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## Metaphors as Transdisciplinary Vehicles of the Future Science and Tradition

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### 0. Introduction

Despite the original promise of various initiatives, it is reasonable to assert that enthusiasm for "interdisciplinarity" has waned. There is continuing recognition that some degree of cross-disciplinary "fertilization" is fruitful, but the possibility of any interdisciplinary methodology is largely considered a contradiction in terms. Attention has instead focused on the manner in which some useful form of cross-fertilization can emerge in the application of different disciplinary methodologies in response to a single, concrete problem in practice. At its most cynical, this leads to programmes in which interdisciplinarity is only evident in the binding together of the individual disciplinary contributions in a single report of the initiative -- aptly described by the German term "Buchbindersynthese". Any integration is left to the reader. Relatively little progress has been made on the long-range reconceptualization of epistemology in the light of insights from any complementary set of disciplines.

Perhaps most disappointing, is the lack of investigation of interdisciplinarity in its own right -- other than in the above-mentioned juxtaposition of disciplines in response to a concrete problem. General systems has perhaps moved furthest towards this, but has failed to live up to its promise.

Despite this relatively negative picture, there is a desperate need for new ways of integrating insights from a wide range of disciplines which have little respect for one another (if they even recognize each others existence). How do the representatives of the different disciplines see their collective responsibility, if any, in facilitating the integration of insights which would make a success of such events as the purportedly crucial United Nations Conference on Environment and Development (Rio de Janeiro, 1992) ?

This paper explores the use of metaphor, especially in the light of its cognitive function, in facilitating the formulation and communication of insights, whether between disciplines or beyond them, to those who depend upon them. It raises the question of the extent to which the necessary constraint of discipline should be complemented by a necessary freedom that is foreign to the nature of intra-disciplinary cognition. It is argued that it is in the understanding of this complementarity that the nature and potential of transdisciplinarity emerge.

### 1. Constraints

**1.1 Range of disciplines:** It is convenient in the academic world to limit the range of "disciplines" to those which are represented by university faculties or the various branches of research and specialization within them. One exercise to identify the number of such disciplines resulted in a count of 1,800 (see Intellectual disciplines and sciences. In: Union of International Associations, 1976). These are the disciplines currently legitimated in some way by a Western (and often Eurocentric) concept of a valid approach to knowledge.

The scope of "discipline" may also be usefully extended in terms of its relationship to the varieties of forms of intelligence. In this sense, discipline is understood as the disciplined application of intelligence. A recent study by Howard Gardner (1983) identified seven forms of intelligence.

The notion of a "discipline" has been vital to many religions and spiritual traditions which encourage their practitioners to develop a spiritual discipline. This may range from the disciplined practice of prayer characteristic of the major religions, through practices such as hatha yoga, to the progressive development of a range of cognitive skills as in raja yoga. Buddhist literature, for example, is extremely precise in its rich articulation of the nature of such disciplines (Union of International Associations, 1991)

Aside from the disciplines noted above, it is important to acknowledge the kinds of discipline acquired through long apprenticeship in traditional cultures. Typically this includes the knowledge of traditional healers as well as the therapeutic skills of shamans and the like.

In these critical times, when it is unclear what knowledge is vital to survival on this planet, or how it can be rendered accessible, there is merit in accepting a broader rather than a narrower understanding of "discipline". The question of Japanese management education and

its link to military discipline and techniques of political re-education merit exploration.

**1.2 Pettiness in the politics of knowledge:** It would be naive in discussing the prospects of transdisciplinarity to omit any reference to the constraining effects of inter-disciplinary politics. Many have remarked on the arrogance, narrowness and egotism of the eminent in any discipline, whether academic, charismatic or spiritual. Together with a primitive approach to territoriality, these factors have been of major importance in hindering or obstructing any progress towards a more fruitful form of interdisciplinarity. They have reinforced the development of disciplinary priesthoods and bureaucracies of the least helpful kind.

In a period of scarce resources, there is a worrying natural tendency on the part of academics towards self-censorship and the pursuit of fashionable topics which have some chance of attracting funds. Careerist concerns naturally erode the development of disciplines and any tendency towards unrewarded explorations of interdisciplinarity. Respect for disciplinary "pecking-orders" is then to be expected.

It may be asked whether all the historical problems of geopolitical territory (imperialism, colonialism, etc) are not to be recapitulated with respect to the functional territories claimed by the emerging disciplines.

**1.3 Inaccessibility of knowledge and insights:** The problems of information overload are widely acknowledged. Less clearly recognized are those of information underuse. It has been estimated that the average academic article is read by one person (other than those involved in its publication). Much new knowledge is only available in a form which is beyond the current budgets of individuals or institutions, especially those in developing countries.

The conventional response of any discipline is to imply that any information from outside that discipline is to a high degree irrelevant and may therefore be neglected. The implication within the disciplines is that of all the information generated, only that emerging from acknowledged centres of excellence need be accorded serious attention. Sophisticated information retrieval systems reinforce the problem by restricting their coverage in terms of such priorities and favouring the use of narrow search profiles. It is not difficult to argue that this situation is leading to a progressive erosion of collective memory.

