification in an Integrative Matrix of Human Preoccupations*, 1982). The number of elements, using that template, is of course of the same order as Dunbar's number. Given the biomechanical constraints on blastosphere size (of approximately 128 cells), it is especially intriguing how "logical" clusters emerge in the preferred organization of university faculties and how conveniently greater details may be mapped into a periodic table -- all governed by factors of 2 (*Representation, Comprehension and Communication of Sets: the role of number*, 1979; *Patterns of N-foldness; comparison of integrated multi-set concept schemes as forms of presentation*, 1984). What might be the psychodynamic constraints on formation of comprehensible clusters? Another possibility is discussed further in Annex C (*Correspondence between blastosphere and spheroidal I Ching?*).
- **course credits:** There is then an intriguing possible relationship between [course credit](#) accumulation in higher education (typically 60 credits per year) -- as a form of "knowledge globalization" for the individual -- and the "morphogenesis" associated with graduation after some three years, namely some 180 credits (cf. [European Credit Transfer and Accumulation System](#)).
- **government departments:** Here the question is how many ministries/departments are typically engendered and how this relates to confident, credible governance. It would be interesting to explore the change in the nature of government once the number of ministries and cabinet ministers exceeds the critical number for small groups and the usual constraints on span of control. What happens to the ability to govern when their number significantly exceeds the Dunbar range?

Use of the periodic table as a template can be generalized, as originally suggested by [Edward Haskell](#) (*Full Circle: the moral force of unified science*, 1972). Examples include *Towards a Periodic Table of Ways of Knowing* (2009) and *Periodic Pattern of Human Life* (2009).

Given the spherical configuration of the blastosphere, and the number of constituent cells, it is also interesting to consider the spherical organization of any set of categories (*Spherical Configuration of Categories to Reflect Systemic Patterns of Environmental Checks and Balances*, 1994). Rather than a biomechanical dynamic, this points to the possibility of "tuning" any such arrangement, as suggested with respect to a periodic table configuration (*Tuning a Periodic Table of Religions, Epistemologies and Spirituality: including the sciences and other belief systems*, 2007).

In each case it should be stressed that, with respect to "globalization" and its transformation, the "holons" clustered in these various sets are to be understood in communication terms -- distinguished by a qualitative sense of commonality (culture, language, etc) rather than by any quantitative measure of how large one is relative to another. The point is made in the case of the equality accorded in principle to sovereign states. As "cells" in a process of "embryogenesis", they are to be considered of relatively similar size. In any periodic table the entities are typically represented as "cells", however common or rare.

Complexification of "globalization": atemporal context

As a template, invagination and the objective topology of the biology of gastrulation are complexified (as discussed below) with respect to time, embedding, scope and a personal experiential implication. (Each calls for more lengthy exploration than is offered here.)

Transformation of holons: As noted above with respect to embryogenesis (Richard Grossinger, et al., *Embryogenesis: species, gender, and identity*, 2000):

Emergent form is both temporal and atemporal, Aristotelian and Platonic. Derrida has pushed not only the purport of this discussion but all discourse into a situation where it cannot be taken for granted at the level of its intended meaning and cannot be salvaged from its halflives by an identification of most of its culturally determined subtexts

To some degree, in psychosocial and comprehension terms, the possibility of transformation may then be associated with the temporal future whilst significant action may also be undertaken as though that were a current atemporal reality -- responding to the co-presence of two realities, the actual and the potential. The explication of transformation may therefore be anticipated whilst living its implication as a current reality -- living the potential (as suggested by "living on hope", much advocated by politicians as with respect to the [UN Millennium Development Goals](#)).

At the level of embryogenesis, this is the mystery of how an embryo "knows" implicitly how to express its potential from how that is implied by its genetic makeup. This corresponds to some degree to understandings of [entelechy](#) in human beings (*Entelechy: actuality vs future potential -- presenting the future*, 2001).

It is appropriate to note that the electron shell structure of the elements of the periodic table reflects this pattern to a degree in that the more complex elements hold within their structure the pattern of the simpler, and the energy levels accessible to the latter can be understood as implying the potential of the more complex -- if greater energy was incorporated within them. A valid analogue for promotion of enthusiasm and hope?

Transformation: anticipated and lived: In practice this implies that "global" transformation is being simultaneously both anticipated and lived -- especially to the extent of its articulation in the invaginated (enfolded, self-referential) communication processes explored by deconstructionists. Anticipated by those aspiring to its benefits, whilst being lived by those already having those benefits? Playfully again, this offers a way of framing the (a)temporal significance of Spivak's preoccupation with "post-colonial". In a transformational context, does this imply "post-gastrulation"?

