GROUPWARE CONFIGURATIONS OF CHALLENGE AND HARMONY

- an alternative approach to « alternative organization » *

Anthony J N Judge

Introduction

Organizations have traditionally been based on some more or less explicit notion of hierarchy. This paper is not concerned with varieties of alternative organization which may be obtained by tinkering with the hierarchical formula and introducing participative forms of decision-making, worker management, etc. The intention is to look beyond hierarchy (1). A recently much-favoured approach is that of networks and « networking » which has now been quite extensively described and practised (2, 3, 4, 5, 6, 7) as a contrast to hierarchical activity. It has also been taken up and combined with (alternative) « grass-roots » community action and the commune movements or as the mode underlying « situational networks » (8). But there in an emerging recognition that networks do not «work». Many would of course argue that they cannot be expected to « work » in the traditional sense and that their action for non-action) is more subtle and as such more effective. But at least it is unclear how their constructive activities can be facilitated above a certain threshold 9, 10). Unfortunately » network » is often attached as a label to what previous decades called « movement » or even « club ». Many « networks » are in fact hierarchies, although it would be bad form to draw attention to this. It is even possible to speak of the « diseases » to which networks are prone(11). particularly a certain «flabbiness» arising from the progressive elimination of exposure to confrontation, criticism and discipline - as being characteristic of the hierarchic mode. Such weaknesses reduce their viability as true « alternatives ».

This paper rejects the extremes of hierarchy and network and is concerned with **new** types of organization which could combine some of the features of each. It is therefore based on a notion of **complementarity** between hierarchical system and organizational network (1. 12). The organization to which this approach may give rise could emerge from « tensing » networks (10) as a corrective to -«flabbiness ». Exactly how this could be done is not very clear but a number of stimulating clues are available from the study of structural design, namely those relating to « tensegrity » (i.e. tensional integrity) structures. The relevance of these clues to organization design has been discussed elsewhere (1, 13), as has their relevance to ordering concepts, needs and problems (14). The latter focus has highlighted the associated difficulties of comprehending complex configurations and the importance of developing information systems supportive of « configurative thinking » (15, 16). This is not a hardware problem but partly one of computer software and partly one of « groupware » (17) or « orgware » (18) as it has recently been termed - namely the way in which a group of people work together in relation to the information system which links them (whether or not it is computer-based). Ironically it is within the sophisticated communication environments of the emerging computer conferencing systems (15, 19, 20) that these groupware problems are now being highlighted (17), although the tragic inability of the wise to communicate with each other or work together has been remarked upon in the past (21).

The concern of this paper is therefore not to describe existing efforts at « alternative » organization but to see whether, from a study of formal structures, an entirely new approach to organization could emerge. This is therefore seen as a design problem in the broadest sense of the term (22, 23). This problem is particularly challenging when the range of disparate functions active within the organization is broad rather than specialized, and when few of the participants appreciate the relevance of functions other than those with which they are directly associated.

Communication nets vs. Tensegrity organization

Since this paper focuses on configurations, it is important to clarify the relationship to the classic group communication net experiments in social organization. In what follows these have been contrasted with « tensegrity organization », mentioned above, which is derived from the work of Buckminster Fuller and other architects (24, 25, 26). Experiments on communication nets were originated by Bavelas (1948, 1950) and Leavitt (1951) and have been followed by a large number of studies. According to one literature review (Glanzer and Glazer. 1961) : « The area has been worked not only exhaustively, but to exhaustion. After a promising start, the approach has led to many conflicting results that resist any neat order ». And more recently : « It is almost impossible to make a simple generalization about any variable without finding at least one study to contradict the generalization » (27).

Such research is only partially relevant to the more complex structures to be discussed, for the following reasons :

1. Limited number : It is based on groups of 3 to 5 persons. On the basis of Fuller's analysis of structures, such a small number of elements does not give rise to stable tensegrity configurations. The simplest 3-D tensegrity requires 3 compression elements((i.e. 6 function-roles). The first two which are spherically symmetrical (and enclose a space) require 6 or 12 elements. The first with extensive great-circle symmetry requires 30.

* Presented to a workshop on alternative organizations of the European Institute for Advanced Studies in Management (Brussels. June 1979); prepared loi the international conference of the Society for General Systems Research (London, August 1979) and reproduced from its proceedings : Improving the Human Condition - Quality and stability in social **systems.** Washington DC. Society for General Systems Research. 1979 (Editor. B F Ericson). 1051 pages

A : 2-DIMENSIONS (circular symmetry)
Stability: If a square or polygon is made from a series Of struts which define ils edges, and if those struts are connected by flexible joints. the resulting figure can be distorted and is therefore unstable. To be stable a shape must have its faces composed of triangles. If triangulation is done with tension elements, the shape cannot be distorted in 2-dimensions, but it is unstable if lifted off the plane surface.

- Anthony Pugh. An Introduction to Tensegrity.

B : 3-DIMENSIONS (spherical symmetry)
Stability : If a cube or polyhedron is made from a series of struts which define its edges, and if those edges are connected by flexible joints, the resulting figure can be distorted (and is therefore unstable) unless all the faces are triangular (as in the tetrahedron, octahedron or icosahedron). Certain counteracting configurations of struts and tension elements (tensegrity structures) are stable without triangular faces. The resulting network of tension elements outlines the polyhedral form on which the tensegrity structure is based.

2. All struts pass (approximately) through centre point; ends do not touch and are linked by tension elements (outlining a regular polygon).
N = 2, square outlined
3. hexagon outlined
4. octagon outlined, etc.

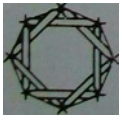
3. Strut ends overlap (but are only connected via tension elements), enclosing an area in the form of a regular polygon.
N = 3, triangle
4, square, etc.

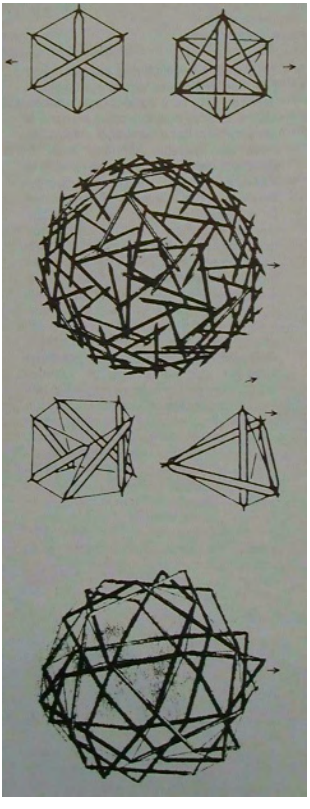
4. Strut ends linked together to form a regular polygon; tension links from vertices

N = 3. triangle
4. square, etc.