This situation with regard to contemporary knowledge is paralleled by the regretful erosion of insights from traditional cultures as they are progressively "civilized". Their insights and languages are progressively lost as informed elders die out. Whether or not some of these insights are "preserved" in anthropological studies, it is not too far fetched to compare the process to the loss of "cultural rainforests", through savage "cultural deforestation". There is a distinction to be made between a living insight and one preserved in a research paper, as with the contrast between a living insect and a specimen of an extinct species preserved in formaldehyde.

In this context is there not a faster mode of access to the key insights of particular disciplines? Is there not something suspect about the length of the period imposed through educational systems for acquisition of such insights? To what extent do practitioners and incumbents require such lengthy periods through respect for the spirit of traditional apprenticeships -- in which long periods of drudge work were considered important to inculcate the lore and social relationships of the discipline or priesthood? The attitude of professors to the use of "post-graduate" manpower certainly reinforces this suspicion, as do the arguments against fast-track medical education in a world where even modest medical knowledge is at a premium.

In a world in which individual and planetary survival is an issue, how are the key insights of disciplines to be communicated? What are the 5, 10, 50 or 100 insights of each discipline? In what form should they be held to facilitate their comprehension and communication? Is it appropriate to ask what is the minimal set of insights from each discipline which are necessary to the survival of civilization in its broadest sense -- namely the nature of a "survival set" of disciplinary insights? What do people need to know and understand to surmount the problems of the immediate future? And in terms of what do the vital decisions on the future of the planet need to be made?

**1.4 Application to crises: towards a higher conceptual order:** The issue is now how to determine what insights are vital to survival (in its broadest sense) and how they can be appropriately configured to guide decision-making. Given the way that knowledge is currently communicated, notably by "consultants", to policy-makers, there is every possibility that simplistic policies will continue to be formulated in response to emerging crises. The best insights from the disciplines are not being brought to bear on understanding of the problems. There is a fundamental problem of complexity both in the nature of the problematique and in the nature of the relationship between the insights relevant to any response.

Beyond this is the very basic issue of the comprehensibility of configurations of insights relevant to any more appropriate approaches. A number of disciplines have identified methodological problems in interrelating incommensurable insights necessary to fully encompass the complexities of some phenomenon. The complementarity of the "wave" and "particle" theories in physics is the most cited example. In this sense the core issue of transdisciplinarity may lie in the possibility of providing tools to handle configurations of essentially incommensurable (and mutually "irrelevant") insights in response to the global problematique. The much discussed "new world order" may in this sense call for a corresponding, or complementary, "higher conceptual order".

For any such higher conceptual order to be of relevance to policy-making, it must be comprehensible not only to the policy-makers but also to those who mandate them, and ultimately to the electorate. This itself is increasingly problematic at a time when there is an alienation from academic knowledge and a rise in functional illiteracy, notably in the most developed countries. Academic knowledge is increasingly perceived as having failed to address issues and dimensions vital to everyday life, or as having exacerbated such problems by irresponsible initiatives (notably in relation to weapons research).

**1.5 Personal survival and development:** There is a well-documented search, on the part of many in industrialized societies, for disciplines which will ensure their own sustainable personal development. There is an expressed need for appropriate knowledge for personal psychic survival. A major dimension of this search is oriented to those forms of knowledge appropriate to personal integration. This is part of the traditional spiritual quest acknowledged in many cultures.

There is increasing recognition that there is some sort of "mirroring" relationship of complementarity between the degree of personal integration or maturity achieved by an individual (if only on occasion) and the degree of integration that then becomes perceivable in

"external" reality (if only occasionally). It may be supposed that the reverse also holds true to some degree. The issue of transdisciplinarity may therefore also be considered vital to individual psychic survival. The present fragmentation of the disciplines and specializations does little to facilitate personal psychic integration or any quest for transcendence. But presumably a useful transdisciplinary perspective is itself dependent on the achievement of some form of sustainable personal integration, through whatever disciplines this is achieved.

**1.6 Reconfiguring conceptual resources:** The constraints above all point to the need to reconfigure the elements of knowledge and insight -- if only for some "extra-disciplinary" purposes. Somehow the pattern of conceptual resources needs to be reconfigured to increase the fluidity with which insights emerge, are cross-fertilized and are integrated into larger patterns (Judge, 1971, 1977). At the same time there is the fundamental question of how to render such patterns comprehensible beyond the territories of self-elected elites -- to those who have a desperate need for such insights in response to the crises which we collectively face.

There is much to be criticized in the current politics of knowledge. But however much the arguments for the status quo are misused to protect vested interests, there is nevertheless considerable validity to efforts to protect the identity of individual disciplines and their methodologies. Transdisciplinarity cannot be usefully achieved through a loss of disciplinary precision (painfully acquired) or through a general blurring of categories. Ways must be found to protect the "purity" of disciplines from the "abominations" they perceive in alternative perspectives.

## 2. Metaphor: an unexplored resource for transdisciplinarity

In Julie Klein's review of interdisciplinarity (1990) she devotes a chapter to the phenomenon of borrowing of conceptual tools, models and theories between disciplines. She notes:

*"Inevitably borrowing invites speculation about the metaphorical nature of interdisciplinarity. Metaphors may be didactic or illustrative devices, models, paradigms, or root images that generate new models. Some metaphors are heuristic, whereas others constitute new meaning...Borrowing is metaphoric in several ways. Theories and models from other disciplines may sensitize scholars to questions not usually asked in their own fields, or they may help interpret and explain, whether that means a framework for integrating diverse elements or hypothetical answers that cannot be obtained from existing disciplinary resources. When a research area is incomplete, borrowing may facilitate an inductive open-endedness. It may function as a probe, facilitating understanding and enlightenment. Or, it may provide insight into another system of observational categories and meanings, juxtaposing the familiar with the unfamiliar while exposing similarities and differences between the literal use of the borrowing and a new area."* (p. 93).