There is a further curiosity of potential relevance in alternative interpretations of "post" (cf *New Paradigms via a Renewed Set of Prefixes: dependence of international policy-making on an array of operational terms*, 2003). Much is made of its synonyms in governance, as with "stake" (holder), "pole" and "pillar" (cf *Coherent Value Frameworks: pillar-ization, polarization and polyhedral frames of reference*, 2008). However with "modernism" suggesting a temporal focus on the present, "post" reinforces its connotations as a pillar of reference or its polar relation to that which replaces it -- without reframing such simplistic cognitive geometry. There are also simplistic sexual connotations.

The atemporal nature of globalization is more brutally evident in the common recognition that "the world is f***ed", "humanity is f***ked", or "the planet is f***ed" (to all of which there are numerous web references). In this twisted temporal framework, the world has already been "raped". In terms of embryogenesis, this could only be feasible through the co-presence, in the current condition of "globalization", of a "post-invagination" phase of development, however that may be related to a "post-colonial" phase.

Surprisingly however this degree of development is not matched by the co-presence of any "political spine" or "backbone" at the "global" level (given that, even in the chick embryo, neural cells acquire midbrain, hindbrain, and spinal cord character over a 6-hour period during gastrulation). "Global" society, constrained by its spheroidal metaphor, is eternally questing for the political will for change when it is "gastrulation" that may be a pre-requisite for its emergence. Strategic "pillars" may then be better understood as prosthetic devices for the "spineless" forms of globality (*International Organizations and the Generation of the Will to Change*, 1970)

Inhabiting distinct temporal realities: The psychosocial intertwining of temporal and atemporal development, in the light of the associated communication processes and pressures, clearly constitutes a complexification of the pattern of embryogenesis -- even though there is recognition of "the oak tree in the acorn" and of "the beautiful maiden in the aging crone". This suggests reflection on the manner in which people are obliged to inhabit two distinct cognitive realities related by a form of psychosocial [uncertainty principle](#) -- living one's hopes and engaging with daily constraints (Garrison Sposito, Does a generalized Heisenberg Principle operate in the social sciences? *Inquiry*, 1969)

To see a world in a grain of sand,
And a heaven in a wild flower,
Hold infinity in the palm of your hand,
And eternity in an hour.
(William Blake - *Auguries of Innocence*)

The curious temporal context of "globalization" is evident in its reframing by Gayatri Chakravorty Spivak as the "vanishing present" (*A Critique of Postcolonial Reason: toward a history of the vanishing present*, 1999). The challenge for those living it is how the past can be rendered present and how the future can be "presented" (*Engaging Macrohistory through the Present Moment*, 2004; *Presenting the Future: an alternative to dependence on human sacrifice through global pyramid selling schemes*, 2001)

Frozen in time: Psychosocial "blastospheres" may, in some instances of "globalization", be understood as frozen in time (or with their point of reference centered on a particular moment in time) -- upheld as a perfect expression necessarily appropriate for all eternity. This is a characteristic of revealed religion -- or continuing adherence to an economic model (such as "growth"). Change is then anathema, as are those who believe otherwise. Pressures to change -- as in the dynamic of embryogenesis to further express identity -- are considered as ill-conceived and inappropriate from that point of reference. From any such "global" perspective, others are necessarily ignorant and demonstrate the impossibility of being "other wise". Curiously this plays out most strikingly in the case of the Catholic Church, for

example, in problematic dynamics in relation to gender, abuse by clergy, intercourse (notably with other worldviews), and reproduction (including its unconstrained consequences).

At the time of writing, one report noted (*Editorial, The Guardian*, 18 September 2010):

But the pope is not in any sense a modern man. He believes that there is only one Christian church - his - which represents the word of God.... Further, he believes that there is only one one spiritual source - again his - from which all our values derive.... Again, it is not just the fashion in which this message is made but its content which is troubling.... Are the enemies solely external, or does the behaviour of the church and its priests play a part? A little less preaching and a bit more humility might help the next state visit of a pope.

"Eternal hope": Immediately subsequent to the above comment, another editorial was offered from the same source (*Aid: Making development go, The Guardian*, 26 September 2010) with respect to the UN summit on development goals:

Ten years ago, the [millennium development goals](#) held out the prospect for a transformation in the life chances of the global poor.... They were designed to focus government effort in developing countries which, in a new venture in global community, would be backed by the rich world. With just five years left to meet the objectives, the MDGs' proponents at this week's UN summit began to look anxiously at progress. Like all extravagant gestures, the goals contain the implicit danger that they will be revealed as just that: a gesture... There are cogent arguments to be made against the grandiose scale of the MDG project and its top-down structure.... by their very nature targets can distort outcomes.... The whole idea of globally dictated standards to be achieved in just 15 years is unquestionably flawed. But there are strengths too in setting out a globally supported programme.