5. Strut ends linked together with struts overtapping; vertices linked by tension elements.
5.1 Forming a continuous circuit (for N odd)
N = 5. pentagram
7, heptagram, etc.

5.2 Forming independent overlapping for interweaving) circuits
N = 6 (2 triangles)
8 (2 squares), etc.





2. All strut centres pass (approximately) through centre point; ends do not touch but are linked by tension elements (outlining a regular polyhedron)
N = 3, octahedron outlined
4. cube outlined, etc.

3.1 Tensegrity diamond pattern with struts enclosing a volume; external tension elements outline a regular polyhedron
N = 8, octahedron
12. cuboctahedron, etc.

3.2 Tensegrity zig-zag pattern with struts enclosing a volume; external tension elements outline a regular polyhedron
N = 6, tetrahedron
12, octahedron
30, icosahedron
36, cube, etc.

3.3 Tensegrity prism, with struts not enclosing a volume (i.e. not spherically symmetrical)
N = 3. triangular prism
4. sqaure prism, etc.

4. Strut ends linked to form a regular polygon with a single strut passing at right angles through the centre point of the plane. Vertices linked to the ends of the single strut. (N.B. not Spherically symmetrical)
N = 4, triangular polygon
5. square polygon, etc.

5. Strut ends linked together with struts interweaving; vertices linked by tension elements.
5.1 Forming a continuous tensegrity circuit pattern.

5.2 Forming a tensegrity made up of several independent interweaving circuit patterns of Struts (each forming a regular polygon)
N = 9, triangular circuits (3) : cuboctahedr.
12, square circuits (3)
15, pentagon circuits (3).

5.3 Forming a tensegrity made up of several Independent interweaving circuit patterns of struts (each forming a polyhedron)
N = 12. tetrahedra (2)
18, tetrahedra (3)

2. Two-dimensional structures : The communication nets investigated are necessarily conceived in two-dimensions.

Their patterns, in many cases (e.g. triangle, square, pentagon, wheel, etc.) of course constitute parts of a tensegrity tension network, but not the whole which requires pacific combinations of such sub-networks (see Annex 1).

3. Limited role differentiation : Little attention is paid to the differentiation of roles. Although H. Guetzkow distinguished factors operating to allow role formation from those which induced interlocking roles into organizational structures, only 3 roles (plus a role-less role) emerged (28). As groups get larger, and the task more complex, more specialized roles tend to emerge - to a point where there is only very indirect interaction between some roles(20). Opposed or counter-functions are required in maturer groups to counter-balance each other's excesses. It is at this level of complexity and functional « incompatibility - that tensegrities could prove of value.

4. Single communication mode : The emphasis is on communication, whether one-way or two-way, and the nets do not distinguish between tension and compression features (essential to the formation of a tensegrity configuration),

5. Sub-systemic : Such task-oriented groups in fact are dependent on external factors for the justification of their artificial (laboratory) activity. As such they are essentially sub-systems for which a state of equilibrium can only be reached within the context of a larger system. Tensegrity is primarily of interest in exploring systems at equilibrium for switching between equilibrium states) namely systems with a richer variety of counter-balancing functions.

Challenge and harmony

One point of entry into the argument of this paper is that arising from the « single communication mode» (point 4, above). The experiments appear to have concentrated on the flow patterns (possibly including directionality) without any attention to whether the flow between communicants was perceived as (• mutually challenging - or - harmoniously reinforcing » - namely a unimodal rather than a bi-modal focus(*) (This raises the question whether what is perceived as alienating and boring in many conventional organizations, particularly bureaucracies, is not precisely a suppression of challenge or harmony relationships in favour of a neutral, uni-modal form. And what is rejected or attractive, in competitive organizations is the challenge, which may become dehumanizing and more than the individual cares to bear Similarly what is attractive to many in networks is the harmonious nature of relationships and the absence of challenge. It is however clear that even in the case of the most staid bureaucracy, challenge will emerge. But it will not be openly recognized, as it is in competitive organizations. Harmony will also emerge, but only through the extensive informal networks in such bureaucracies). Use of «challenge» and «harmony » as terms obviously calls for a precise definition. The problems of clarifying their significance have been discussed elsewhere in relation to tensegrity organization (1, pp. 258-9), as well as in more general terms (15). Basically such precision would be premature. The implications of the difficulties of comprehending the significance of any verbal definition are themselves important. One interesting sense in which they may respectively be understood is as reciprocated negative and positive feedback relationships. Negative feedback is a challenge to a position and has to be « dealt » or « coped » with. Positive feedback reinforces an existing position, confirming the harmony of the relationship between the two parties.

Given the lack of attention to this aspect of communication in groups, the question is what kinds of challenge/harmony configurations might prove significant as a basis for alternative organization ? It would seem that no effort has been made to look into configurations of positive and negative feedback - and it is not even clear what would be involved. Attention has always been devoted to the « processing boxes » in a system and not to the configuration pattern of the flows between them (**).

In contrast to the communication nets, the rules for interrelating challenge and harmony relationships may be more complex.

Some of the possibilities are evident from Annex 1, where a compressive strut (stick) can be interpreted as a challenge relationship and a tension element (string) as a harmony relationship. The interesting clues to new types of structure seem to Me in configurations which :

- separate challenge relationships by harmony relationships (embedding the former in the latter) and « tensing » the latter by the former to avoid flabbiness;
- are based on a 3-dimensional structure rather than on a 2-dimensional structure and thus encompass a volume rather than an area;
- are symmetrical, or rather in which all the relationships are handled symmetrically;
- avoid cluttering up the centre of symmetry or creating structural dependence on that centre.

The significance of these structural features for organizations is explored elsewhere at some length (1, 13).

Of great interest is the manner in which challenge/harmony configurations use 3-dimensions to achieve symmetrical closure. Those which achieve closure in 2-dimensions (see Annex 1) do not bring out the unexpected features of the 3-dimensional. In fact they bear a predictable resemblance to those of the classic communication net experiments.

A further word on challenge relationships: if the mutual challenge is too great, this must necessarily result in the elimination of one (annihilated) or both (mutual destruction). Similarly, if a harmony relationship is too strong, the identity of one is lost, being merged into that of the other. In both cases such tendencies can be counter-balanced by harmony or challenge relationships respectively, provided they are appropriately positioned within the configuration. If this is not possible then clearly the configuration is not stable and other patterns could be explored. (Note that the stability of a communication net only arises, if at all, in terms of information overload).