Klein then points that borrowers have been called translators, clarifiers, who interpret one discipline to those in another.

**2.1 Metaphor and comprehension:** Metaphor has often been viewed with disdain by academics, administrators of programs, and documentalists, even when they find themselves obliged to use it. It is seen as implying intellectual sloppiness, an inability to be rigorous, and even basic incompetence. This perception is increasingly challenged by those exploring the cognitive role of metaphor, namely the fundamental manner in which metaphor enables and conditions most thought processes (Lakoff, 1987). Of immediate relevance, this is seen in the root metaphors governing different styles of organization (Morgan, 1986) and management (Belbin, 1981; Handy, 1979).

From this perspective metaphor provides the patterning by which categories emerge and are organized. This has always been relatively clear to those engaged in any form of creative activity, whether artists, advertisement designers, educators or fundamental physicists. As Anne Buttner (1982) notes: *"Metaphor, it has been claimed, touches a deeper level of understanding than 'paradigm', for it points to the process of learning and discovery -- to those analogical leaps from the familiar to the unfamiliar which rally imagination and emotion as well as intellect."*

**2.2 Metaphor and categorization:** The authors most closely associated with the exploration of the cognitive role of metaphor are George Lakoff and Mark Johnson (1980), notably in their collective work on *Metaphors We Live By* and in subsequent studies (Lakoff, 1987). The processes of categorization are now being shown to involve metaphor at the most fundamental level, implying an organization of knowledge by cognitive models. Thus the "conduit" metaphor, implicit in much discussion about communication, maps knowledge about conveying objects in containers onto an understanding of communications as conveying ideas in words.

As with other memorable metaphors, the "container" metaphor, implying a boundary distinguishing an interior from an exterior, defines the most basic distinction between "in" and "out", notably in transactions between organizations, economic sectors or conceptual frameworks. The container schema is inherently meaningful to people by virtue of their bodily experience. It is through that bodily experience that the schema has a meaningful configuration. Whilst this may be relatively obvious in dealing with physical concepts, the mode of understanding is also carried over to the understanding of abstract concepts. It thus conditions ability to elaborate and comprehend complex structures and policies. The challenge is to discover how to overcome the habitual cognitive constraints implied by these insights, especially as they effect the capacity to formulate more appropriate, and possibly counter-intuitive, transdisciplinary frameworks.

Points made about the container metaphor suggest the need for a review of the somewhat similar metaphors implicit in the discussion of disciplinarity -- especially those associated with "inter", "cross" and "trans".

**2.3 Metaphor and political inquiry:** The language of political inquiry would seem to be inescapably metaphorical. "Metaphor is essential to political inquiry, because it permits us to extend our knowledge from our familiar world to a region that is not open to immediate experience....Metaphor is necessary to political knowledge precisely because the meaning or reality of the political world transcends what is open to observation" (Miller, 1979). (An international symposium on "Political Metaphors in Historical Perspective" was organized in Naples in June 1991.)

Especially with the constraints of media communication, politicians in particular resort extensively to the use of metaphor as a means of

explaining complex policies, whether to their peers or to their constituencies. Thus, for example, in June 1991 those involved in the EEC Commission efforts to articulate the new treaty details for European economic and political union were clarifying alternatives amongst themselves using code words, including "pillars", "hats", "temples", "trees" and "ivy". The pillars were separate chapters of the treaty, the hat was the prologue creating a European union embracing three pillars. The alternatives were described in a "temple-versus-trees" debate in which the Commission argued that the treaty should look more like a "tree trunk with branches" than a "shaky temple supported by pillars". Others criticized a revision as "pillars covered in ivy", namely with largely cosmetic change's (Independent, 17 June 1991). Are these metaphors of the requisite richness to handle the complexity and opportunities of such challenges?

**2.4 Metaphors for survival:** It can be argued that the selection and use of metaphors by individuals and groups to reconfigure their environment and its challenges offers new degrees of conceptual freedom. In this sense metaphors are an empowering device which allow people to adjust and modify the conceptual patterns by which they are surrounded. They provide a means for handling the kinds of conceptual inconsistency, dynamism and paradox on which disciplines have few comprehensible insights to offer. They may also be used to handle the many difficulties of reconciling part-whole and local-global relationships -- reconciling global integration with local relevance. In this sense a metaphor can be used as a temporary cognitive discipline.

**2.5 Visual metaphors and adequate conceptual complexity:** A concept structure of adequate complexity may pose the same problems of comprehension as a spiral staircase when explained through words alone. By the time the explanation is complete the audience is bewildered if not alienated. A visual presentation ("worth a thousand words") instantly clarifies the simple elegance of the concept, subsuming its necessary complexity. The vital importance of the latter dimensions to those who mould the major policy options through various processes of governance has been strongly emphasized by Harold Lasswell (1968): "Why do we put so much emphasis on audio-visual means of portraying goal, trend, condition, projection, and alternative? Partly because so many valuable participants in decision-making have dramatizing imaginations. They are not enamoured of numbers or of analytic abstractions. They are at their best in deliberations that encourage contextuality by a varied repertory of means and where an immediate sense of time, space and figure is retained".