Does this reflect a tardy intimation of "invagination" -- namely a degree of self-reflexivity that contrasts with the "bombastic" declarations and commitments of the past -- appropriate then for a "blastosphere" yet to undergo "gastrulation"? More worrying however, in the above statements, is the seeming inability to reassess and transcend an outmoded pattern of discourse -- in the eternal hope that it is still appropriate for the future (*Credibility Crunch engendered by Hope-mongering: "credit crunch" focus as symptom of a dangerous mindset*, 2008). The ability of global institutions to deliver on commitments to the common weal is tragically symbolized (at the time of writing) by the problematic concrete arrangements for the Commonwealth Games -- and the assertion and denial of responsibility.

The contrast between rhetoric and reality has been admirably documented by [John Pilger](#) (*Flying the Flag, Faking the News, New Statesman*, 1 September 2010).

Complexification of "globalization" through fractal embedding

If the morphogenetic pressures and processes of embryogenesis are associated with the spectrum of holons (to be understood generically as systems), then it is to be expected that these would be effectively nested in some way (in space, time and consciousness) - with that of human embryos necessarily embedded within the "globalization" processes of human societies.

In that sense the dynamic of "embryogenesis" **as a pattern** drives that of "globalization" -- as does human reproduction and the consequent overpopulation pressures on resources.

The necessarily complex nature of such nesting is best understood in the light of the [complexity sciences](#) and most helpfully in the light of the visual renderings of the [Mandelbrot fractal pattern](#). In that representation, as a fractal, the pattern is echoed from the "global" level down to the embryonic. As such it constitutes a comprehensible holding pattern whose implications merit further exploration (*Psycho-social Significance of the Mandelbrot Set: a sustainable boundary between chaos and order*, 2005; *Sustainability through the Dynamics of Strategic Dilemmas: in the light of the coherence and visual form of the Mandelbrot set*, 2005).

Complexification of "globalization" through "gastrulation"

As noted above, the focus on invagination offers a very narrow window on gastrulation as a stage in embryogenesis. This is not to deny the fundamental implications of this process as highlighted by Derrida and his followers. However, to the extent that it is the larger pattern of gastrulation which may be of immediate relevance to understanding the "gastrulation phase" of the "embryogenesis" faced by a "globalizing" society, then the focus needs to be enlarged. "Gastrulation" does not appear to be a point of reference in the deconstructionist preoccupation with "invagination" (except potentially through interpretations of "double invagination").

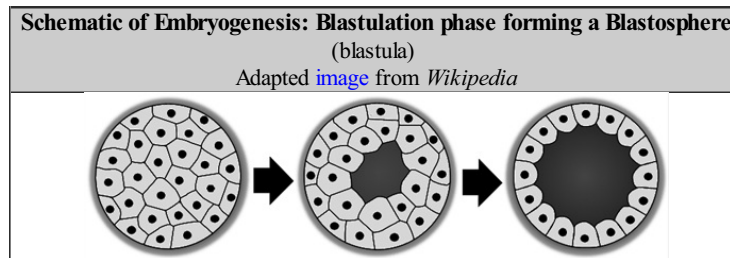
The argument here is that deconstructionists do not go far enough in exploring insights to be drawn from a topological transformation so well-patterned in embryogenesis. Arguably the apparent impenetrability of deconstructionist arguments regarding "invagination" arises in part from their loss of both the topological and biological frameworks in terms of which the transformation takes place. Whilst deconstructionism and postmodernism may be confused about this process -- as might be reminiscent of first-time sex -- somehow (as noted) the embryo "knows" how to progress in its development beyond invagination. This knowledge is embedded at the cellular level of every form of life. There is a simplicity to the process which needs to be elicited from the deconstructionist insights into "invagination", despite a necessary degree of complexification relating to the atemporal and fractal dimensions (discussed above).

Of course it could be argued that such insights are unnecessary if the knowledge is indeed embedded in the [collective consciousness](#) in some way such as to ensure appropriate transformation through a "globalization" process. This lack of necessity would be consistent with the "unconsciousness" of civilization as highlighted by [John Ralston Saul](#) (*The Unconscious Civilization*, 1995) or the [collective unconsciousness](#) highlighted by [Carl Jung](#) (*The Archetypes and the Collective Unconscious*, 1959). However, given the arguments for self-reflexivity, it might be presumed that collective awareness of the process could be a factor in the light of the communication

processes by which it is enabled.