Completeness

The communication net experiments were designed around laboratory problems which did not call for extensive functional differentiation between those in the net.

An extreme contrast is to be found in a mature self-reliant community when a complete range of functions - from agricultural to cultural - is required. It is characteristic of this degree of functional differentiation - found to a lesser degree in large, complex organizations - that there is no theoretically grounded logic to the relationships between some of these functions. Allocation of resources to functions can only be justified by experience, possibly disguised by « good » public relations (e.g.a harvest cultural festival keeps the agricultural workers happy, etc.)..

The question is what are the functions in a « complete » range if only 4 or 7 or 12, etc functions emerge in a given case ?

How is the absence of a function sensed (e.g.a self-reliant community may feel the need for some cultural, religious, psychotherapeutic or other expression) ? If some functions are not expressed, what dependence does this create on the external environment ?

Clearly it would be useful to clarify the nature of :

(*) This paper only considers bi-modal structures based on tensegrities. it is highly probable thai whole families of psycho-social structures can **be** based on tectural counterparts. If **any,** hove not **yet been** explored. The mode chosen is partly a question of comprehensibility. Modes of value greater then two may depend upon multi-valued logics (30).

(**) It is only Fuller who has draws attention to systems has being polyhedral structures (24. p. 95)

- completeness in narrow, highly specialized groups
- incompleteness in mature, self-reliant, richly differentiated groups.

The question is how much variety can be usefully incorporated and expressed within the group without tearing it apart or rendering it incapable of functioning as a whole ? - given that a rich variety pool is a guarantee that the group can formulate many survival strategies in response to possible crises and that it offers many different opportunities for personal fulfillment (Note that the current tendency is to aim for structures which will operate effectively with the minimum functional variety).

It is clear that completeness in a spherically symmetrical tensegrity is structurally explicit. The consequences of removing an element in the simpler structures are immediately evident for the whole. Completeness in this sense is not explicit in hierarchical organizations from which whole divisions may be removed without raising questions as to the implications for the functioning of the whole.

In a tensegrity each relationship constitutes a different kind of challenge or a different kind of harmony, depending upon its position (and orientation ?) within the configuration. It is the totality of these qualitatively distinct relationships which defines the whole although it is at the level of their distinctiveness that they are operationally comprehensible rather than through the abstractions of « challenge » and " harmony ».

Comprehension

It is strange that the problem of comprehension is seldom raised in connection with alternative organization. One reason that hierarchical organizations are so widespread is that they are the simplest to comprehend, and that any challenges to comprehension are effectively disguised as the responsibility of the « boss ». An individual in the depths of some such hierarchy is in fact encouraged not to worry about the why and wherefor of what goes on elsewhere.

The result is that when confronted with the presence of for the need to express) a complete range of functions, an individual will tend automatically to separate out as irrelevant all those which are not immediately compréhensible from the position he is currently expressing. For this reason the functional richness and maturity, which may be assumed to be desirable characteristics of alternative organizations, render them a major challenge to comprehension (*).

Not only is there the problem of comprehending the distinct functions which are expressed in an organization of a given level of complexity (i.e. richness), but there is also the problem of comprehending the pattern of challenge and harmony relationships characteristic of the structure. In a hierarchy the pyramidal structure also serves as an encoding or classifying structure, effectively pigeonholing more specialized functions which can then be handled conceptually at a more general level (**). Characteristically, horizontal relationships between hierarchical sub-divisions are ignored if not forbidden, except via the « boss ».

In order to comprehend the challenge of envisaging real alternatives, attention must be given to the conventional process by which we are « locked into » the existing patterns of organization. Curiously both philosophers and physicists share this concern. For example A.T. de Nicolas, a philospher concerned with the patterning freedom implicit in the chanted Rg Veda and how it is to be comprehended, notes :

« The approach of Classical Physics corresponds very closely to the commonsense approach in the following sense : It operate on the assumption that we should primarily search for individual, unique, atomic entities like things, and events, and only secondarily that we should see how these atomic units combine into classes of units and classes of classes of units and so forth...

The approach of Modern Physics corresponds to the Eastern view of reality in the following sense : It operates on the assumption, that whenever we are in search of anything, we are primarily in contact with a totality, the most « real » aspect of any entity being the total pattern. Our perception of it defies any atomicity or real identification. It is only secondarily that classification of individual entities is made possible, and for this we revert to ordinary symbol manipulation. In other words, to perceive anything apart from the total field is to perceive it as a subsystem, an artificially created aspect of a field of stresses, i.e. a pattern. In fact, according to the law of complementarity, what can truly be said in one context-language, the same cannot be truly said in the other context-language ». (31 p. 32-3).

The final statement can be made of the different functional perspectives into which a complex organization can be differentiated, since each gives rise to its own context-language. There is a relationship of complementarity between them but not of classical logic. De Nicolas is concerned to show that it is the activity whereby man generates these languages and patterns which is the clue to patterning freedom. A similar point could be made with regard to the (collective) entrepreneurial initiative whereby an organization comes into being - the initiating attitude is usually neglected in favour of uncreative attention to a narrow range of well-know organizational forms. De Nicolas argues that the conventional « view of language fails to take into account the human activity by which language itself is formed made flesh » (31 p. 55).

« When Language is grounded on a tone system, as in the Rg Veda, then the immediate result is a plurality of systems; that is a Language which we can speak only through sub-linguistic systems» (31 p. 58). « Language, in the above sense, is only to be reached as a viewpoint gained through the activity of contrasting perspectives .» (31 p. 182) (***).The immediate consequence is an infinite patterning possibility, and a rich multiplicity of alternative perspectives. In Western music number is used to constrict all possibility to an economically convenient limit by arbitrary adoption of an international pitch standard and an equal temperament tone system. This was not the case in the past : the infinite possibilities of the number field were considered isomorphic with the infinite possibilités of tone and there was no theoretical limit to the divisions of the octave.

« Rg Vedic man, like his Greek counterparts, knew himself to be the organizer of the scale, and he cherished the multitude of possibilities open to him too much to freeze himself into one dogmatic posture. His language keeps « alive that « openness » to alternatives, yet it avoids entrapment in anarchy. It also resolves the fixity of theory by setting the body of man historically moving through the freedom of musical spaces, viewpoint transpositions, reciprocities, pluralism, and finally, an absolute radical sacrifice of all theory as a fixed invariant » (31 p. 57).

