NEEDS COMMUNICATION

- viable need patterns and their identification

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INTRODUCTION

This chapter deliberately attempts to take a somewhat different approach to the much-debated question of human needs and to the related debate on human values. It is less concerned with which specific needs should be selected as a basic set and more with the constraints on the formulation of a viable set. In particular, it is concerned with the lack of consensus on a need set even within self-selected groups and the time spent on establishing distinctions that are not necessarily comprehensible to a wider circle.

There is a weakness in the debate process. The nature of the debate of needs that we have (and its associated confusion) implies a learning process on our part—if consensus is achieved. But whatever the conclusions arrived at, they have to be presented to others, thus presumably imposing an equivalent learning process on others. And the amount of time required to clarify such an issue within an "informed" group is a measure of the confusion that will continue to surround the subject prior to any learning process—since each generation comes to it afresh, and deliberate attempts will continue to be made to exploit the confusion.

The emphasis here is therefore not on need definition but on the framework within which a need set is defined. This leaves the definition process open, rather than aiming for closure and thus stifling alternative reconceptualizations. Hopefully by focusing on the framework more can be understood about relationships both between needs and between the highly diverse perceptions of needs. This should provide a support for the debate, as well as a degree of order, without attempting to settle detailed problems that may not in fact need to be settled.

Many of the points made somewhat briefly in this chapter have been examined at much greater length in a more general paper that does not make specific reference to needs or values.[1]

STRUCTURED NEED FIELD

It is usual to assume that needs exist in isolation from one another with well-defined boundaries between them. This neglects the process of need identification that separates out the need in a manner determined by the individual's perceptual processes. The boundaries are imposed. It also neglects another important factor in the process of applying a verbal wrapping or label to the bounded need. Namely, that particularly in this domain, words are highly ambiguous (and increasingly so, the more sectors and cultures involved) and do not contain or exhaust the meaning of the need identified. At best they can serve as pointers. In the light of these remarks it is appropriate to start from the assumption of a need field within which what can be distinguished as needs are in fact woven together in a "seamless web." Johan Galtung makes the point that "A list of needs looks like a list of components. The question is: what is the whole that has been subdivided to deliver that list, and what, if anything, has been lost in the process."[2]

Clearly, the key question is whether this need field has any structure.[3] Without discussing specific needs, suppose that there is consensus in favor of a two-need set. Implied in this decision is the notion that the two needs are (see Annex 1)

1. Independent but mutually relevant—namely, that they are compatible. The one is not meaningful without the other. The two constitute a complete set.
2. Of the same logical type, making contributions of the same kind to the set as a whole.
3. Of distinctive character.

Two problems arise in attempts to understand the structure of need fields.

1. There is decreasing probability of consensus on a need set as the number of needs included increases. In the first instance it is unlikely that a 500-need set or even a 100-need set would be formulated. Second, its viability as an ordering factor in knowledge and social change would be low. It would not attract significant support for any length of time. There is a very marked tendency to formulate need sets containing only a limited number of needs (e.g., four to ten).
2. Even where the number of needs is low, there is considerable variation in the needs included in such need sets, depending on the context within which consensus is achieved. Part of the problem derives from confusion over the boundaries to the meanings associated with word labels for portions of the need field. Part derives from different degrees of sensitivity to different portions of the need field.

OUTLINE OF A METAMODEL[4]

Some evidence is available that indicates that the probability of inclusion of N terms in a set of this kind bears a close relationship to the form of the relative abundance curve for isotopes (see Figure 12-1).[5] The peaks in the curve indicate more stable configurations. There is strong evidence that this stability is based upon favored geometrical configurations governing the three-dimensional arrangement of spheres to form a compact whole. It has been argued that there is at least some probability that such "packing constraints" would govern the preferred ordering of concepts in the mind, given man's seeming inability to comprehend within a four-dimensional framework.[6]

From this it would follow that there is a greater probability of a viable need set being formulated with certain numbers of needs rather than with others, although this probability would decrease with an increase in the number of needs. This raises the question of how to explore such viable sets and the dynamics resulting from formulation of a less viable set.

The following procedure gives a way of predicting and ordering the multiplicity of perceived needs. First, in the case of "human needs," in how many ways can needs be distinguished by subdividing the set?

Two-Level Distinction. The set may, for example, be split into two subsets, but in how many ways may this be done in a particular case? Depending on the level at which the distinction is made, there may be one, two, three, four, or N recognized two-level distinctions—namely, the most fundamental distinctions and successively less fundamental levels of distinction. Clearly these are not unrelated, since the less fundamental distinctions are regrouped in distinctions at more fundamental levels. For example, at the level at which only four distinctions can be recognized, the regrouping would tend to bear a relationship to the level at which only eight distinctions are made (by regrouping pairs of distinctions). On initial examination of

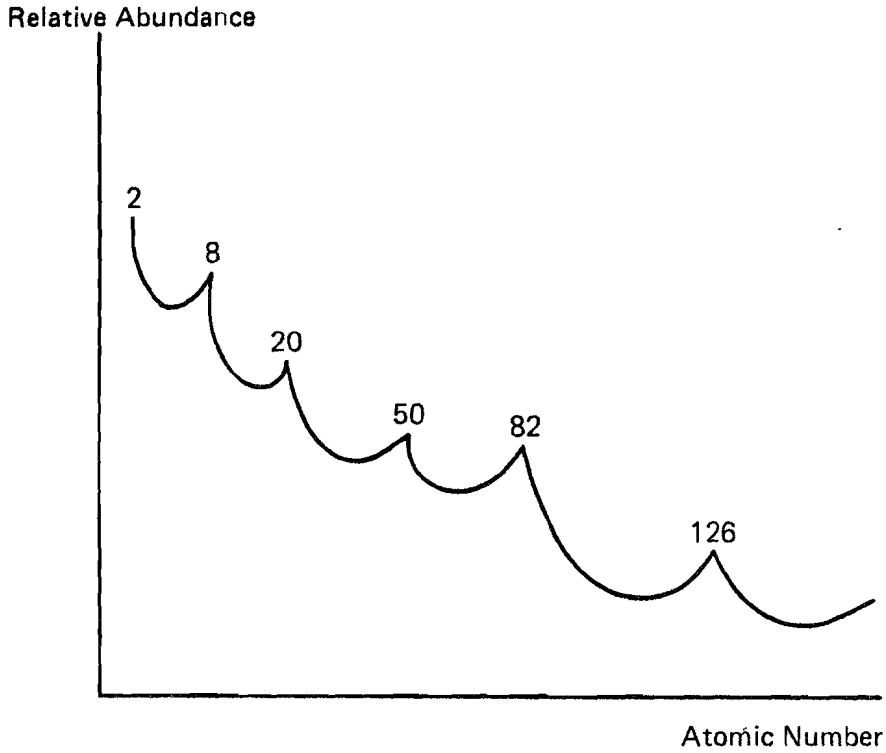


Figure 12-1. Indication of Progressive Decrease in Relative Abundance of Isotopes of Increasing Atomic Number.

all such two-level distinctions, there would tend to be some confusion as to the level to which they should be allocated in order that the most fundamental should not be embedded in a set of less fundamental distinctions. The probability of any particular two-level distinction being advocated as most fundamental is likely to be higher, the greater the number of possible distinctions at that level. (Namely, it is less likely that the more fundamental two-level distinctions would be recognized.)