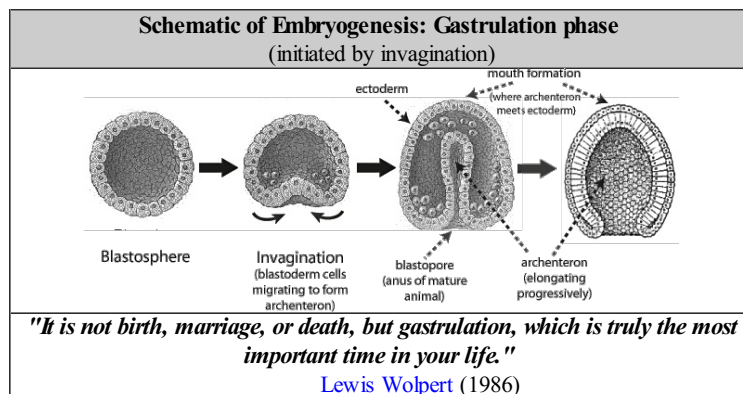
Blastulation as a pre-gastrulation phase: Biology recognizes a process of [blastulation](#) initiated during early stages of cleavage of the fertilized egg. Formation of the definitive blastosphere is thought to terminate cleavage and to initiate gastrulation. Blastulation thus involves the formation of a cell-free segmentation cavity (the [blastocoel](#)) within a mass of cleaving blastomeres. Their rearrangement around this cavity forms a definitive blastosphere of some 128 cells (variously characteristic of each species) -- again corresponding potentially to the Dunbar number. The cellular areas, the mosaic composing the wall of the blastosphere, each normally produce a certain structure during subsequent development.

In terms of "globalization", the emergence of the set of sovereign nations is one example of the psychosocial analogue to this process with the set of faculty/disciplines of a university being another. But of potentially great significance is the manner in which any such "global" configuration is "emptied" of significance, as previously discussed in relation to governance ([Psychosocial processes of "emptying"](#), 2010).



Gastrulation processes: Biology understands gastrulation of multicellular animals as leading to the formation of an embryo with a two- or three-layered body wall. This involves complex shifts of cellular material through which part of that material enters the interior of the previously single-layered embryo and lines its wall. The three layers so formed are: the ectoderm (outer skin, epiblast), the mesoderm (middle skin, mesoblast), and the endoderm (inner skin, hypoblast) from the outside to the inside. More than 30 of the 35 described animal phyla develop from three layers rather than from an outer and inner layer.

As a model for psychosocial processes this could be seen as highlighting the emergence through "globalization" of what are typically recognized as "insiders" (in the loop) and "outsiders" -- and those of intermediary status.



Modes of gastrulation: Biology distinguishes four basic modes of gastrulation:

- *invagination* (or intrusion), the process by which the wall of a one-layered embryo gradually turns inward and forms an internal layer.
- *epiboly* (or overgrowth), by which relatively large cells rich in yolk are overgrown by the small ones and find themselves inside, forming an internal layer.
- *immigration* (or settlement), by which certain cells move to the interior of the embryo and settle under the superficial layer; immigration may be unipolar (settlement from one place) or multipolar (from various places).
- *delamination*, by which the cells split transversely, converting the one-layered wall of the embryo to a two-layered one.

In the majority of animals a combination of means of gastrulation occurs, predominantly by invagination and epiboly but also by immigration. The precise pathway by which gastrulation takes place may be quite variable (L. Wolpert, [Gastrulation and the Evolution of Development](#), *Development*, 1992). Curiously reminiscent of the above argument for an atemporal process, Wolpert concludes that:

Gastrulation may represent a very primitive metazoan whose development has been elaborated and extended in evolution. It is one of the few examples, possibly, of the discredited [theory of recapitulation](#).

Different modes of gastrulation can be found in different phyla or even within a single phylum, suggesting that there is no strong selective pressure on the cellular mechanism itself. However, comparative analyses suggest that invagination/epiboly (however associated) may indeed be the original process (Ulrich Technau and Corinna B. Scholz, [Origin and Evolution of Endoderm and Mesoderm](#), *International Journal of Developmental Biology*, 2003).

Deconstructionists, following Derrida, have given great attention to invagination as a model for a variety of psychosocial communication processes. It remains to be seen whether the other modes of gastrulation are of relevance as models in some conditions (of cultural evolution) -- or whether their psychosocial implications have been confusingly conflated with invagination.

Dynamics of gastrulation: Clearly of great interest are the insights to be derived from how such a fundamental process as gastrulation takes place. In a review of current understanding in developmental biology (Ray Keller, et al., *How We are Shaped: the biomechanics of gastrulation*. *Differentiation*, 2003), morphogenesis, and especially gastrulation, is recognized as a fundamentally biomechanical process. The authors note:

Cells bring about changes in embryonic form by generating patterned forces and by differentiating the tissue mechanical properties that harness these forces in specific ways. Therefore, biomechanics lies at the core of connecting the genetic and molecular basis of cell activities to the macroscopic tissue deformations that shape the embryo.... Biomechanics forms the rationale of morphogenesis and provides a theoretical and experimental framework in which its genetic, molecular, and cellular basis, as well as its evolution, can be understood. The repertoire of cell behaviors in gastrulation is fairly small in terms of general categories (cell crawling, cell intercalation (a specialized form of crawling), cell shape change, changes in cell adhesion, epithelial-mesenchymal transition, cell division, growth), and they are conserved in gastrulation of many species across the phylogenetic landscape. What varies between species is the specific combination, the geometry, the timing, and the mechanical linkages of these basic cell behaviors.