« Language in music is grounded thereby on context dependency; any tone can have any possible relation to other tones, and the shift from one tone to another, which alone makes melody possible, is a shift in perspective which the singer himself embodies. Any perspective (tone) must be « sacrificed » for a new one to

* Despite their supposed *complexity,* the challenge of ways avoided - to the point that there is even pride in their perceived amarphousness (which markedly distinguishes them from their conventional mathematical representation).

** Functional distinctions are seldom explicit in organizational or grassroots networks. On *may* even question whether functional differentiation is acceptante therein.

*** De Nicolas describes Language as « a heuristic anticipation of a reachable goal, which establishes structures of systematic inquiry guided by sets of canons and embodied in a pattern of human exploratory behavior. When Language is formulated, we no longer have Language, but rather a complete and closed set of semantically linked descriptive predicates internally related and forming one or several sublinguistic systems, or languages » (31 p. 183)

come into being: the song is a radical **activity** which requires innovation while maintaining continuity, and the « world » is the creation of the singer, who shares its dimensions with the song » (31 p. 57).

Whilst one may share the enthusiasm of the last paragraph, the Rg Veda has been around for several thousand years and has not apparently given rise to alternative patterns of organization. By what have its interpreters been trapped ? Lest it be thought, however, that musical form has little to do with organization, one may cite socialist economist Jacques Attall .

« La musique est plus qu'objet d'étude : elle est un moyen de percevoir le monde. Un outil de connaissance. Aujourd'hui, aucune thèorisation par le langage ou les mathématiques n'est plus suffisante, parce que trop lourde de signifiants préalables, incapable de rendre compte de l'essentiel du temps : le qualitatif et le flou, la menace et la violence... Il faut dore imaginer des formes théoriques radicalement neuves pour parler aux nouvelles réalités. La musique, organisation du bruit, est une de ces formes... Dans les codes qui structurent les bruits et leurs mutations, s'annoncent une pratique et une lecture théorique nouvelles... » (32 p. 9-11).

He demonstrates the prophetic role of music and that social and economic organization is the « echo » of the music of the immediate past. But this still leaves indications which remain to be anchored in real possibilities for comprehending operational alternatives for organization. A « bridge » is required from the rich possibilities of patterning freedom indicated by musical coding to that of organizational structure. It is the argument of this paper that tensegrity structures constitute such a bridge, both in the variety of possible patterns which provide structural guidelines ('), and as sophisticated reflections of the problems of comprehending the range of such true alternatives. It may even prove to be the case that a given tensegrity is an isomorphic representation of a particular lattice of sub-linguistic systems which could characterize a particular pattern of functionally differentiated organization. De Nicolas notes (31 p. 187) that man, in his expressions and behavior, uses a lattice of languages. This was first pointed out by P.A. Heelan in connection with the peculiar logic of quantum mechanics (35). The logic in question turned out to be, not an ordering of sentence, but a partial ordering (lattice) of complementary descriptive languages. He found this complementarity of languages to be a pervasive phenomenon of human communication and dialogue. « Man is at the centre of his own activity, creating and recreating himself in relation to how efficiently he climbs or descends the contextual multiplicity within which he constantly operates - (31 p. 187). It is noteworthy that taxonomies of games have been based on lattice structures which bear a tantalizing resemblance to the tensegrity structures discussed here (36). Game.s are themselves challenge/harmony patterns.

In 3 tensegrity the structure is comprehensible as a gestalt, but it is very difficult to conceptualize the gestalt from its elements. There is a counter-intuitive barrier to reaching an understanding of the whole from its parts, although the structure of the whole is very clear once represented by a three-dimensional model. This barrier is even clear when constructing such a model. It becomes even greater as the number of elements increases in the more complex tensegrities.

Aside from one's own problems of comprehension, there are obviously problems of communicating the nature of alternative organization to others.

Levels and stages of comprehension

It follows from the previous section that individuals exposed to a complex structure, whether existing or proposed, will tend to comprehend it in different ways and to different degrees. The point has been well made by F.F. Kopstein and others (37) in terms of learning about a pattern of interlinked concepts (in a network). There is a tendency for each of those in the learning process to fail to register, retain or retransmit parts of the pattern. In addition there is the natural tendency to want to perceive the pattern as being of a well-known kind and thus to ignore features which imply that it is more complex and less intuitively predictable from past experience. Such tendencies are exacerbated by limited effective attention span.

The consequence is that, whatever the point of introduction to a structure of complexity greater than that to which he is habituated, the individual will tend to work with it for reject it) as though it was a simpler structure. It may even be useful to think in terms of a series of « delusions » through which the individual must pass before attaining to full comprehension of the structure. These learning experiences or cycles are perhaps better appreciated in the apprenticeship « doing » mode of learning than in the more academic « information » mode. Whether it be in Maoist China or in a diversified capitalist corporation, there is a well-established practice of requiring individuals to work successively in different contexts to get an overall « feel » for the different cycles of a production process and to understand the constraints to which each part is subject (**). These are contextual realities not communicated by look-learning or briefings. It may well be the case that a particular individual will never really get more than a distorted feel for what is going on in some of these settings because of innate bias or ineptitude of which he is unaware or is unable to overcome effectively (e.g. « agriculture - may remain an eternal, messy mystery to someone who is temperamentally oriented toward «engineering.»).

From the individual learner's point of view it is difficult to distinguish between « levels " of comprehension, successively encompassing each other (e.g. progressively more sophisticated reality models), and « stages » of comprehension arising from successive exposure to alternative reality settings (e.g. with respect to a complex production process). The two are intertwined, the progressive refinement of the former being dependent upon the variety of foundational experiences provided by the latter. Where the point of entry is dictated by convention, certain levels and stages may be labelled as •• superior « or « advanced », introducing an unnecessary spirit of elitism. But this is fairly arbitrary since individuals tend to have an innate aptitude for the skills required at certain levels or stages (rather than at others), irrespective of their point of entry into the learning process. Of greater importance is the extent to which the individuals can respond to for master) the requirements of a wide range of levels or stages (***). It is the number (i.e. the variety) so mastered which is a truer measure of comprehension of the whole, not the apparent sophistication of the stage or level reached from some entry point dictated by circumstances. («The first shall be last, and the last shall be first » !)