On the other hand, this tendency is counterbalanced by the lower stability, viability, and acceptability of the less fundamental distinctions. Over longer periods of time they are meaningful to fewer people and are of less value to the ordering of perceptions, however vigorously the use of any particular one may be advocated.

In sorting out the level to which each two-level distinction belongs, reference may be made to the pattern of relations between the various distinctions at that level in the light of the underlying qualitative characteristics of the number associated with that level (see below).

Three-Level Distinction. The set may, however, be split into three subsets. As before, it is a question of the number of ways in which this may be done in a particular case. The argument above applies again.

N-Level Distinction. Clearly the argument may be generalized for *N*-level distinction, although, in the light of earlier arguments, *N* is unlikely to exceed about 10.

Now the procedure adopted to clarify the ordering at any particular *N*-level effectively clarifies the nature of the most fundamental distinction for $N = 2, 3, 4 \ldots N$. This in turn provides an ordered configuration of aspects that exemplify the nature of the original totality (i.e., $N = 1$) that was explored by subdivision. Since the dis-

tinctions are made and labeled with words, it is vital to recognize that the result of the exercise is an approximation. Closure is not possible, for the future will necessarily develop a better sense of the significance of such fundamental needs. In addition, within whatever context this is performed, the result as a whole is colored by the constraints of that context. The resulting order only reflects a larger or smaller aspect of a more comprehensive series of meanings that could have arisen if a wider range of inputs had been incorporated.

In addition to proceeding by subdivision, clarification concerning a named need may be sought by determining that it may be considered to be a part.

Two-Level Combination. The set may, for example, be paired with one other set to form a two-element set. But in how many ways may this be done in a particular case, given that the pairing cannot be arbitrary but must be based on some aspect of the quality associated with the number 2? Such combinations could be ordered and clarified as suggested by the previous section.

Three-Level Combination. The set could be grouped with two other sets to form a three-element set. As before, it is a question of ordering the ways in which this may be done to clarify the many possible aspects of the superordinate set.

***N*-Level Combination.** Again the argument may be generalized, although it is unlikely, as before, that the total in the resulting set would exceed about ten. In this procedure it may well be that particular combinations are not meaningful or useful. Clearly it becomes increasingly difficult, as N increases, to integrate the original set into a combination. But at any stage, a further procedure may be adopted to identify the successive elements of $N-1$, $N-2$ . . . $N-M$ combinations. This clarifies the aspects of the nature of the more fundamental superordinate sets (where $N-M=1$) that may underly any given set.

Comment

Both procedures ensure that any given set is embedded in a context. In the first case, this is in relation to alternative (or more superficial) possibilities. In the second, it is in relation to more fundamental possibilities.

By such procedures a particular set is tested and refined in a manner that should establish the constraints on its meaningfulness and communicability to those who—in contrast to the set's vigorous advocates—may be sensitive to other aspects of the context in which it is embedded. The procedures necessarily highlight the extremely limited value of dependence on the univocal, unambiguous meaning of any words (in definitions) used to label such sets or their elements.

It should be stressed that, in contrast to the usual competitive preoccupation, the concern is not with establishing any particular set as the most valid. Rather, it is to give some understanding of the probability that any such set will be advocated, perceived as valid, or widely comprehended and communicated. At the same time it supplies a context for elucidating the meaning underlying whatever marks (words, numbers, codes, etc.) are used to identify a set and its elements.

Contrary to widespread assumption, formulation of a N-term set is not without its "side effects." It is fairly obvious, for example, that a two-term need set establishes a dynamic both for those who conceptualize about needs and for those involved in any institutionalization

in response to them. In this case the dynamic arising from the dyad would have any or all such dyadic qualities, as active-passive, right-wrong, we-they, dominant-subordinate, conflict-complementarity, and so on. Namely, the very choice of a two-term need set establishes the nature of the dynamics surrounding its use (e.g., between two agencies or professions, each responsible for one of the needs and consequently competing for resources). It is equally obvious that promulgation of a one-term set (e.g., the need) gives rise to another kind of dynamic. It is, however, much less obvious what kinds of dynamics tend to be associated with sets of a larger number of terms. Like it or not, certain interaction qualities are built in by choice of the number of set elements. If ignored, they will erode or completely undermine the effectiveness of any action based upon them. They define the problem by which an *N*-term-based initiative will be counteracted or nullified.

NUMBER-CODED NEED SETS

In investigating the implications of the above points, it emerged that the fundamental attributes isolated at this level of concern were ultimately related to the qualities associated with certain numbers. In fact the use of numbers to "code" such qualities gave a much less ambiguous means of representing them than via words with their many polysemantic associations. The problem, however, is one of comprehending the qualities involved, given the widely recognized inability to get beyond dyadic thinking.

The above outline suggests a way of deriving a well-ordered range of needs whose characteristics would be exemplified by the qualities associated with the number coding. This would be based upon the identification of a "primary" need (one term) and a "secondary" need (two term) to establish the series for which higher terms would be increasingly difficult to identify.

Because of their verbal ambiguity, such needs would be identified as a "fuzzy concept" having "something to do with":

One-Term: wholeness, identity, boundedness of the human being. Clearly this could focus (depending on the preference of the set creator)

- on the biophysical level, leading to a series concerned with the conditions for a viable biological animal (a necessary precondition for any "human" characteristics);
- on the psychological level, leading to a series concerned with the condition for a viable psychological being. And in this one-term case, R. D. Laing's concern with ontological insecurity is relevant.[7]

Two-Term: polarity, duality of the human being.

- on the biophysical level, this would imply the need for exposure to such conditions as heat-cold, light-dark, up-down, and so on as a basic environmental stimulus in terms of which biological processes can be ordered (cf. the consequences of sensory deprivation);
- on the psychological level, this would imply the need for dualistic stimuli such as a sense of pleasure-pain, we-they, approval-disapproval, and so on as basic stimuli for the orderly development of the "human" being.

Carrying such series on to three or more terms is a challenging exercise in view of the difficulties of comprehension. One attempt that could be adapted to a human needs series is illustrated in Annex 1.