From a systems perspective, clearly the challenge is to translate this articulation into psychodynamic terms of relevance to "globalization". A related possibility was explored experimentally with respect to the **system dynamics** model of Jay Forrester from which the *Limits to Growth* (1972) analysis emerged (*World Dynamics and Psychodynamics: a step towards making abstract "world system" dynamic limitations meaningful to the individual*, 1971).

Double invagination: The deconstructionist literature makes occasional, but significant, reference to "double invagination". In the case of embryogenesis, the gastrulation process necessarily leads to formation of two apertures -- which become the beginning and the end of the digestive tract. The more complex animals, both **invertebrates** (proterostomes) and **vertebrates** (chordates, deuterostomes), develop by a process of gastrulation. A fundamental difference between invertebrates and vertebrates is in the fate of the blastopore, the opening of the **archenteron** (seemingly the metaphorical "pocket" on which deconstructionists focus). In the case of the vertebrates, after the archenteron develops, a second opening forms at the opposite end of the gastrula. Ultimately, the blastopore and this second opening become the two ends of the digestive tube (the mouth and the anus). The mouth of many invertebrates develops from the first opening. The occasional references to "double invagination" with respect to gastrulation do not seem to relate specifically to the formation of both openings in vertebrates.

The argument with respect to the morphogenetic transformation of globalization is that in the case of the vertebrates (notably including mammals) the emergence of the digestive tract heralds other modifications which reinforce recognition of the topological transformation from a spheroidal to toroidal form -- with a degree of functional polarization between the ends. Such polarization also heralds the shift from one form of centro-symmetrical symmetry (spheroidal) to another (toroidal) in which "centre" and "pole" can hold a more complex cognitive status.

With respect to "globalization" the question is how to distinguish between its spheroidal form and an emergent toroidal form. It could be argued that, as with the planet itself, the implicit polarization is fundamental to the spheroidal stage of "globalization" (and to the binary logic sustaining it). Ironically, this is evident in the dynamic of spin on the polar axis by which a degree of stability is ensured. Indeed, for some, "globalization" could well be understood as "polarization with spin".

Animations and simulations: The process of gastrulation is the subject of an extensive literature distinguishing a variety of factors -- as with the literature of "globalization". It would be presumptuous to assume that this argument could do more than point to the possibility of a degree of isomorphism meriting further exploration. There are few animations representing "globalization" as such (Nathan D. Bos, et al., *A Globalization Simulation to Teach Corporate Social Responsibility, Simulation and Gaming*, 2006). Visual representations of the progressive growth in relationship connectivity "around" the globe are presumably readily animated.

Animations have endeavoured to clarify the processes of gastrulation and embryogenesis and therefore merit attention as a potentially relevant source of insight. This is especially the case with simulations arising from mathematical biology in which the variables of morphogenesis can be controlled to enable better understanding of how they effect outcomes at various stages of instability. The experiments of Magnus Röding (*Monte Carlo Studies of Blastulation and Gastrulation*, 2007) are valuable as a summary of earlier efforts -- less sophisticated than might be expected (D. Drasdo, et al., *Modeling the Interplay of Generic and Genetic Mechanisms in Cleavage, Blastulation and Gastrulation*. *Developmental Dynamics*, 2000; L. A. Davidson, et al., *How do sea urchins invaginate? Using biomechanics to distinguish between mechanisms of primary invagination*. *Development*, 2005). Others have followed.

Many other instructive animations relating to the transformation between sphere and torus are available, including:

- Projection of the map of the spheroidal Earth onto a torus by Greg McShane (*Understanding the Geography of the Gauss map*)
- Transformation of a sphere into a torus by Herbert W. Franke (*Between Sphere and Torus*, Wolfram Demonstrations Project)
- Morphing sequence between a twisted torus (genus 1) and a sphere (genus 0) by Janine Bennett (*Twisted torus - Sphere*, 2008).
- Relationships between the torus knot, ring, sphere, tetrahelix and hand by Stan Tenen (*3,10 Torus Knot in Rotation*, Meru Foundation, 1996)
- Transformations of a soccer ball by Michael Trott (*Bending a Soccer Ball -- Mathematically: 6 animations of morphings* for an article by Dieter Kotschick, *The Topology and Combinatorics of Soccer Balls*, *American Scientist*, July-August 2006, 94, 4)

Complexification of "globalization: experiential implication

As noted above, it is difficult to imagine a term more capable of acting as a template for problematic sexual fantasies and more provocative of the sensitive concerns articulated by feminists. This is a major factor in the engagement of some with "invagination" (cf. Nancy J. Holland, *Feminist Interpretations of Jacques Derrida*, 1997; Ellen T. Armour, *Deconstruction, Feminist Theology, and the Problem of Difference: subverting the race/gender divide*, 1999). The use of the term provides a high degree of focus to the potentially problematic relations associated with sexual intercourse and the role and identity of those engaging in it.