Clearly it may prove to be the case that a particular individual is quite content to perceive a complex structure in over-simplified, distorted terms and to work within it for in opposition to it) on that basis. A mature complex structure should in fact support those who participate in it in their perception of it according to their abilities and preferred modes whilst challenging

(*) There is a strong, possibility that further exploration of musical patterning (cf ref. 33) in relation to tensegrity

them since both are governed by number (cf. ref. 16). itself a basis of the patterning of the field of archetypes in the Jungian sense (34). The hey seems to lie in the patterning of a spheric surface (a finite but unbounded attention surface) by configurations of discord/challenge and harmony

(**) This is also the case in semi-secret guilds, such as the Compagnons du Devoir. It is also evident in the sequence of initiations in certain religious orders, such as the Sufi (38).

(***) An extreme, but nevertheless elegant example of this may be found in the reports by different Sufi masters on the 7 colours associated with visionary experiences at the 7 colours associated with visionary experi-

the colours there is disagreement concerning tne order of the levels. One scholar suggests that « this corresponds to a difference is the way each of these depths is innerly attained, oriented » (38. p. 126). The same point may de made with respect to the supposed level « superiority » claimed for Mohammed over Jesus within that system - a distinctly non-trivial point given the misunderstanding and violence arising from attachment

them with alternatives which would lead to greater understanding. Tensegrity structures in fact form series or families of different degrees of complexity such that one may be considered a simple approximation to another and thus easier to understand.

The alternative organizations of the future may even recognize the learning situations associated with such historical structures as slavery, feudalism, fascism, imperialism, communism, etc and attempt to internalize them. In fact « slavery » and » feudalism ». for example, are labels commonly attached to some family, work or leisure (e.g. sport) situations. Even « fascism » may be accepted to further the shared goals of a team. It may prove that each is valuable under certain conditions, provided : (a) that the pattern is not permanently maintained or (b) that the same people are not continually (under) privileged, or (c) that people feel free to experience alternative patterns or are having such experiences in other settings (e.g. work, religion, leisure, etc. Organizations have to internalize education as a continual learning process (39) in order to respond to each generation born anew with the potential for organizational errors of the past. They need to « process ignorance » as well as information (40, 41), offering ritual re-enactment or preventive exposure to the organizational equivalent of early childhood diseases (e.g. mumps, measles, etc), and using any such ignorance as a structuring element of the whole.

« Keeping the act together »

In a hierarchical organization it is fairly easy to impart or receive the idea « Joe is the boss; do what he says ».Whatever the participatory nuances and constraints, it is that which orders the structure. In the case of a network the matter is more subtle, but it may be little more than « We must keep in touch; and don't forget to inform Joan in Melbourne ». The matter is more complex in situations which blend both modes informally, where organization is amorphous, or is overshadowed by a charismatic leader or inner circle.

The challenge of alternative organization is that it should provide a new balance of relationship between those who participate; one which is not dependent on a central figure or group and is more strongly bound than the conventional network.

Basically it is a question of a configuration within which « energy » can be processed and transformed to the satisfaction of participants. It is common to refer to organizations as processing « information » but both these terms fail to convey the essential difficulty of keeping an organization alive and self-regenerating. R.G.Siu. a taoist scholar with a background in biochemistry and management, has this to say:

« We suggest that living systems possess some unique capability of marshaling ch'i, which is not present in inanimate systems. The living organism processes ch'i in conjunction with the energy transformations which are characteristic of inanimate reactions. Death sets in where the capacity to process ch'i is disrupted and the corpse reverts to the inanimate world of energy exchanges, pure and simple. Energy is the essential stuff for structural integrity and mechanical and chemical processes, while ch'i is the essential stuff for pattern perpetuity and thinking and feeling. While energy-metabolism accounts for the vigour of health in the physical sense, ch'i-metabolism accounts for the well-being of the person in the psychic sense. A smoothly operating cross-feed exists between energy and ch'i in the normal and serene human being » (42, p. 261-2).

As might be expected, ch'i does not lend itself to easy definition although Siu's whole study attempts to legitimate the concept within contemporary scientific and philosophical throught. He does not however relate ch'i to the interpersonal « energy - processing characteristic of an organization which would make of it a « ch'i receptacle » (*).

But it would seem to be legitimate to argue that an organization which is « alive » and « vibrant » is held together by more than the inter-exchange of information, funds and other resources. (There are many » dead » organizations so equipped which are merely memorials to problems of the past or to past inspirations). And whatever that « something » is, the trick is to keep it moving in order to maintain the energy level (of which « enthusiasm » is an aspect), and to prevent it from draining out of the organizational configuration. In order to succeed in this, at each transformation of « energy » at any functional station within the organization, there should be a receiver to continue the process, and those involved in the functional transformation should feel fulfilled by it.

But lacking a « boss » this becomes a very delicate balancing act : containing excess and stimulating weakness. The question is how to render it self-balancing but with a developmental disequilibrium which will provoke convergence on more complex configurations. It is much more than a conventional systems management problem, given that there is no « manager » and that some of the relationships are not perceptible through the spectacles of systems management. Somehow the weaknesses of negative by-products of the organization's activity should be ingested (rather than dumped on the environment) in such a way as to strengthen the organization. It should work with its constraints rather than against them using their strength to provide structure (**).

More complex still is the creation and initial growth of the organization when special protection and support is required (from whom ?) before the organization becomes self-balancing.

Computer facilitation

It is curious that in the creation and operation of both networks and hierarchical organizations there is little or no necessity for the kind of information « scaffolding » that a computer can provide. In a network this may even be anathema, although the potentially significant computer conferencing networks now emerging depend upon them (19). But here a distinction must be made. This dependence is upon the point-to-point, rapid conveyance of information; there are either no structural restrictions on to whom the communication is addressed (as with the telephone) or else these are hierarchically determined by policies external to the computer system (as in the case of access code distribution). Where computers are used in support of communication within a hierarchy, this is merely an electronic form of a conventional memo/message system. Again the computer is not used to provide any structural support not already implicit in the hierarchically governed policy of the existing system - although it may help to do this more efficiently.

That this is not necessary in either case is perhaps evident from considering the physical equivalents. A « network » of telephone lines could be laid over the surface of a large open-plan office. If a switchboard was used, this would only perform the same functions as a manual memo clearing desk. When a hierarchical structure like a pyramidal building is put up, each level provides the support for subsequent levels. Scaffolding is only required temporarily to bridge over ambitious spans (i.e. more ambitious than those of Stonehenge). It may be argued that hierarchical organizations start with a « boss », but by acquiring his first layer of assistants he establishes himself upon their shoulders - a process which they can repeat for themselves as hiring is extended and the pyramid built up.