Some academic disciplines make extensive use of graphic presentations, especially the natural sciences and various forms of engineering. However the social sciences, and notably political science, tend to avoid such presentations. There is even a tendency to disparage such use of visual displays as an indication of incompetence, if only in verbal skills. The lack of any need for visual aids to explain sustainable development policies suggests that they may be of a level of complexity inadequate to the challenge.

The great developments in computer hardware and software for the generation and manipulation of graphic images have been principally applied to special media effects (notably advertising clips and science fiction movies), to computer-aided design (architecture, engineering, etc), and to representations of systems (process control, chemical molecules, physical systems). No effort has yet been made to use techniques of this sophistication to represent social processes in all their complexity as an aid to more appropriate forms of decision-making. These techniques have become so sophisticated that they can now generate comprehensible visual representations of dynamic structures which could not exist under the laws governing physical space. They are also used to enable people to experience, explore and generate "virtual realities" (Helsel, 1990) -- if only as a leisure experience (currently recognized as the major market for which such products are being developed).

It is quite possible that the more readily accessible metaphors may themselves be of insufficient richness to encompass the conceptual complexity of processes on which decisions are called for at this time. Or if they are rich enough, in a period of increasing functional illiteracy, they may be essentially incomprehensible to the constituencies from which mandates for new strategies are sought. There is therefore some probability that the metaphors required to sustain the conceptual frameworks for new strategic options may only be expressible through dynamic visual forms generated by the computer techniques noted above.

### 3. Images of disciplinary activity

Understanding of the development of a discipline, and the advance of knowledge, can be seen as based on one or more implicit metaphors. In the case of social organization, this approach to new understanding has been explored by Gareth Morgan (1986). His insights may be adapted to the understanding of disciplinary activity.

A number of classical papers have endeavoured to clarify the different possible relationships between disciplines using diagrams. These diagrams may be considered as visually metaphors. The most helpful is that of Erich Jantsch (1972) who identifies different patterns of relationships between a set of boxes (representing disciplines) laid out in patterns which resemble the standard hierarchical organization chart.

Whilst Jantsch's approach succeeds in its aim of distinguishing multi-, cross-, inter-, pluri- and trans-disciplinarity, the question must be asked whether the visual metaphor used is not a conceptual trap in its own right. Just as the past decades have witnessed a severe criticism of organizational structures and the restrictive way in which they are understood (cf Gareth Morgan), is it not appropriate to ask whether understanding of disciplinary relationships should not be questioned in a similar manner. The basic issues are:

(a) are the metaphors used to envisage the relationships between disciplines too simplistic in comparison with the levels of complexity which transdisciplinarity is required to address?

(b) if the extremes of the classical "hierarchical organization of knowledge" and recent experiments with the "network organization of knowledge" are inadequate to the challenge, what kinds of structural metaphors might prove more appropriate?

The currently favoured response might be considered the "star" or "basket" approach of those who see focus on a specific concrete problem as the only meaningful way to ask questions about the future of disciplinary relations. Disciplines are then focused in a star-formation around the problem, or treated as a basket of resources which can be called upon in response to a problem.

Such structurally crude approaches, which now have a track record of decades, are considered in this paper to be inadequate to the emerging challenges. The basic criticism to be made is that these approaches have no way of:

- structuring a pattern of checks and balances between the advocates of different methodologies,
- constraining efforts at domination by one (or more) and
- ensuring the contributions of minority views.

They have no appropriate way of constraining excess, guaranteeing the creative juxtaposition of "uncomfortable" levels of variety, and appropriately focusing the insights which it engenders.

## 4. Conceptual scaffolding

**4.1 Interlocking insights (in the light of an architectural metaphor):** The above indications point to quite concrete possibilities which could provide a major new facility for disciplined debate, whether electronically-based or otherwise. These possibilities are basically concerned with the whole issue of what might be called "conceptual scaffolding". In the process of constructing a building scaffolding is necessary, especially to hold mutually dependent structures in position until appropriate permanent building elements can be inserted to lock them into place. Much can be learnt from the history of architecture in considering the challenges of developing more powerful and appropriate forms of conceptual architecture (Judge, 1979).

Structurally the organization of a project involving a number of disciplines, a policy-making agenda or a conference programme (even a multi-track programme), is rather simple -- even simplistic -- especially when considered in relation to the complex ecology of problems and organizations which are supposedly to be interrelated effectively through it. Is it any wonder that "interdisciplinary" projects and conferences are relatively ineffective in coming to grips with complex issues? What is being attempted with current practices is in defiance of Ashby's Law of Requisite Variety, namely that, to be effective, any governing or controlling system must be at least as complex as the system it seeks to govern. Simplifying reality to simplify the decision process is a dangerously unsustainable way forward.

The issue is therefore how to enable those involved to collectively design more complex forms of conceptual scaffolding to hold in place embryonic concepts (essentially unstable in isolation) until other concepts can be fitted into the pattern to lock them into place. Ideally, of course, it is the conferencing "software" which should provide such scaffolding. And, like the scaffolding for buildings, it should be adjustable to different structural configurations as the building grows.