Such an approach would seem to identify primary needs that are so basic that they are not usually considered in the human needs debate. The intermediate terms in the series should cover those conventionally included in such sets, whereas the higher terms should identify much more subtle needs that are usually ignored for that reason.[8]

There is a tantalizingly elusive relationship to the current techniques for investigating and representing macrodynamics. This is itself interpreted in terms of catastrophe theory—namely, the theory of the transitions of attractors (macrons) in a phase space, which is the basis of the geometry of macrons as it has developed so far.[9] The interesting question is what macron patterns the mind chooses to recognize under different circumstances. The ramifications of this question are discussed elsewhere,[10] and it is interesting that the same authors are cited by Erich Jantsch in considering the archetypal implications of the decomposition of a whole in relation to modes of learning, evolution of consciousness, and methods of inquiry.[11] For example, von Franz, a Jungian scholar, states of the time-bound qualities of the first four numbers:

> one comprises wholeness, two divides, repeats, and engenders symmetries, three centers the symmetries and initiates linear succession, four acts as a stabilizer by turning back to the one as well as bringing forth observables by creating boundaries, and so on.[12]

Jantsch notes that it is the transitions between these four basic qualities that symbolize how a gestalt system maintains its nature (to comprehension?) in the presence of many temptations to become formalized. And it is the first step from one to two that constitutes the "original sin" of formal division which, according to Pankow, "separates the two sides of complementarities and treats them as identities."[13] He relates this to the work of Spencer Brown and concludes:

> therein lies a formal justification for the ultimate complementarity of the search without (in the physical world) and the search within (in our own experience), "for what we approach, in either case, from one side or the other, is the common boundary between them."[14]

RELATIONSHIP TO EXISTING NEED SETS

In order to clarify the nature of this approach, it is appropriate to consider some examples of need sets. Carlos Mallmann, for example, has produced a table of need categories in Chapter 2.[15] This makes the following four-term distinctions:

existence/living	growth
co-existence/co-living	perfection

which group the following eight-term distinctions:

subsistence	esteem	transcendence
security	development	maturity
belongingness	renewal	

He also redefines the same need field in terms of nine-term distinctions:

maintenance	understanding	creation
protection	self-reliance	meaning
love	recreation	synergy

Johan Galtung (Chapter 3) has, on the other hand, produced a list of "basic human needs" that at the four-term level appears as:

security	identity
welfare	freedom

He also chooses to distinguish more specific needs within each such category (as indicated by the numbers in parentheses), making a total of twenty-eight needs.

As is to be expected, there are various kinds of overlaps between the Mallmann and Galtung versions. Comparison is, of course, difficult because the meaning of the terms is necessarily elusive and there is no means of cross-checking the adequacy of mutual comprehension, however precise the verbal definition. Furthermore, Katrin Lederer makes the point that

> as needs are theoretical constructs, any researcher's notion of even general categories of human needs is dependent on his or her perception and thus dependent on her or his value system. Therefore, any categorical system of needs is in principle as "good" as the next one. There is no logical criterion for deciding that any system is more complete than others.[15]

There are therefore two problems to be faced: (1) comprehension and communication of the meaning of each term; and (2) comprehensiveness or completeness of the need set. These are even more challenging if one requires of the above authors to each define their need sets at the two-term level, regrouping the four-term elements. In the case of Mallmann, this might be achieved with "being" (i.e., existence with coexistence) and "becoming" (i.e., growth with perfection).

At this level of abstraction, however, the adequacy of comprehension of such terms must be constantly called into question—even more so were the one-term level to be approached through this framework, leading perhaps to the term "life" in its richer sense. This is the need field labeled as a continuity to which other labels may also be applied, each clarifying an aspect of the human need at this level of abstraction. Paradoxically, the richer the sense of a one-term need set, the less "operational" it becomes in the conventional context. (The converse is, of course, also true.) Were the accent to be placed on "survival," the task might appear less problematic. The question must always be how narrow or limited is the concept of the need associated with the label, for clearly the more inclusive the concept, the greater the convergence between "life" and "survival," for example.

The completeness of the set may be tested, as suggested above, by asking of any need term (1) how it might be subdivided into subsets; and (2) with what it might be combined to constitute a superordinate set. The question is, What is the need (set) with which a given need (set) can be combined in order to enrich the significance conveyed by the individual term labels used and to render comprehensible the more abstract (fundamental, subtle) need set of which they are an articulation? And what alternative subordinate sets of needs can be identified to challenge and deepen superficial comprehension of any particular set of need terms?

It is interesting to explore the relationship between Mallmann's four-term and eight-term sets and the shift in significance in moving to the nine-term set. The whole question of the status of needs repressed from (or unexpressed in) such need sets requires careful

exploration. It is too early to accept the judgment that it is only a question of the individual's predeliction and his ability to sway others to his viewpoint.

NEED REPRESENTATION: ANTIQUATED, PREMATURE, AND UNEXPRESSED NEEDS

It may be useful to think of the question in terms of a rubber sphere whose surface represents the continuity of the human need field. Each individual distorts such a sphere in a different manner, creating "continents" of expressed needs projected beyond the equilibrium mean position and intercontinental "troughs" of unexpressed needs below that mean. The topography may be expected to change over time in response to the individual's changing understanding of his short- and long-term circumstances and priorities. Furthermore, the "resilience" of the sphere may be expected to ensure that, over a sufficient spread of cultures or period of time, each need will be expressed or represented.

This representation fails to clarify the tricky normative question of needs that "should be" positively valued by society. It is doubtful whether the highly charged issue of the positive systemic function of negatively valued needs in a dynamic, evolving society could be examined at this time—either (1) as a corrective to the misuse of satisfiers of needs positively valued by society, or (2) as a trigger to provoke collective social recognition of hitherto ignored needs.[16] This raises the question of how needs may be misunderstood or perceived as irrelevant. How do we "discover" the unrecognized needs of the past? What are the articulated "basic human needs" of the year 2050 that we are now unable to recognize as significant—and why is that so? Using the metaphor of a food diet, are there psychosocial "trace element" needs the consequences of whose nonfulfillment take some time to manifest and are, by definition, difficult to detect other than by the obscure symptoms of their absence?

Why is it that both Mallmann's and Galtung's need lists stress the needs of the individual and ignore the social systemic effects on the individual of the attempt to fulfill those needs? They list the needs that can be associated with positive ("growth facilitating") feedback loops, presumably on the assumption that negative ("growth constraining") feedback loops are not, or at least should not be, associated with needs. Then at what level are they to be taken into account? If such constraints are considered to be societal rather than human needs, then this opens the door to all the distortion and abuse to which Galtung has drawn attention once the individual is no longer the measure of all things. (If they are labeled "responsibilities" rather than needs, in order to shift them into a separate arena of debate, then there is still a basic need for such responsibilities to be fulfilled by the individual, thus reintroducing them into this debate.)