In contrast to the above uses of computers as a more or less automated pigeonpost or messenger service (justified by

(*) It is common for connosisseurs of alternative organ-

ization activities to use the phrase « there was a lot of good for bad) energy there ».

(**) Presumably interesting clues are to be found *in*

ples. One of them. Aikido is specifically concerned with

the large quantities of information), one may envisage a very different structural approach of considerable significance to the creation and operation of tensegrity-type organizations. Surprisingly, physicist Ted Bastin in contrasting the classical and modem paradigms in physics (mentioned earlier), argues that « computer people work all day » with relationships required for the latter « whereas physicists work with ideas which are foreign to it ». The principles are « the bare bones of a non-existent logic of sequential relationships « in which spatial « relationships have to be constructed before they have meaning » and are not intuitively obvious as normally assumed (44 p. 124).

The construction of a tensegrity communication configuration may imbue its elements with logical significance in the sense of this paradigm. The computer is therefore an appropriate tool by which to learn how to work with the new paragigm and avoid the traps of the old (*).

As should be clear from the previous sections, the problem is to build up communication configurations of appropriate complexity. But tensegrity-type configurations only acquire self-balancing structural integrity when they are complete for all but)
- hence the need for - scaffolding » or an
- assembly frame ». And in fact only then do they become comprehensible as structures rather than as a maze of possibilities (as is discovered when building models).

There are many potentially de-stabilizing problems which may themselves interact counter-productively :

- initial setting up difficulties
- (mis)understanding of functions to be activated
- (mis)understanding of relationship pattern to other functions
- (mis)understanding of nature of relationships
- ensuring completeness of function/relationship pattern
- (varying) levels of comprehension of those participating and consequent variety of learning experiences triggered
- distinguishing equilibriating, growth and evolutionary dynamics
- determining one for more) appropriate configurations (and distinguishing between them)

The context for the emergence of such alternative organizations may be conceived as a pool of unfulfilled perspectives or skills (in the broadest sense and including the affective) with a range of completed and partially completed configurations. In contrast with the conventional labour pool/job offer situations, the computer is used both in attempting to match the functional skills and the incomplete configurations and to propose new configurations of unlinked functional skills (Note that one person may possess **many** such perspectives or skills;.

Now each tends to perceive his own skill or perspective as « most fundamental » or « most central », whilst perceiving many others as « irrelevant » or at best « of secondary importance ». Each only wants to be linked with others with which his perspective is either in harmony or by which it is appropriately challenged. Computer software is therefore needed to « protect » each perspective and any pattern of communication links around it (to the extent desired by the individual concerned).

Now the task of the software is not simply to match skills/perspectives in sets of communication dyads. The challenge is to interrelate such dyads in larger configurations within which a greater variety of skills/perspectives is expressed - namely to « configure » an organization which is richer in internal resources as a basis for self-reliance and viability in relation to the external environment. (In one sense this is the antithesis of the alienating « division of labour»).

In attempting to set up complete configurations, the software may first have to propose partial « harmony » configurations (e.g. triangles, squares, stars, etc), as in the communication net experiments, and then attempt to combine a number of these, opening up the necessary « challenge « relationships if possible. (Note that without the latter, the organization would simply be of the mutual admiration variety dependent upon external challenge, possibly transmuted into « enemies »). There is of course no reason why this process should not lead simply to the emergence of networks or hierarchies wherever participants are satisfied with these - although they are not configurations in the sense implied here. More concretely, a « proposal » initiated by the software would merely indicate to one or more participants that (in the light of information currently stored on a particular set of their related interests/perspectives/skills) they could each usefully restrict their communications to a named set of partners, if only as a control on information overload, (In addition, or alternatively, advice might be given on the frequency or volume of communication - possibly enforced by software). Feedback to the software would indicate whether alternative configurations could usefully be tried. » Communication » itself might be face-to-face, mail, or phone, but as an experiment it could well be done in association with a computer conferencing network. This would permit many configurations to be tried (sequentially or in parallel) with much flexibility, avoiding any communication hiatus (***).

Most intriguing is that, by definition, it is not clear what synergy effects would become evident once a configuration had been completed nor to what kind of dynamic stability it would give rise. Since the whole concept of a tensegrity is based on the ability to distribute any stress most effectively throughout the whole structure, how would this need to affect beneficially any software mediated communication (such as by giving preference to lines of communication relating to symmetry features. « great circle » routes, etc) ? How would it be necessary or possible to respond to excessive challenge between two partners (uncontainable within that configuration), excessive harmony (leading to identity of two perspectives/skills which need to be distinct in that configuration), etc ?

The strength of the computer lies in its ability :

-to propose any of a very wide range of tensegrity-type structures (stored for that purpose)
- to introduce and possibly regulate communications until the discipline has been internalized or the configuration abandoned, or for its duration (if it is difficult to maintain without « software scaffolding »)
- to facilitate the learning process about such structures particularly when the individual is embedded in a complex structure
- to facilitate the re-categorizing /re-classifying process the individual can undertake as he clarifies/comprehends « what he is into » (namely a form of « evolutionary selfindexing ») in order to provoke better suggestions as « to whom he should be talking » within configuration contexts of greater completeness
- to distinguish clearly, when necessary, between a perspective and the holder thereof; or to permit a perspective to be shared by several holders, if appropriate.

Dynamics : growth and evolution

The great advantage of tensegrities is that they constitute an extensive range of interrelated structures. There are even transformation paths between them although these have not been extensively explored (24, 25). When a given configuration becomes inadequate participants can interlink in terms of a more or less complex structure. Or, better still, they can use different communication configurations under different conditions (**).

(*) A new example relevant to this paper is the use of *non*-hierarchically related « co-routines », simultaneously resident and exchanging data on the initiative of either within the computer system.

(**) It is possible that the lattice structure, mentioned above in connection with languages, can also be used to describe the relationships between the différent configurations.

(***) Even without computer support, experiments at deliberately - tensing - a network of people in telephone communication may be made In fact, the presence of « tensions » may be the normal condition of a dynamic group communicating in this way.

The relationship between growth and evolution into a new structure is explicit in that tensegrities can be complexified quantitatively by continually triangulating the faces of the polyhedral form on which they are based. This corresponds to a functional differentiation.