In a sense, both through the associations of consummation with the forms of completion associated with "globalization" and through the focus on penetration, "invagination" constitutes a topological catalyst which readily becomes a psychoactive symbol for intercourse, even in the most general sense (*Human Intercourse: Intercourse with Nature and Intercourse with the Other*, 2007). As such it must necessarily be a focus for sensitivity and engagement. Curiously the focus of deconstructionists on only this first phase in the gastrulation process might however be understood as a psychodynamic form of cognitive *coitus interruptus*. The long-term consequences of "invagination" -- namely "embryogenesis" -- are seemingly obscured and avoided. A powerful metaphor in its own right.

The self-referential implications of the process of "invagination" can understandably be related to "rape", for which it might be a convenient topological synonym. There is a pejorative connotation in terms of the preceding, spheroidally intact, condition. Reference to "hymen" is a feature of the deconstructionist literature as an indication of the "undecided" -- both appreciated and challenged by feminists. For Ellen T. Armour (*Deconstruction, Feminist Theology, and the Problem of Difference*, 1999):

Thus, to enter into a consideration of Derrida's use of such figures as *hymen*, *invagination*, and so on, is again to appear to enter an abyss that threatens to swallow feminism (p. 73)

...Derrida's use of terms like *hymen* and *invagination* registers as an appropriate gesture in many whitefeminists eyes. Derrida's claim that deconstruction needs to start from woman's place (and his professed aim to write from that place) also registers as an appropriate gesture in many feminists' eyes. Derrida takes from woman what suits his needs but bypasses any consideration of what she might need, be, or want. (p. 81)

The associated complexification of discourse, as a form of intercourse, is acknowledged to involve a degree of "contamination", as argued by Derrida: *It is precisely a principle of contamination, a law of impurity, a parasitical economy*. This plays into the traditional problematic framing of women by men. "Invagination" necessarily implies cognitive inbrication and entanglement.

Potentially echoing and anticipating the need for a more integrative transformation of "globalization" is the widespread enthusiasm for [body piercing](#) as a form of body modification through which identity is (topologically)now reframed.

Beyond spheroidal "globality"

Application of mathematics: It is curious that no discipline has emerged to clarify systematically the cognitive significance of mathematics for psychosocial transformation of conventional forms, namely how it can provide a rich panoply of templates to guide and enable exploration of possibilities (*Geometry of Thinking for Sustainable Global Governance*, 2009). It is left to groups with more eccentric agendas to project their insights onto mathematical forms in support of those agendas, as exemplified in the case of [sacred geometry](#). This is more notably the case with the set of numbers and its appropriation into symbolism. (*Marie-Louise von Franz, Number and Time*, 1974).

Unfortunately the conventional sectors of society most appreciative of the possibility of applying mathematics in support of their agendas are: weapons development and deployment, security/intelligence analysis, risk-analysis (especially finance and insurance), market analysis, resource management and performance analysis.

Little effort is employed to enable formal transformation of complex psychosocial structures and dynamics as exemplified by situations of (violent) disagreement, multi-cultural challenges (exemplified by relations with indigenous peoples, immigrants, gypsies, alienated youth, isolated elders), problematically disconnected worldviews (religions, disciplines, ideologies). As a consequence these dynamics are characterized by use of impoverished metaphor deprived of the richness potentially available from mathematics (cf *And When the Bombing Stops? Territorial conflict as a challenge to mathematicians*, 2000; *In Quest of Uncommon Ground: beyond impoverished metaphor and the impotence of words of power*, 1997).

Furthermore, as mentioned above, it is questionable how "comprehensible" mathematical discoveries are -- even to mathematicians. If it takes several years of detailed study by expert reviewers to confirm a mathematical proof of many hundreds of pages, how can it be said that the conclusion is "comprehended" -- even by mathematicians -- beyond being a simple matter of belief, thereby acquiring the status of dogma?

Transition to more viable forms of "globality": More problematic, with respect to "global governance" in the face of the complex challenges of the future, is the probability that the forms through which the responses are articulated are not of requisite complexity to encompass the turbulent dynamics of any "crisis of crises", whether to comprehend them, communicate them, or to elaborate credible strategies (*Comprehension of Requisite Variety for Sustainable Psychosocial Dynamics: transforming a matrix classification onto intertwined tori*, 2006). This recalls Albert Einstein's much-cited comment:

The significant problems we face can not be solved
at the same level of thinking we were at when we created them

Whether individually or collectively, the identity of those involved in conventional psychosocial relations is associated with, and supported

by, oversimplistic forms. To the extent that the integrity of identity is readily associated with the point, the circle or the sphere, it is plausible to expect that a potentially greater degree of integrity (and a richer sense of identity) is associated with their further formal geometric elaboration -- to the extent that it is comprehensible.