In most cases the identified needs reflect the current preoccupation with deconstraining the individual, as with the adolescent attempting to throw off the paternal and maternal scaffolding of family life. But they do not contain any element of the self-constraint needed by the adult in a bounded society—unless generous interpretations are given to some of the terms used.

The needs identified imply no limits to personal growth (contrasting sharply with the supposed limits to economic growth, possibly ignored for a similar reason), although maturity in many realms is acknowledged as being associated with an appropriate

recognition, internalization, and structural use of limitations (e.g., artistic media, military strategy, Taoist philosophy,[17] design, etc.). By failing to note the need for limitations as a catalyst for qualitative maturation, the implication is one of personal growth by quantitative "spread" (reinforcing analogous tendencies at the collective level). There is, for example, no implication of a basic human need for a self-imposed constraint on reproduction or for any other form of self-discipline, including resource conservation. Because such a constraint is not yet a well-articulated felt need, the individual (or the following generation) engenders and is subsequently faced with the social constraints arising from the lack of such self-constraint and will emit the complaints (of a child expecting succour) that basic human needs are not being fulfilled as completely as desired.

The confusion is most strikingly dramatized in the case of the ultimate form of self-constraint—namely, death (as contrasted with "life" in the previous section). Need lists tend to be linear and unidirectional in ignoring the cyclic significance of aging and death as the necessary counterparts of growth and birth, almost implying a static childlike belief in eternal youth and everlasting life (in an endless summertime). This would be an immediate demographic disaster. In the light of the current image of man, there is a basic human need for gradual aging and the eventual death of the individual, whether

1. Suddenly, as an intrinsic feature of some sports (climbing, motor racing, etc.), where it is only by total personal risk that a vital sense of reality is achieved (directly or vicariously, misplaced or not), or as associated with any form of heroism, itself a vital focus of drama in every culture;
2. As a consciously perceived climax of a life lived and developed to its fullest extent (cf. the death of Tagore, Aurobindo, Jung, etc.), in which age is felt to be a consequence and a measure of experience;
3. As a merciful relief for those acknowledging exhaustion at conditions they consider impossible to overcome meaningfully (cf. the euthanasia and suicide issues and the associated embarrassment); or
4. As a basic necessity in a bounded society enjoying the unconstrained reproductive process and its fruits, but with limited resources and currently dependent on death for role renewal and social change (even in so-called revolutionary societies).

Further exploration would probably show how it is such blindspots in the perceived need set of a culture or an era that define very precisely the problems by which it will be challenged or destroyed. (This is also true of the development cycle of the individual personality.) Such problems become the vehicle for the expression of the ignored needs. In this way, for example, warfare, illness, and famine have been tacitly used by societies as a way of allowing the level of their populations to be controlled. Despite efforts to avoid this path, an alternative has not been located, and many have articulated the consequences to be anticipated in the near future.

An approach to these questions is by focusing on the possible "distortions" of some "conceptual surface" that is used to represent the complete range of needs.[18] Some kinds of distortion may favor recognition of grosser, cruder, or more selfish needs, obscuring the subtler needs that are only to be fully recognized by the future. A focus on such a surface might also clarify possibilities for "displacing" the focus of a need—a need to dominate focused on people may perhaps be usefully displaced onto one's own emotions or thoughts.

If there are criteria for distinguishing between more and less complete sets of perceived human needs, these are likely to emerge from the constraints on the representation of such sets, if they are to be comprehensible as sets of interrelated needs. This has been discussed elsewhere.[19] It may be that the Galtung-Mallmann type of "deconstraining" need set should be balanced by a corresponding set of "constraining" needs (possibly on a one-to-one basis). The models discussed here facilitate exploration of this question.

NEED REPRESENTATION: LISTS AND MATRIXES[20]

Clearly the most favored representations of a total set of human needs are the list and the table-matrix. However, both conceal the question of completeness, as noted below.

A list does not order the relationships between its elements except in relation to nested sublists or in the case of a list in series form. This does not imply that such relationships are lacking, merely that they cannot be reflected in the list form. Note that a list is in fact a series of "points," but it is not necessary to conceive of it as such. The points could be represented as areas on a surface. It is only in the matrix that the manner in which the total area is cut up becomes explicit.

The cells of a matrix may be thought of as subareas of the area representing the totality that the matrix attempts to reflect. The subareas are, of course, positioned with respect to column and row commonalities. It is now interesting to ask why the area is bounded in such a limiting manner, for the rectangular or square form is one of the simplest. It provides a (paned) "window" through which the totality may be perceived. But it raises questions about the "wall" in which the window is set and the position of the observer in relation to the observed on the other side of the window.

Now to the extent that the matrix is complete in its coverage, there really should not be any "wall." The matrix should in such cases in effect "wrap around" the observer; all is window and nothing is implicit, unexplicated, or excluded. If this is not so, then the wall should be conceived as wrapping around the observer, possibly with other windows corresponding to other partial views of the external totality to which the observer may turn his attention.

From this point of view the conventional two-dimensional matrix raises the question of the conceptual significance of crossing the encompassing boundary. It seems irrational and unmeaningful because the wall is unrecognized. There is almost a flavor of danger of "falling over the edge," as sailors feared with the early "flat earth" models.

If it is assumed that the matrix is complete, then it should be possible to represent it without such an arbitrary external boundary. If the external boundary is eliminated, then the matrix takes the form of a closed surface (wrapped around the observer). By what procedure can a two-dimensional matrix be so modified, and to what does it give rise?

Consider a two-by-two matrix. The simplest symmetrical figure that retains the same number of areas is the tetrahedron. It provides four "windows" on the external universe for any observer positioned within.

The continuity of surface area of the three-dimensional figure emphasizes any functional continuity between the aspects associated with the individual subareas or facets (the "panes"). But at the same time, it draws attention to the discontinuities between the areas

associated with the edges. They are not smooth transitions but are marked by sharp angles. It may then be asked (if reality is continuous in contrast to our conceptions thereof) whether such a representation suggests others that would reflect a lesser degree of discontinuity between aspects. And indeed there are, for the greater number of symmetrically disposed surface areas ("panes"), the larger the angle between adjacent areas and the closer the approximation to a continuous surface—namely, a spheroid.

However, the greater the number of distinct areas (whatever they signify), the more difficult it is to comprehend the totality with any precision. The patterning of the surface area may be readily scanned, but it is only through the "distorted discontinuities" of the simpler and most unspherical figures that it may be grasped to any degree (e.g., those corresponding to the simpler matrixes). A compromise may be considered, however. Even a tetrahedron may be projected onto a circumscribed sphere. This cuts up the surface of the sphere into four (spherically) triangular areas. More complex figures would, of course, result in more complex patterns on the surface of the sphere.