Relevance : organizations, meetings, programmes

As has been discussed elsewhere (45), the distinctions drawn between organizations, meetings and programmes are arbitrary, particularly within a computer conferencing environment. The special problem of exploratory/innovative meetings at this time is to re-configure through a sequence of (possibly parallel) structures as the topic is clarified/comprehended, and to provide some structure to ensure a non-trivial integration of the meeting's specialized working groups (46). The tendency in the latter is to select out the contrary/opposing/challenging perspectives in order to form a simple harmonious round-table communication net. Interrelating such groups requires explicit recognition of the challenge relationships between group perspectives - possibly as a tensegrity which thus given appropriate recognition to the nature of the whole (47).

A critical assessment of the current approach to action programmes could well suggest the need to switch from a hierarchical ordering of the temporal structure of programme phases to an « a-temporal » action configuration of continuing action.

A tensegrity could prove appropriate for modelling this concept which is more in tune with non-western approaches to change and action (48).

Configurative training

Although tensegrities are an expression of the whole/part relationship, the counter-intuitive problem of understanding them is aggravated by the absence of any training in detecting and handling configurations. What is the skill which enables people to select a configuration of complementary elements and how can it be developed ? Examples are complementary colours (for decor, art), courses (tor education), sounds (for music), TV programmes or newspaper sections (to balance the weekly diet), etc ?

How can 3 for 5, 7, etc) « basic » complementaries be determined ? How does choosing N+1 elements « shift » the meaning of the labels attached to whatever is selected or omitted form the classification ? How can people be sensitized to a functional « gap » (of 1 or more) in a configuration of complementaries ?

For a given N-element configuration, why is it complete ? How could the element labels be comprehended to render it incomplete ? If a complete configuration of complementaries is like a chord, how can one detect when an element is being comprehended discordantly ? How complete/comprehensible is the configuration if the labels are translated into another language ? (49).

How does one learn to identify a configuration to balance « functional enemies » (cf. the role of a skilled hostess) and what is the complexity required to absorb a given degree of antagonism/challenge ? How can existing systems/networks be represented configuratively to facilitate comprehension ?

These skills of composition and balance are more art than science, but people could be helped in developing them. Without them, how could people be expected to favour a « balanced » programme or understand how to maintain the functional balance within an organization ? Stability (« half-life » ?) of collaborative comprehension of functions and the pattern of their interrelationship is the key - namely how we apprehend such configurations. How can we stabilize our focus on less probable configurations in the hope that there are « islands of stability » amongst them which could prove to be the basis of self-stabilizing alternative organizations ?

Current concern with correcting the bias in the western comprehension of science, change and time (50) could well give greater practical significance to a concept of an alternative organization as continually re-creating or re-envisaging itself by the recognition of processes which recycle levels of awareness associated with both its « ontogeny » and « phylogeny » through a form of a-temporal standing wave motion (51). In particular «what each is doing » and « what we are doing together » may be continually re-comprehended each at his own rate in the light of his experience, by participants and in relation to the whole possible range of meanings behind the labelled functions and structures into which ongoing activity could be classified (The organization is then the Word being continually and collaboratively enfleshed anew !)

Conclusions

The focus on configurations of challenge and harmony as modelled by the range of tensegrity structures would appear to offer possibilities neglected by the weaknesses in communication net experiments in social organization. Of particular interest is the manner in which « challenge and harmony « internalize « they and we » dichotomies in new patterns of dynamic stability. This also moves the debate beyond the somewhat sterile « hierarchical systems versus organizational network » perspective.

The special role of the computer in setting up and, if necessary, supporting such configurative communications indicates possibilities for a range of fairly well-defined experiments which could be undertaken in a computer conferencing environment. Such experiments could clarity some very interesting problems of comprehension and re-conceptualization in relation to the manner in which organization functions are perceived, whether individually or collectively, in order to maintain the stability of the configuration. Further work could well focus on the nature of non-dualistic complementarity in a wide range of traditional sets (e.g. gods, virtues, etc, even in mandala form) or their contemporary counterparts (e.g. values, needs, problems, etc), and how these are to be comprehended as sets. For it is from the stability, for a group, of less probable conceptual configurations that new forms of alternative organization could emerge - even if only for those who can maintain whatever conceptual discipline is required for a given degree of complexity.

Clearly this paper suffers from lack of precision and concreteness, but there is possibly even a configurative element in advancing this topic by tangential investigations which thus delineate the central focus without attempting premature closure within an inadequate framework. The possibility for experiment is however very concrete.

References

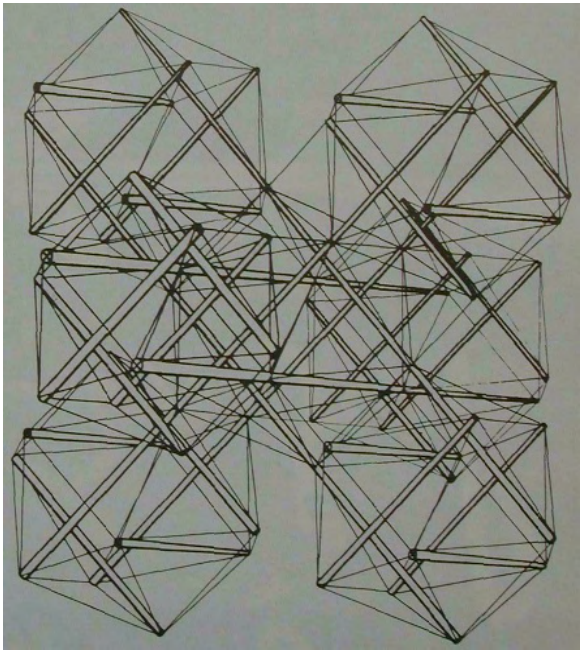
1. A J N Judge. From systems-versus - networks to tensegrity organization. Transnational **Associations,** 30. 1978. 5. pp 258-265.
2. David Norton Smith with A J N Judge Inter-organizational networking. **Transnational Associations,** 30. 1978. 10. pp. 429-434. bibl.
3. A J N Judge. International organization networks; a

   J R Groom (Eds). International Organizations; a

   1977. pp. 381-413.
4. - The network alternative. **Transnational Associations.** 29. 1977, 9. pp. 352-359.
5. - Organizational systems versus network organization. **Transnational Associations,** 29. 1977. 9 (pp. 360-364) and 11 (pp 479-484). An edited transcript of a debate on the question.
6. Sue and Linton Freeman. The networtkers network: a Study of the impact of a new communications medium on sociometric structure (Paper **presented at**