A typical function of scaffolding in an academic or policy debate is to provide a framework within which complementary perspectives can be articulated, especially when there is a major tension between them. When Concept A is formulated, the scaffolding can usefully "hold" a space for Concept B to counter-balance it. Such scaffolding is even more essential when more than two concepts have to be held in balance in order for the dimensions of a viable "grand policy" or "unified theory" to emerge -- or even a "theory of everything". As with buildings, the scaffolding provides a protection against disruptive forces in the discussion process. A typical disruptive force in a contemporary conference might focus narrowly on "countering exploitative industry" when the larger issue is to provide a sustainable framework in which to balance the exploitative characteristics of industry against the socio-economic benefits that it provides in the light of environmental constraints. The more complex the pattern of "checks and balances", the more vulnerable is the conference debate to disruptive forces.

**4.2 Symmetrical structures and tensegrity structures:** Geometry supplies a vast repertoire of geometrical patterns which could be used to interrelate concepts. Of special interest are the symmetrical polygons in 2-dimensions and polyhedra in 3-dimensions. Symmetry has the merit of being in some way associated with "global" or integrative comprehensibility. As such it may offer routes to the higher conceptual orders characteristic of transdisciplinarity. To the extent that opposing perspectives can be mapped onto such structures, there is greater possibility of collective recognition of the distinct functions they perform in relation to one another. It is also possible that the more complex the structure, the greater its stability.

Eastern religions have made extensive use of such conceptual patterns in the form of mandalas. These hold the complex relationship between a multiplicity of complementary insights, whilst maintaining an integrative focus on the whole. The software issue here is how to massage an associative network of concepts into the pattern (or a range of alternative patterns) which can give the most appropriate overall order to it. Maybe there is a place for marrying approaches to mind-maps and concept networks to those of sacred geometry.

A feature missing from such geometrical structures is any explicit recognition of the dynamics between the elements and of how they contribute to the dynamic integrity of the whole. The "tension" between opposing factions or options is a fundamental issue in policy-making. It could be argued that such tension is also present in the co-existence of complementary theoretical perspectives in cases where none of the individual theories (although necessary) is sufficient to encompass the nature of the phenomenon to which they apply. Although music may offer richer insights, again architecture points to the importance of appropriately interrelating tension and compression elements.

In the policy-making process the art is to creatively interrelate perspectives that are in sympathy and in opposition to each other. Buckminster Fuller (1975, 1982) pointed to the existence of a whole family of tensegrity structures which make possible his well-known geodesic domes (cf radar domes, exhibition halls). Tensegrity (or tensional integrity) has many suggestive implications for more effective configurations of concepts and policies (Judge, 1979):

- a. Such structures make explicit the value of having **discontinuous (antagonistic) relations between concepts (or their advocates) embedded in a continuous (mutually supportive) network of relationships**. Both have a role to play. They depend uniquely upon the creative configuration of the polarized forces which are the bane of so many efforts at theory- building consensus policy-making.
- b. Such structures make clear how **an appropriate combination of appropriately positioned elements can give rise to a totally**

**unsuspected structure of unsuspected stability.** Whilst it is relatively easy to comprehend the logic of such a structure in 3-dimensions, the process of constructing it is much less clear. This suggests that the conceptual elements and dynamics characteristic of today's policies could lend themselves to structural patterning of a totally new kind.

- c. Such structures make clear that facilitating communication between all parties (all to all) is not the only way forward, even if it were feasible in practice. They suggest that much may be accomplished by **ensuring a supportive relationship with neighbouring nodes, provided that position is "challenged" by an appropriate opposing node.** This is a step beyond all the work done on social networks. It implies that software could be used to configure communication pathways (opening some, closing others) to bring about much more healthy (non-flabby) networking.
- d. Of special interest is that such structures have **empty centres** so that every point is visible from every other, suggesting a desirable form of "transparency". The centre is a virtual one rather than being occupied by some dominant body, individual, concept or value. It can be argued that this makes for a higher order of conceptual elegance.
- e. As will be seen below, such structures also imply **a range of global transformations through which the set of concepts or policies can grow to encompass greater variety.**

It is clear that only with the use of appropriate software could tensegrity-based conceptual frameworks or policies be explored with the benefit of insights from those such as Ron Atkin (1977, 1981). The scaffolding problem is an ideal computer challenge. It opens the door to a totally new way of representing agendas non-hierarchically and of enabling the fruitful **coexistence of mutually constraining conceptual elements and policies.**

## 5. "Re-reading" patterns of concepts

**5.1 Isomorphism and similarity between concept patterns:** General systems theory has over several decades explored the extent to which the different systematic organizations of phenomena articulated by distinct disciplines contained features which were isomorphic with one another. For general systems the interest lay in the stronger forms of isomorphism, especially those which could be effectively described by mathematical equations. In this respect it overlapped preoccupations of cybernetics and operations research and, like them, has proved of limited value in response to the interdisciplinary crisis of the times.

Rather than searching for "strong" isomorphism between disciplines and seeking an expression for it in equations, it is possible to explore "weaker" forms of isomorphism between disciplines. This might be more appropriately defined in terms of the "similarity" between patterns of concepts. This approach leads to two questions:

- a. how weak can such similarity become before it is of no value in linking the insights of one discipline with those of another ?
- b. to what extent can a pattern explicit in one discipline be used to elicit a similar pattern in another, when the latter has not (yet) articulated its understanding in the domain of interest ?