The challenge is to maintain continuity, but the realities of the discontinuities between extant conceptual frameworks may suggest that any such goal is idealistic. Disturbing factors are:

1. Unequal development: Clearly, a particular cell of a matrix may itself be broken down into more subcells than is yet possible with its neighbors. Such differences would be reflected in the surface patterning of the associated sphere. (The intermediate three-dimensional figure would naturally be asymmetrical to a corresponding degree.)
2. Gaps: Assuming that the original matrix was incomplete to the extent of missing one row, for example, then its "presence" could be indicated by an appropriate number of (shaded) areas on the surface of the sphere—if their "absence" from the total pattern had been remarked, of course.
3. Zones: Assuming that originally there were two or more unrelated matrixes that each encompassed aspects of the reality to which an observer could be sensitive, then their representation on the sphere surface would give rise to patterned noncontiguous zones separated by unmarked (shaded) areas reflecting the discontinuity between them. (The rules for projecting the plurality of intermediate three-dimensional figures onto the surface would be more complex than before.)

The manner in which these disturbing factors are handled indicates the freedom associated with this representational approach. Clearly distinct matrixes either could give rise to distinct spheres or could be incorporated onto a single sphere as noncontiguous zones (case 3). On the other hand, the possible articulation into many nested levels of a particular cell in a matrix (case 1) could be handled by representing the latter on a separate sphere if the totality of its special perspective needed to be stressed. List elements, represented by areas (see above), could be disposed around the surface of a sphere on the basis of a projection of a three-dimensional figure with the appropriate number of sides. If the list was not "complete," then gaps in the spherical surface would be required (case 2).

NEED REPRESENTATION: PATTERNS OF CONTIGUITY

In a matrix it is clear how the cells relate to one another. Once the boundary is eliminated, however, the question of what is contiguous to what is raised. Also, in a two-dimensional matrix there

are two types of contiguity (row and column) between cells. But, considering the simple example of a two-by-two matrix transformed into a tetrahedral surface, the validity of juxtaposing areas may be questioned.

Enantiodromia: A strong objection that may be made to juxtaposing cells at opposite boundaries of a matrix is that they obviously reflect extreme poles of distinction. And yet there is much to suggest the intimate relationship of extremes.[21] Whether it is the French phrase "les extrèmes se touchent," traditional Chinese concept of the continuous transformation from yin to yang and vice versa, or the classical Greek dramatic notion of enantiodromia, in all cases there is a functional continuity that the matrix form conceals. On the other hand, the matrix itself may be missing rows and/or columns, in which case juxtaposition would be inappropriate.

Valency: In a two-dimensional matrix, all cells have a valency of four (neglecting the boundary question discussed above). The better known three-dimensional closed figures may have surface elements of valency three, four, five, six, eight, and ten, and although not all combinations are possible, this implies a greater richness than can be adequately captured by a matrix and a richness whose continuity is maintained in its projection onto a spherical surface.

Linkage lines: In a two-dimensional matrix, the links between cells of the same row or column are clear. Such strings of areas may also be present on the three-dimensional closed figure, although partial strings are then also feasible.

Matrix projection: Although it is acceptable to portray a map of the globe as a "matrix" of latitude-longitude cells, despite the distortion, a less distorted representation is achieved by using other projections that depart from the rectilinear mode. These clarify to different degrees the time relationship between the areas as projected from the position of the observer. It is possible that representation of matrixes could benefit from being seen in this light.

Complementarity: In some matrixes, complementary pairs of cells are evident. Such complementarity may be even more evident in the symmetry of three-dimensional closed figures.

REPRESENTATION OF *N*-TERM NEED SETS

In order to clarify and facilitate the process of exploration advocated above, it is useful to look at the representational possibilities. This can be done in two or three dimensions (as indicated in Annex 2). The latter constitutes a framework for richer insights and signals more interesting constraints on the problem of identifying "stable need sets."

These questions can be explored using the strut models of Annex 2 as a guideline. The struts may be conceived as "incompressible" (or irreducible) needs. (An alternative set of insights may be obtained by treating each vertex as a need, allowing the struts to signify counteraction or conflict between needs—especially between "constraining" and "deconstraining" needs, as suggested above.) But their relationship to each other must be governed by a tensional network (of norms?) to avoid privileging any particular need or allowing it any special freedom with respect to the others—for this would give rise to an "unbalanced" set of needs.

On this basis (and in the light of the series presented in Annex 1), consider the following:

One term: A one-term set is inadequate. Things are not that simple or that static. Growth of the need (i.e., the strut) has nothing to restrain it.

Two term: A two-term set is also somewhat simple. The changing (oscillating) relationships of the needs to one another can only be stabilized by using four tensions. The system is, however, too abstract to take a form in 3-D.

Three term: The new term transforms the polar dynamics into a mediated system.

2-D: There are two ways of representing this in 2-D. One requires "tieing" the needs (struts) directly to each other to form the conventional triangle. Here no need can grow unrestrained unless the two others grow with it. In the other form, one "end" of each need is "tied" directly to one of each of the others; but this must be stabilized with three tensions. Again, no need can grow unless the whole systems grows. Both systems are, however, still too abstract because in 3-D, raising a free need end collapses the second system or, in the case of the first, rotates two struts about the third.

3-D: A stable structure can be formed in 3-D if twelve tensional links are provided; it is not truly symmetrical, however, because the struts cannot pass through the same central point. (Note: It is relatively difficult to form this structure.)

N-term: No attempt will be made to interpret the significance of each new term, since it is widely recognized that the four-term situation and above pose problems of comprehension.[22] Annex 1 constitutes a guide, but an unsatisfactory one for that reason.

Use of the strut models may be considered trivial, but the assumption here is that this is not the case. In fact, it is suggested that they provide the basis for a kind of "language" with which to discuss and compare need sets. This language is only necessary, of course, if it is assumed that the relationships between the needs (the need "pattern") merits as much attention as the sum of the needs taken in isolation.

Clearly such a language would require much more detailed investigation to discover its strengths and weaknesses. But some of the possibilities are as follows (see Annex 2):

2-D/3-D: The two-dimensional representation seems to indicate a potential pattern, but the possibility of actualizing it as a viable need set is only indicated by a stable three-dimensional strut model.

Symmetry: The degree of symmetry seems to be a good indicator of the overall equitability of the implied need pattern.

Strut length: The strut length in any given pattern may be considered an indicator of the need strength. Since it has been assumed that need patterns should be equitable, the lengths would tend to be equal. The tension pattern may be conceived as compressing the need struts to such an equitable pattern. Of special interest is the possibility of nesting one such pattern within another, with only tension links between them. In such a case, the scale at each level may be assumed to be different—that is, a given length in the smaller nested pattern may represent a need of much greater

strength, given that each such a need pattern is stabilized or balanced at its own level.