   East-West Communication Institute, Honolulu, 1979).
7. Alvin Toffler. The USA. the UN. and transnational networks. **International Associations.** 27. 1975. 12. pp. 593-599 (Extracts from testimony before the **US** Senate Committee on Foreign Relations).
8. Theodore Roszak. Person/Planet London. Goilancs, 1979, pp. 10-16.
9. A J N Judge. Practical problem in using the potential of INGO networks. In : The Future of Transnational Associations from the standpoint of a New World Order. **Brussels.** UIA. 1977. pp. **168-205.**

10- Tensed networks: balancing and focusing network dynamics in response to networking diseases. **Transnational Associations.** 30. 1978. 11. pp. 480-455.
11. - Networking diseases: speculations towards the development of cures and preventive measures. **Transnational Associations, 30.1973, 11, pp** 486-490.
12 - System/network complementarity. **Transnational Associations** 29. 1977, 9. pp. 365-368.
13. - Organization and lifestyle design: characteristics of a nonverbal structural language. (Paper prepared for the Internationale Konferenz Bedingungen des Lebens in det Zukunft und ihre Folgen für die Erziehung, Berlin. November. 1978).
14. - Viable **need** patterns and their identification through constrains on representation in 3-dimensions (Paper for a workshop on human needs of the Goals. **Processes** and Indicators of Development project of the United Nationals University. Berlin. May. 1978).
15. - Development : beyond « science » to « wisdom »; facilitating the emergence of configurative understanding in « Councils of the Wise » through computer conferencing dialogues. Transnational Associations 31. 1979.7/8, pp. 364-372.
16 - Representation, comprehension and communication of sets, the role of number. International Classification. 5, 1978. 3. pp. 126-133; 6. 1979. 1.pp. 15-25; 2. op. ... (In 3 parts).
17. Peter and Trudy Johnson -Lenz. Three ways to organize information. (Document communicated through the EIES computer conferencing system. 1979) Develops the notion of « groupware ».
18 Gennady Dobrov. Statement on « orgware » during planning meeting of the World Future Studies Federation, Berlin, December 1978.
19. Stam Roxane Hiltz and Murray Turoff. The Network Reading. Addison-Wesley. 1978.
20. Special issue on computer conferencing. **Transnational Associations,** 29. 1977, 10.
21. Arthur Koestier, The Call Girls. New York, Random House. 1973.
22. Christopher Alexander. Notes on the Synthesis of Form. Harvard University Press. 1964.
23. J C Jones. Design Methods; seeds of human futures. New York. Wiley. 1970.
24. R. Buckminster Fuller. Synergetics; explorations in the geometry of thinking. New York, Macmillan. 1975.
25. K Critchlow. Order in space: a design source book. London. Thames and Hudson, 1969.
26. Anthony Pugh. An introduction to Tensegrity. Los Angeles. University of California Press. 1976.
27 B E Collins and B M Raven. Group structure: attraction, coalitions, communication and power. In: The Handbook of Social Psychology. Reading, Addison-Westey. 2nd ed.
26. H Guetzkow. Differentiation of roles in task-oriented groups. In : D Cartwright and A Zander (Eds). Group Dynamics; research and theory. Evanston, Row Peterson, 1960. pp 683-704.
29. G Miller. The magical number seven plus or minus two; some limitations on our capacity for processing information. In his : Psychology of Communication. New York, Basic Books. 1967. paradigmatic dialogues. Tokyo. United Nations University. 1978 (Working paper).
31. A T de Nicolas. Meditations through the Rg Veda; four-dunensional man. Boulder. Shambhala Press. 1978.
32. Jacques Attak Bruits, essai sur l'économie politique de la musique. Paris. Presses Universitaires de France. 1977.
33. Ernest G McClain. The Myth of Invariance: the origin of the gods, mathematics and music from the Rg Veda to Plato. Boulder. Shambhala **Press. 1978.**
34. Marie-Louise von Franz. Number and Time; reflections leading towards a unification of psychology and physics. London. Rider. 1974.
35 P A Heelan. Quantum and classical logic; their respective roles **Synthése,** 21, 1970. PP 2-33.
36 Rammonan K Ragade Lattice theoretic approaches for a taxonomy of 20 games **General Systems,** 21. 1976. pp 61-72
37. E Kingalay. F F Kopstem and R J Seidl. Graph theory as meta-languaga of communicable knowledge In: M D Rubin (Ed). Man in **Systems.** New York. Gordon **and Breach. 1971. pp 43-69.**
38. H Corbin. The Man of Light In Iranian Sulism Boulder, Shambhala Press, 1978.
39. Unesco. Learning to **Be: the** world of education today and Tomorrow. Paris, Unesco. 1972.
40. Donald Michael. On the requirement for embracing error. In his ; On Learning to Plan and Planning to Learn. San Francisco. Jossey-Bass. 1973.
41. R Ducan and M Weston Smith (Eds). The Encyclopaedia Of Ignorance. New York. Pocket Books. 1977,
42. R G H Siu. Ch'i : a neo-taoist approach to life. Cambridge. MIT Press, 1974.
43. A J N Judge. Facilitating the networking processes lerencing. **Transnational Associations,** 30, 1978.4, pp 205-214.
44. Ted Bastin. A clash of paradigms in physics. In réf. 41,pp 119-127.
45. A J N Judge. Categorical straightjackets; PO, a suggestion for a depatterning device for international organisation descriptions. International **Associations,** 26, 1974. 3. pp 148-150.
46. - Interrelating viewpoints In complex meetings **Transnational Associations, 30,** 1978, 12. pp 542-546.
47. - Emergence of integrative processes in a self-reflective assembly. **Transnational Associations,** 30 1976.5, pp 271-276.
48. Scott Boorman. The Protracted Game; a wei ch'i approach to Mao's revolutionary strategy. Oxford University Press, 1971.
49. A J N Judge. Conceptual gaps and confused Distinctions: possible ambiguities in the translation of Interrelated concepts. **International Associations, 26.** 1974,3. pp 156-159
50. Unesco. La Science et la Diversité des Cultures Paris. 1974.
- Cultures and Time. Paris. 1974.
51. M 0 Waller. Chladni Figures: a study in symmetry. London, 1961.



STOP PRESS **Information just** received indicates **that the Hexiod** Project, launched in 1979 to link **such alternative** *communities* as Findhorn (Scotland). Arcosanti (USA), and Auroville (India) with *computer* ***conferencing*** **assistance, has been** deliberately **based** on the above tens*egrity* structure of R Buckminster Fuller (ref **24. page 430) - an** unexpected practical **confirmation of** some **of the** views **expressed in this** article. (**A description** of the **project** will **appear** in a future **issue of Transnational Associations).**