**5.2 Evaluating similarity:** In approaching such questions, a distinction needs to be made between different perspectives:

- a. Independence: For a discipline, such explorations may readily be perceived to be an infringement of its internal concerns (analogous to geopolitical sensitivity about national sovereignty). Any similarity is therefore of no relevance;
- b. Integrity: On the other hand, for those endeavouring to advance knowledge within that discipline, some degree of "cross-fertilization" is valuable -- but not to the point of succumbing to the insights of some other discipline (analogous to the problems of cultural imperialism);
- c. Utility: However, for those seeking clues to fruitful alternative possibilities, the sole criteria is whether the insights are useful in dealing with the problems under consideration -- especially those problems which cannot apparently be adequately defined within any particular discipline.

**5.3 "Re-reading" as a metaphorical art:** The concern here is primarily with the "utility" perspective, although the process of "re-reading" is also relevant to the second. The radical suggestion is that **all conceptual patterns, from any discipline, can be profitably "re-read" as metaphors** -- through which insights can be gained of relevance to other domains of knowledge. The body of knowledge, generated by the disciplines over the years, may therefore be systematically (re-)explored as a resource for implicit insights. In a sense the geological layers of knowledge laid down over the centuries, including "fossilized knowledge", may be mined. Much will be irrelevant, but there are seams of insight of great value. The challenge is to separate the two.

## 6. Transdisciplinarity and its articulation

**6.1 Unarticulated "holism" as a conceptual trap:** In the desperate search for meaningful forms of conceptual integration, some simplistic forms of holism have exerted a hypnotic effect. The "holographic paradigm" and the concept of "Gaia" have performed a useful function in focusing attention on the possibility of forms of integration beyond the fragmentation of the disciplines. This tends to be achieved at the expense of any means of articulating variety and detail within such perspectives.

Setting up integrative perspectives in opposition to fragmented frameworks is not sufficient. It does not provide a basis for organized action -- or rather it opens the way to abusive forms of action in the name of "integration". Furthermore it merely establishes a new form of (part- whole) polarization when what is required is a more insightful way of dealing with polarization -- and benefitting from its advantages when appropriate.

From understanding of evolution, it is recognized how different species can coexist, whether they compete for resources or not. Ecosystems provide for, and depend upon, the coexistence of members of a species at different stages of growth within a life-cycle. Within such ecosystems are also to be found species which may be of different ages in evolutionary terms -- including species that may be labelled "prehistoric".

**6.2 Transdisciplinary conceptual transformation:** The need for conceptual scaffolding is clear given the kinds of complexity with which society has to work. The challenge of making the more complex structures comprehensible is also clear -- those most appropriate

to the challenge of sustainable development may be beyond the ability of any single human mind to grasp (Judge, 1986a). But any form of development implies structural transformation. Whilst transforming simplistic structures, like conference agendas and organization charts, may pose little challenge, the transformation of the complex structures described earlier is quite another matter.

The process of conceptual or social transformation appears to call for a form of dynamic scaffolding which provides some form of continuity -- from stage to stage -- through the transformation process. The metamorphosis of a caterpillar into a butterfly provides a sobering metaphor of the possible complexity of the challenge.

Two examples of this kind of structure may be noted:

- a. **Image transformation:** The skills of image-transformation on computer suggest many possibilities. The challenge is to find ways of relating conceptual structures and real-world challenges to such images so as to benefit from this facility. Of special interest is the way in which development is to be understood or encoded in such image transformation. For example, if the many details of the global problematique could be encoded onto one (or more) archetypal animals, suitably animated, this would be of major conceptual and symbolic significance -- especially when the animation can be used to represent a transformation process. The media advantages are obvious.
- b. **Vector equilibrium:** Buckminster Fuller (1975, 1982) drew attention to a very unusual symmetrical polyhedron, the vector equilibrium (normally known as the cuboctahedron) as the common denominator of the tetrahedron, octahedron and cube. It is unusual in that it lies on a transformational pathway to a variety of other structures. An appropriately jointed model can be transformed into an icosahedron and from there to an octahedron and on to a tetrahedron. The merit of this model, aside from the many claims made by Fuller himself, is that it provides a way of understanding the structural transformation process. The challenge in a policy-making environment is not to focus on this particular structure, but rather to use it as an example to persuade topologists to locate other transformational systems of this kind so as to build up a library of possibilities on which to draw.

**6.3 Metaphors of transformation: breaking through the "imagination barrier":** In this context, and with or without computer assistance, metaphor is a most intriguing unexplored resource as a guide to the elaboration of more complex conceptual frameworks and organizational structures. In effect the arguments already made rely to a large extent on the power of metaphor, especially visual metaphor. Metaphor is renowned as a key to creative thinking and innovation. Information systems have traditionally been ruthless in eliminating the ambiguity of metaphor from the communications they support. But the classical triangle of text, data and graphics processing is only 2-dimensional. Imaginative insight can be usefully placed at the apex of the (tetrahedral) pyramid based on that triangle. Metaphor is the prime vehicle for such insight.