Tension length: The above remarks also apply to the tension lengths, tentatively assumed to represent norms. Clearly, norms of different strengths should be associated with need patterns at different levels; otherwise asymmetry and imbalance immediately arises. It should be noted that the strut models very soon hit a constraint of equal tension length as they increase in complexity. If this is relaxed, a large series of models can be produced with two types of tension link differing in lengths by about 10 percent. At somewhat greater complexity, the same is true for strut lengths.

Geodesic models: At a certain level of complexity, a large range of models can be produced in which the struts and the tension links become coterminous. The notion that needs and norms could coincide under certain conditions is of great interest.[23]

Angles: These seem to be an indicator of mutual relevance of significance.[24] Prior to the geodesic series, the angles between tension link and strut are quite large, possibly signifying the stress of conflict between them.

Thresholds: As is indicated by Annex 2, different kinds of thresholds are reached. New possibilities for interrelating needs in a stable pattern emerge.

Explanations of this kind can only be an indication for possible future work, some of which has already been envisaged in more detail in a related article.[25]

IMPLICATIONS

The approach outlined above has the following implications:

Descriptive

1. A stress is placed on the holistic nature of need patterns, but without losing ability to focus on specific needs.
2. Use of a strut model "language" helps to draw attention to the ambiguity of verbal need descriptors that neither contain nor exhaust that which they signify. This reduces the obligation to devote considerable debating time to establishing, maintaining, and clarifying the boundaries of specific needs. Specific definitions are not required.
3. The manner in which one need may impose limits on the satisfaction of others is clarified, particularly when needs cannot be fulfilled simultaneously.
4. The nature of a complete need set becomes much clearer—namely, how many needs are linked in what way, so that if there is a desire to have an eight-need set or a twelve-need set, the various possible patterns can be shown with some indication of what they are likely to be, given the kinds of need selected. The relationship between need sets having different numbers of needs is clarified.
5. The implications arising from incomplete or overcomplete sets may be explored with greater ease.
6. The nature of need patterns and subpatterns (and their degree of independence) is also clarified as an aid to discussion.
7. Indication is given concerning the possibility of redefining a single need in terms of a pattern of less fundamental needs that may be more easy to fulfill. To some degree need patterns may substitute for one another.

Transformation and Growth

8. This approach implies and indicates alternative pathways through alternative stages in need pattern elaboration—given that there is an interlocking series of transformations between the different configurations of the strut models (or the polyhedra on which they are based).
9. It brings out very clearly the nature of the succession of stages of need patterns in any progress toward maturity, without imposing any elitist interpretation on this. Each need pattern is an indication of the predominant influences in a way of life. If a need pattern can be complexified to new levels of stability and maintained there, this is an indication of development and maturation in the style of life. This is, of course, only possible if the most basic needs are satisfied in a balanced manner.
10. The nature of the possible transformation of the need structures is highlighted in "progress" toward maturity or in "regression" toward more simplistic need patterns. This discourages any concept of the most basic human needs as the only pattern of needs; it points the way to more subtle patterns of needs.
11. In a less analytic manner, a concept of human growth is indicated that is not dependent on the rather suspect and overabused terminology currently available.
12. The approach distinguishes between (a) change in need patterns about an equilibrium point (namely within a particular strut model); (b) growth to a new equilibrium pattern of need (namely, as represented by a new strut model within the same series); and (c) growth via an alternative pattern of need (namely, as indicated by strut models of different patterns but of equivalent complexity).
13. Transformation and growth clarify how development is a problem of elaborating new and more appropriate need patterns—namely, displacing cruder patterns, in which interneed conflict is more direct, by patterns in which it is more indirect and better contained by the structure as a whole. Any implication that development should eliminate needs (or related problems) should be questioned. (Most occupations, for example, are associated with need fulfillment or with the attack on, or defense against, problems. Models of a need-free or a problem-free society have little credibility and have not been successfully outlined, even in fiction. They are boring and offer no challenges, and it is questionable whether they are viable, even in the short term.) The focus should be more on the displacement of problem-need patterns by "more sophisticated" patterns, and the challenge is to determine the nature of such potential patterns and their relationship to the existing ones—and to avoid "regressing" to "more primitive" patterns.
14. The approach avoids implying that a need set is definitive for all time. A need set elaborated this year will not necessarily be valid in five years time, particularly when an agreed set quickly becomes institutionalized, resistant for further modifications, or a vehicle for interinstitutional conflict; hence, the value of incorporating the possibility and direction of need set refinement in the need set by the manner in which it is represented. This reduces the tendency of agreed need sets to reinforce any simplistic style of organization. Adding, modifying, or removing items does not change the hierarchical pattern of simplistic need lists significantly, for it is at the pattern level that the challenge lies.

Isomorphism

15. A particular need pattern may be seen as having isomorphic relationships to (a) the psychosocial development process (given that the pattern is intimately associated with psychosocial processes of the individual); and (b) the pattern of organization units whereby such processes can be maintained and facilitated.
16. From the previous point, it seems clear that the conventional structured list or hierarchy of needs is inadequate to the task of representing the interrelationships between the needs as they emerge under real conditions. Need "hierarchies" in particular imply a real or hoped for "dominance" by a particular need. As such they lend themselves far too easily to adaptation by the bureaucratic process. (Each need in the structured list becomes the concern of a subsection of that agency. The interlinkages between needs may then be conveniently ignored if they do not match the hierarchical channels of the bureaucracy—or are only paid token attention.) The nature of need "dominance," if any, is thus totally distorted. This is not true in the case of "tensegrity organizations," to which these need patterns should be isomorphic.[26]
17. There is clearly an intimate relationship between "need patterns," "value patterns," "problem patterns," and "patterns of norms." A relationship between need and norm patterns is identified by the strut models. Value patterns may usefully be seen as those which "pull" the individual (on the "carrot" principle)—namely, those to which he aspires. In contrast, need patterns are those by which he is "pushed" or driven (on the "stick" principle). Problem patterns may perhaps be conceived as distortions (away from symmetry) of the need or value patterns. These distinctions should be further classified. (N.B.: The assumption is made that the needs and values are "positive." But to each positive set there is a "negative" counterpart of exploitative needs or values. Individuals and societies oscillate between actions guided by the positive and the negative sets.)