In geometry, a torus is a doughnut-shaped surface of revolution generated by revolving a circle about an axis coplanar with the circle. The sphere is a special case of the torus obtained when the axis of rotation is a diameter of the circle. It is in this sense that any sense of "globality" may well be variously associated with a point ("making a point"), a circle ("circling the wagons", "ring fencing"), or a sphere ("sphere of influence", "sphere of knowledge").

What is the sense of "globality", and the psychosocial significance, that might be associated with more complex forms, such as the torus. And, beyond that, what of the identity to be associated with the most complex mathematical objects, such as the [Monster Group](#) and [Lie Group E8](#), which human cognition is purportedly able to encompass (*Potential Psychosocial Significance of Monstrous Moonshine: an exceptional form of symmetry as a Rosetta stone for cognitive frameworks*, 2007).

What of the constraints on their comprehension, despite the obvious elegance of their visual renderings (cf *Dynamics of Symmetry Group Theorizing: comprehension of psycho-social implication*, 2008)? With respect to the latter, it could be argued that the objections made to new computer-based "proofs" of the most complex mathematical theorems suggest analogous objections to the validity of non-computer-based "proofs" whose comprehensibility remains questionable -- to many, if not to most (E. R. Swart, *The philosophical implications of the four-color problem*, *American Mathematical Monthly*, 1980).

References to approaches to the possibility of a [periodic table of design](#) note the proposal of Gray Holland (*A Periodic Table of Form: the secret language of surface and meaning in product design*, *Alchemy Labs*, 2009):

For the purpose of this argument I propose that form (or Design), in the context of both the natural and man-made world has two jobs: to be the messenger of a certain experience; and to fulfill on that promise. When the two don't match up, the experience is unfulfilling and its form superficial...If there is an empirical meaning behind form then, how does it manifest across the natural and into the man-made world? Going further with this notion, let's deconstruct the meaning of form naturally, and then distill that meaning into some simplified geometric categories technically.... The result is the beginning of a kind of Periodical Chart of Forms that can be parsed for their associated Meanings. Like the Periodic Table of the Elements, this system holds ample opportunity for mixing proportions, creating alloys, and adding impurities. We propose that this visual paradigm has room to house all the things that have been, and the things yet to be.

(cf. Guillermo Restrepo, et al. *Topological Study of the Periodic System*, *J. Chem. Inf. Comput. Sci.*, 2004)

Psychosocial implications of toroidal geometry

It is of course the cognitive transition from associating with a "circle" to associating in terms of a "sphere" which exemplifies the challenge (*Engaging with Globality: through cognitive lines, circlets, crowns or holes*, 2009). Curiously it is artists who have explored the transition from sphere to torus.

Toroidal habitats: The torus has been imaginatively explored in science fiction with respect to future habitats -- beyond the Dyson sphere (mentioned above) -- notably in the award-winning classic by [Larry Niven](#) (*Ringworld*, 1970; *The Ringworld Engineers*, 1980, *The Ringworld Throne*, 1996; *Ringworld's Children*, 2004; and its roleplaying adaptation *The Ringworld Roleplaying Game*, 1980), the orbital structure of [Iain M. Banks'](#) fictional universe depicted in his *Culture* novels), or the ring [megastructure](#) featured in the [Halo](#) video game series. This has been related to a "[torus world](#)" megastructure envisaged in discussion by the [Mars Society](#).

More pragmatically, the [Stanford Torus](#) was the principal design considered by NASA (*Space Settlements: a design study*, NASA Publication SP-413, 1975). It consists of a torus or donut-shaped ring that is one mile in diameter, rotates once per minute to provide Earth-normal gravity on the inside of the outer ring, and which can house 10,000 people (see *Torus Designs*, National Space Society, 2008). The [Engineer's Ring](#), as worn by members of the US [Order of the Engineer](#), might be seen as a cognitive anticipation of toroidal and other [megastructures](#).

Such considerations offer indications of the psychosocial implications of dwelling within a toroidal geometry. However this "objectivity" detracts from, and effectively obscures, the necessary complexifying arguments made above with regard to time, embedding, scope and personal experiential implication. Metaphorically such objectivity remains trapped in a kind of "geocentric" framework in which the "sun rises", rather than enabling a transition to a more appropriate "heliocentric" understanding, as notably recognized in paradoxical topological forms -- Mobius strip, Klein bottle -- as discussed in the main paper.