Consider the fashionable focus for the international community at this time, namely sustainable development. How is this complex notion to be carried and addressed in the imagination, and especially in the media. Metaphor can be used to highlight the collective difficulty in developing strategies to bring it about. Metaphors such as "global village" or "Gaia" do not give focus to the strategic dilemma and the operational opportunities. Due to imaginal deficiency, sustainable development is best understood at this time through the metaphor "having our cake and eating it too". This corresponds to its corporate (re)interpretation as "sustainable competitive advantage". Both are tragic examples of poverty of imagination in a complex environment.

## 7. Transdisciplinarity: a sustainable ecology of developing conceptual frameworks

**7.1 Selection (or design) of appropriate metaphors:** The most practical implication of this paper is the need to select (or design) metaphors which can bridge the schizophrenic separation of inputs from policy-making sciences and media-led policy-making. What metaphors underlie the major strategies of the different Specialized Agencies of the United Nations and of the unquestioned administrative jargon in which they are discussed? Is it possible to select or design better metaphors:

- to articulate richer policies in response to more complex problems;
- to capture the imagination of wider constituencies increasingly alienated by the outworn clichés of public information programmes and prone to compassion or donor "fatigue";
- to acknowledge proactively the pervasive role of "corruption", which only the unrealistic can afford to ignore;
- to provide an integrative scaffolding to interrelate issues, policies and institutions in a more fruitful manner.

One set of interesting candidates are the metaphors drawn from ecological and environmental insights. Institutional factions and coalitions may then be usefully perceived as distinct animal species, as a development of an existing tendency to label opponents as "sharks", "sheep", "snakes", "dogs", and the like. The aim would be to endeavour to map out the ecology of factions and actors, identifying the web of interactions between them. Such an ecosystem can be as complex as is required and provides a comprehensible language in which to explore the ways in which niches are defined and protected -- and the extent to which particular species are imbalancing the system and evoking the need for counter-active measures. And the crisis of the times may perhaps best be illustrated in considering the application of this ecological approach to the green movement. The challenge for the tragically factionalized green movement is to reinterpret its simplistic perceptions of its internal factional relationships into the organic, ecological metaphor which is supposedly most meaningful to them (Judge, 1990a).

Another rich and accessible set of metaphors can be obtained from traffic, especially from the manner in which streams of traffic with different, related, and conflicting "agendas" (speeds, directions, capacities) can be interwoven (using underpasses, stoplights, systems of priority, etc) so as to maintain the flow of vehicles. At this physical level conflicts are not "resolved". Consensus on a single agenda is not sought. Rather the distinct agendas are appropriately channelled and interwoven. Much can be built on such traffic insights at the level of social policy-making.

Another frequently used response to metaphoric attack is to reframe the situation by switching to another metaphor. The protagonists then effectively view each other's policies through incommensurable languages. There is normally no creative response to this situation. However, by recognizing such competing frameworks as embodying valuable insights -- however incompatible -- the way is opened to

using both alternately, without reducing the exercise to a ridiculous effort to "marry a hedgehog to a snake".

**7.2 Alternation between conceptual frameworks: key to development of insight:** Conceptual frameworks of adequate complexity may not be stable in isolation. For them to emerge, with any degree of viability, from complex configurations of professional (and political) forces, they may have to alternate with one or more, more or less, incompatible policies of equal instability. It is then the pattern of alternation or resonance between the essentially incompatible frameworks which constitutes a form of dynamic transdisciplinary "framework". It is this "trans" or "meta" perspective which is the appropriate and stable response to the complexity of the problematique -- not the essentially unstable frameworks by which it is engendered (Judge, 1984a). The time dimension is thus used to design more complex frameworks and policies.

In principle this is how the democratic process works through alternation of governance between political factions, although no such faction would accept the necessity for such alternation (except when it was out of power). The challenge is then to discover ways of designing, and rendering comprehensible, cyclic patterns of alternation. In this light it is probable that reconciling the incompatibilities of the "sciences" and the "humanities", of "centralized planning" and "market economy" policies, or of "environmental conservation" and "industrial growth" policies, can only be achieved through some form of alternation using phasing through the time dimension.

**7.3 Conceptual and policy cycles:** It has long been recognized that the practitioners of any discipline tend to view the further application of their particular perspective as the most appropriate response to a challenge, of whatever nature. But is it not also correct that the selection of relevant disciplines, methodologies or policies needs to be alternated through cycles in order to correct for each others defects as a guarantee of sustainability? Again this is the implicit message of democracy, although no political party would recognize the need to "sacrifice" a cherished policy as part of such a process -- unless it had the assurance of its reinstatement in a subsequent phase. At present the distinct policies of opposing parties do succeed each other in a kind of chaotic cycle, as each endeavours to respond to (and profit from) the defects of its predecessors. But it is doubtful whether such chaotic cycles provide the sustainability required through the crises to come.

From this perspective the challenge is whether there are ways to design such cycles. Of great interest, in the light of the work of Buckminster Fuller (1975, 1982), is that significant new forms only emerge when a minimum number of such cycles can be made to interlock or interweave. This level of structural complexity is very elegantly modelled by the tensional integrity ("tensegrity") structures that he so successfully explored. It is also implicit in the traditional policy tool of the Emperor of China, namely *The Book of Changes*, which offers a useful, richly articulated, non-western perception of sustainable development, replete with metaphor (Wilhelm, 1950 tr). An adaptation in terms of sustainable policy cycles is given in the *Encyclopedia of World Problems and Human Potential* (1991, Section TZ).