Representational Values of Strut Models

18. The form of representation appears to bear an isomorphic relationship to the structure of the need relationship pattern.[27] As an iconic representation, it considerably facilitates comprehension. An individual should be able to "get inside" the representation (rather than be confronted with it) so as to be able to associate to its elements and interrelate a complete range of psychospiritual functions. As noted earlier, a two-dimensional representation begs the question of what is omitted and allows the observer to turn aside. If, however, the observer places (or imagines) himself within such a three-dimensional model, the configuration of its elements about him goes far toward triggering a powerful influence on his comprehension as a whole person (within a sort of three-dimensional mandala).[28]
19. The emphasis on representation of the need pattern provides a basis for implementation of any organized action. In the absence of such a structured representation, the manner of implementation is problematic and usually simplistic (ignoring the interaction between needs in favor of unrelated actions on each need).

20. The form of representation is both new and culturally neutral —to the extent possible. It avoids dependence on terms and modes of understanding that require considerable background and may themselves introduce miscomprehension, such as text, films, matrixes, or mathematics (whether or not they are used as alternatives). Having both analytic and holistic features, the form of representation appeals to both the right and left hemispheres of the brain.
21. The form of representation offers a support on which the elements of different symbol systems may be "hung" to help bring out their related features and clues about how needs may be balanced. This may be particularly important as an approach to a nonverbal, or at least nonanalytic, interaction with non-Western cultures, with the media—and with those disenchanted with the intellectual mode.

It is not recognized, when advocating or imposing the use of particular sets (e.g., of values, needs, etc.), that in traditional societies these effectively constitute functional substitutes for other sets or qualities represented by hierarchies of gods or spiritual beings governing those qualities (or some of them). The fundamental sets society now attempts to generate are indeed designed to perform many of the regulatory functions previously ascribed to supernatural beings or potencies. Given the relative rapidity with which sets are now formulated—compared to the long refinement of a pantheon—it is not suprising if they are viewed as superficial, "bloodless" and unrelated to the cultural refinement of the traditional sets that has led to their meaningful representation (with nested levels of interpretation) through richly decorated beings and memorable tales exemplifying their relationships. . . .[29]

CONCLUSION

The merit of this approach lies in its holistic emphasis and the lack of dependence on the identification of a particular set of needs. By stressing the relationship between various need patterns, a developmental feature is directly incorporated into the approach. A specific need pattern is thus one of a series activated through human and social development. This highlights the possibility of moving the focus of attention from (1) simple need patterns (within which the interneed dynamics are necessarily simple, powerful, and highly resistant to disturbance) to (2) more complex need patterns (within which the powerful dyadic dynamics are distributed throughout the pattern and therefore become more susceptible to handling at a multiplicity of points). Clearly, further work (now in progress) is required to explore what kinds of needs emerge in patterns of different levels of complexity.

ANNEX 1: EXAMPLE OF AN ELABORATION OF A NUMBER-BASED SEQUENCE OF SYSTEMS

The series below was developed by J. G. Bennett to replace the Aristotelian and Kantian categories, with their dualistic characteristic. His definitions of systematic features are given this annex. The characteristics given here summarize the extensive descriptions of Bennett.[30]

Comprehension of the systems proceeds in a definite sequence, given their order of emergence into awareness and the minimum number of terms required to exemplify their attributes. Only twelve systems are identified here, although systems of any number of terms may be considered in order to encompass whatever degree of concreteness one is capable of grasping. The limitation is one of understanding.

A particular system never exhausts the possibility of description and comprehension, for whatever number of terms is reached, some degree of abstraction remains, and additional terms must be admitted in order to move toward a greater concreteness. Growth in understanding requires recognition of the representational power of successive systems and a deepening appreciation of their significance. As implied here and as stressed in the main text, Bennett's word labels and comments are only indicative and do not encompass or exhaust the meanings to which they refer. Their indicative power may be severely eroded by irrelevant polysemantic associations and increasingly so for the three-term case and above. Conversely, the richness of meaning in a given case is indicated by the symbol complexes that cultures produce to exemplify such systems. The symbols may facilitate a better intuitive grasp of each symbol as a whole, in contrast to the fragmented comprehension resulting from the following descriptions presented as linear text.

One-Term Representation and Comprehension ("Wholeness")

Systemic attribute: universality. Term designation: totality. Term character: diversity in unity.

Any situation to which we direct our attention is a monad, but some exemplify the systemic attribute of universality more strongly than others. The monadic character of the universe as a totality is present in all its parts. Wholeness is universal and omnipresent but relative; it may be transformed into identity. The combination of confused immediacy and the expectation of finding an organized structure gives the monad a progressive character; it is what it is, but it holds the promise of being more than it appears to be.

Aspects of wholeness: unity, coherence, togetherness, completeness, order, organization.

Two-Term Representation and Comprehension ("Polarity")

Systemic attribute: complementarity. Term designation: poles. Term characters: positive, negative. Connectivity: force.

Any pair of terms between which both connection and disjunction are recognized, although few pairs stand in more than weak opposition to one another or with more than insignificant connection. Through polarity, everything is in a state of strain, which polarity itself can do nothing to relieve. It gives rise to force, which may be transformed into direction. It can neither show how oppositions arise nor how they may be resolved. Its closure is not that of completeness.

Aspects of polarity: active-passive, pleasant-unpleasant, like-dislike, and so forth.

Three-Term Representation and Comprehension ("Relatedness")

Systemic attribute: dynamism. Term designation: impulses. Term characters: 1, affirmation; 2, receptivity; 3, reconciliation. Connectivities (first order): acts (1-2, generation; 2-3, consent; 3-1, decision). Connectivities (second order): actions (1-2-3, expansion; 1-3-2, interaction; 3-2-1, freedom; 2-1-3, concentration; 2-3-1, identity; 3-1-2, order).

Every dynamic structure has the form of a triad, and the three independent impulses found are those to which all relationships are reducible. Such relatedness may be transformed into interaction. The triad shows how acts enter into the structure of the world and resolve contradictions.

Four-Term Representation and Comprehension ("Subsistence")

Systemic attribute: activity. Term designation: source. Term characters: motivational (1, ground; 2, goal); operational (3, direction; 4, instrument). Connectivities (first order): interplays.

Subsistence is the limitation of existence within a framework and may be transformed into maintenance. The tetrad specifies an event. It is the form of all activities that lead to a change of order and as such is inherently inflexible. Its very nature is to be an activity of transformation. Its lack of central emphasis allows activity to be studied as ordered diversity, but prevents the association of the activity with a particular entity. Indeed, it does not allow for the existence of separate entities.

Five-Term Representation and Comprehension ("Potentiality")

Systemic attribute: significance. Subsidiary attributes: potentiality and meaning. Term designation: limit. Term characters: 1, intrinsic; internal limits (2, lower; 3, upper); external limits (4, upper; 5, lower). Connectivities (second order): ten triads. Connectivities (third order): five tetrads.

Meaning and potentiality must be added to activity, if the significance of a structure for itself (and for the totality that contains it) is to be specified. Only then does a structure become a bounded significant entity. Such entitites have limits of significant connectedness with the outer world and limits of connectedness with their inner range of meaningful potentialities. Everything that exists has potentialities for actualization that outstrip the relationships that it can sustain within any concrete situation.