Of relevance is the description of how a torus world would look like for somebody living in it, by the physicist-philosopher [Hans Reichenbach](#) (Andreas Kamlah, *The Causal Relation as the most Fundamental Fact of the World: comments on Hans Reichenbach's paper: the space problem in the new quantum mechanics*, *Erkenntnis*, 35, 1-3, pp. 49-60). This discusses his thesis that the topology of space-time is established by the causal connections of space-time points or events. His torus world is the subject of further comment by [Graham Nerlich](#) (*The Shape of Space*, 1994, p. 190).

Curiously, as implied by envisaged habitats, psychosocial analogues may well provide more uncrowded "space" within which people can have much more "breathing room" -- as is starting to be explored in the case of [virtual worlds](#) like [Second Life](#). Of particular interest is how issues of "intellectual property" are then handled, together with the sense of identity associated with it,

Experiential implications: Such unconventional insights are increasingly accessible in experiential terms by those with kinaesthetic intelligence (extreme sports, skateboarders, etc) and by those exposed to the complex visual effects (notably associated with interactive

gaming and the like). It is curious that the capacity to produce striking visual explorations of the Mandelbrot set, as mentioned above, is not matched by any attempt to derive psychosocial significance from such striking renderings (cf. Dr Mercola, *Mystifying and Naturally Psychedelic Fractal Zoom*, 20 September 2010). The problem is that the nature of the discussion with regard to any such transition is subject to a "sticky" dynamic, as highlighted by deconstructionist explorations of "invagination". The discussion has not been significantly facilitated for others by their appropriation of paradoxical topology -- as mocked by Alan Sokal (as remarked above).

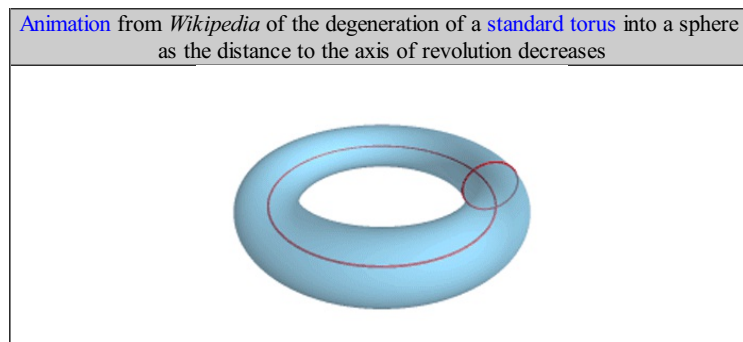
Pressures for "toroidal governance": It remains the case that, like it or not, "global society" is increasingly faced with challenges to its integrity and viability (Jared Diamond, *Collapse: how societies choose to fail or succeed*, 2005; Thomas Homer-Dixon, *The Upside of Down: catastrophe, creativity, and the renewal of civilization*, 2006). As noted above, it is becoming rapidly "emptied" of meaning both at the "global" level and in the content or "weight" of individual communications (Nicholas Carr, 2010). There is ever increasing pressure to reframe the manner in which conventional boundaries of any kind are defined (*Framing the Global Future by Ignoring Alternatives: unfreezing categories as a vital necessity*, 2009).

Ironically, understanding of these developments -- as with "boundary" -- is frequently described through geometric metaphors, such as "pointlessness" and "emptiness", perhaps to be associated with the welcome (open source) development of "openness" (with its own topological connotations). Hence the justification for exploring formal transformation from the inadequacy of the sphere to the torus -- as a more appropriate vehicle for engagement with "globality", through which "pointlessness" and "emptiness" can be given vital significance.

It is extremely unfortunate, as with popular, worldwide uptake of the internet and the web, that institutions of governance have lagged decades behind appreciation of the significance of what has long captured popular imagination -- and only then to respond reactively, or repressively as previously argued (*From ECHELON to NOLEHCE: enabling a strategic conversion to a faith-based global brain*, 2007).

It is this context which justified earlier discussion of toroidal governance (*Enabling Governance through the Dynamics of Nature: exemplified by cognitive implication of vortices and helicoidal flow*, 2010; *Warp and Weft of Future Governance: ninefold interweaving of incommensurable threads of discourse*, 2010).

Comprehending the formal transformation from sphere to torus: The topological transition between sphere and torus is well-illustrated by the following animation (duplicated here for convenience, from Fig. 2 in the main paper).



Essentially, as the figure suggests, the world cannot "breathe" when confined to a spheroidal geometry. The transformation into a torus (and back) points to a possibility of cycling through a pattern of geometric forms various supporting understandings of "globality". If mathematicians consider the sphere as a "degenerate" form of the torus, it is appropriate to consider that efforts to associate "globality" with the sphere may be correspondingly "degenerate" in comparison with other possibilities.

As indicated [above](#), many other instructive animations relating to the transformation between sphere and torus are available



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