#### **7.4 Comprehensibility of transdisciplinarity: the quest for sets of complementary metaphors:**

The degree of complexity, with which it is now necessary to deal, strongly implies that no single conceptual framework (or policy based thereon) is adequate to encompass it. Despite the potentially greater richness of metaphors, the same should also be assumed. The "answer" does not lie in the choice of a single magical new metaphor. The challenge may prove to be one of selecting (or designing) a set of complementary metaphors which together encompass that complexity.

Classic examples from physics are the "wave" and "particle" metaphors through which electrons are understood in different ways, and the "flowing waters" and "teeming crowds" metaphors through which electricity must be understood (Gentner, 1982). In each case, both metaphors offer necessary but insufficient insights when used independently. The question may then be to discover the art of shifting between the perceptions offered through appropriate metaphors in a set that articulates a complex pattern of insights (and their policy implications). The nature of such shifting (honoured in children's games in the respect for "taking turns" and in the rotation of presidencies), is richly articulated in the resonance hybrid metaphor and in cycles of phases. Other examples of such metaphors have been given in the *Encyclopedia of World Problems and Human Potential* (1991).

Ironically it may be from the arts that much insight can be derived from the complementarity of metaphors relevant to policy-making (Judge, 1991b). Poetry, like music, is skilled in combining both complementarity and rhythm. Gregory Bateson (1972) recognized the importance of poetry in dealing with complexity as follows: "One reason why poetry is important for finding out about the world is because in poetry a set of relationships get mapped onto a level of diversity in us that we don't ordinarily have access to. We bring it out in poetry. We can give to each other in poetry the access to a set of relationships in the other person and in the world that we're not usually conscious of in ourselves. So we need poetry as knowledge about the world and about ourselves, because of this mapping of complexity to complexity." This could well prove of significance for the governance of social processes characterized by patterns of relationships normally too complex for the human mind to grasp.

**7.5 Travelling patterns on metaphoric pathways:** The challenge of information overload for an individual exposed to a plethora of geographical information is alleviated by ordering this information in relation to a pattern of physical locations, disposed around the globe, and linked by roads and other features. It might be argued that a form of spatial ordering for information from the disciplines is the preoccupation of the classification sciences -- with implications for the physical layout of libraries and bookshops. Thus the most recent information system user interface is based on a metaphor of "rooms" (with "walls") which can be "walked through" to the points where the information is located. Ironically it has also been noted that idiot savants, and those with exceptional memorising power, use spatial mnemonics to handle information.

It may be asked whether we can hope to clarify the complexity of disciplinary relationships within a spatial ordering based on a grid system, whether a matrix of categories, the stacks of a library, or the "rooms" of a user interface. This is undoubtedly perfectly adequate within a specialized domain, where a grid system does not introduce significant distortion. It is an appropriate assumption in any detailed map projection. But it is not appropriate to handle the relationships between disciplines which are only "distantly" related. The attempt to do so results in severe conceptual discontinuities. Even more unfortunate for any thinker is the pernicious influence of such implicit metaphors in reflecting about the sum total of human knowledge.



Such difficulties have been resolved in the case of geographical information by spreading cities over a surface. No effort is then made to reconcile the street plans of different cities. It was only when dealing with the challenge of relating distant cities that it became necessary to recognize the "curvature" of the surface on which they were located -- and ultimately the spherical nature of that surface. It remains appropriate for those in any city to treat the world they know as flat, for all immediate purposes. However, information from distant locations, such as whether it is currently night or day, requires recognition of a spherical surface to reconcile apparently incompatible perceptions.

## Conclusion

**It is the difficult-to-justify sphericity that is called for in the transdisciplinary organization of knowledge -- reconciling local disciplinary knowledge with the "global" organization of such knowledge.**

Recognition of the sphericity of the physical world has since been surpassed by the vital recognition of the complementarity of different bioclimatic zones -- whether the contribution of the tropical forests or of the polar regions. It is such features which ensure the viability of the biosphere. It is perhaps in this sense that the necessary complementarity between a set of metaphors (see 8.4 above) should be understood. It is then this complementarity which guarantees the viability of the noosphere.

The challenge to comprehension lies in enriching our understanding of such complementarity. Some insights come from properties of symmetry for which geometrical metaphors are helpful. These extend into patterns of dynamic stability for which tensegrity structures are helpful. Both point to the existence of "pathways" around spherical structures -- corresponding to "great circles" around the globe. Several may interweave and interlock to define zones in a spherical grid. Such pathways may perhaps be understood as conceptual "ley lines". (For a computer user, by contrast, travelling pathways through a hypertext stack without any sense of overview, may be likened to a rat exploring a maze)

This paper suggests that metaphors constitute our best understanding of the nature of the vehicles to travel along these pathways and around the noosphere. Metaphors may be used to articulate our understanding of the processes of balancing, building and holding conceptual relationships to permit higher conceptual orders to emerge in a conceptually turbulent environment. They can be used to point to the "environmental" problems of the noosphere, including such challenges as "cultural deforestation" and "acid rain" resulting from the unchecked excesses of irresponsible disciplines.

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