Six-Term Representation and Comprehension ("Repetition")

Systemic attribute: coalescence. Subsidiary attributes: recurrence, progress, and self-realization; independence; form of events. Term designation: law (governing the coalescence of events). Term character: 1, order; 2, expansion; 3, identity; 4, freedom; 5, concentration; 6, interaction. Connectivities (first order): steps.

Coalescence is understood as the property of structure whereby significance acquires depth and enrichment and yet retains the unique character associated with a particular event. The hexad, as progressive cyclicity, is the system most appropriate for studying structures in a step-by-step process of realizing their significance as events. It expresses the twofold character of creation and countercreation and also the movement of the entire process toward a goal. Although potential energy can be stored up indefinitely, it can only renew itself through the repetitive twofold action of a disturbing and a restoring force. Success in action requires a balance between atten-

tion to what actually is and what potentially might be; events continue to transform themselves even when their actualization is completed. However, the hexad does tend to emphasize the separateness and isolation of such events from one another.

Seven-Term Representation and Comprehension ("Structure")

Systemic attribute: transformation. Subsidiary attributes: structure, history. Term designation: state. Term characters: 1, initiation; 2, involvement; 3, separation; 4, harmonization; 5, insight; 6, renunciation; 7, completion. Connectivities (first order): intervals. Connectivities (second order): harmonies.

A structure is a self-regulating system capable of relatively independent existence. Such a system is no longer closed, and changes in the environment accompany changes in the entity. A transformational superstructure is therefore provided by the heptad to reconcile the self-realization requirement of the well-defined entity (namely, the acquisition of new properties that were previously neither potential nor possible) and the dissolution of identity required for integration as a part within a whole. A heptadic system is required whenever there is change involving a real gain or loss in significance. By such transformation, significant events are integrated into the stream of universal history.

Eight-Term Representation and Comprehension ("Individuality")

Systemic attribute: completedness, organized totalities. Term designation: element. Term characters: active (1, summit; 3, atom; 5, base; 7, totality); structural (2, states; 4, functions; 6, necessities; 8, ideals). Connectivities (first order): components (dyads). Connectivities (third order): fields (tetrads). Connectivities (fourth order): significant substructures (pentads).

Individuality (whether actualized or potential) is the source of initiative residing in organized structures; it may be transformed into endurance and is also a unique center of conscious subjective experience. The octad is able to represent organized structures and historical processes ranging in scale from unity to totality. Its value is classificatory, interpretative, heuristic, and predictive. It is, however, only applicable to structures organized in depth.

Nine-Term Representations and Comprehension ("Pattern")

Systemic attribute: harmonization. Term designation: sources (3), steps (6).

Experience would lose all coherence if there were not always active sources of order residing in the patterns of organized structures. The ideal completion of the octad does not take into account the uncertainty and hazard encountered in actual experience. The ennead permits the representation of everyday working structures (disturbed by impredictable environmental factors) in which harmony is established and maintained. The harmonization is dynamic and indeterminate.

Ten-Term Representation and Comprehension ("Creativity")

Systemic attributes: integrative complementarity.

In all experience there is evidence of a creative (pattern-generating) activity that is not only the source of order but also the vehicle of disorder—a polarity exemplified by the decad. At this level, several sets of processes are able to compensate for one another's defects and produce an overall harmony that reacts on, and sustains, the individual structure.

Eleven-Term Representation and Comprehension ("Domination")

Systemic attribute: synergism.

This is the highest form of relatedness and is the power, subject only to the law of necessity, that reconciles order and disorder through the agency of creativity. It provides the conditions for mutual completion of structures of different kinds.

Twelve-Term Representation and Comprehension ("Autocracy")

Systemic attribute: perfection.

The dodecad is significant as a master pattern for understanding all total structures of the universe, because it is the first system in which the main elements of experience can all be represented. It combines dynamism and diversity or relativity and relatedness. It is the culmination of the transformations whereby the structure of existence is first disordered, then corrected, then redeemed, and finally perfected. Autocracy is the primary affirmation by which all possible experience is brought into existence whether as potential pattern or the actual process of the universe. It is the element that acts without dominating, wills without creating, and unifies all possibilities.

ANNEX 2: SUMMARY OF SYMMETRICAL 2 AND 3-DIMENSIONAL FORMS

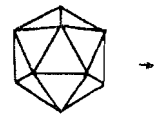
A : 2-DIMENSIONS (circular symmetry)
Stability : If a square or polygon is made from a series of struts which define its edges, and if those struts are connected by **flexible** joints, the resulting figure can be distorted and is therefore unstable. To be stable a shape must have its faces composed 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.

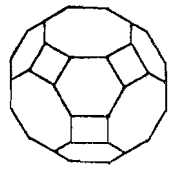
1. Struts linked end-to-end in a « ring » pattern; N struts enclose an **area** of the form of a regular polygon.
N = 3, triangle
4, square
5, pentagon
6, hexagon
7, heptagon
etc.

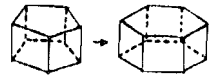
1.2.3 Struts linked end-to-end in several overlapping (or interweaving) « ring » patterns enclosing an area of the form of a regular polygon
N = 6, triangles (2)
8, squares (2)
9, triangles (3)
10, pentagons (2), **etc.**

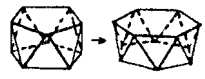
1.4. Concave regular forms
1.4.1 Elaboration of central symmetry by « stellation ».
1.4.2 Elaboration of central symmetry by « faceting ».

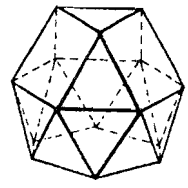
WITHOUT TENSION ELEMENTS

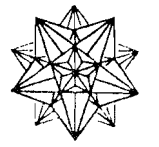












B : 3-DIMENSIONS (spherical symmetry)
Stability : If a cube or polyhedron is made from a series of struts which define its edges, and if those edges are connected by **flexible** joints, the resulting figure can be distorted (and is therefore unstable) unless all the faces are triangular (as in the tetrahedron, 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.

1. Strut end linked to M other ends; N struts enclose a **volume.**
1.1 **Equal faces** forming 5 regular polyhedra
N = 6, tetrahedron (4 triangles)
12, octahedron (8 triangles)
12, cube (6 squares)
30, icosahedron (20 triangles)
30, dodecahedron (12 pentagons)

1.2 **Equal face arrangement** around each vertex 1.2.1 forming 13 **semi-regular polyhedra**
N = 18, truncated tetrahedron
24, cuboctahedron
36, truncated octahedron
36, truncated cube
48, small rhombicuboctahedron
60, icosidodecahedron
60, snub cube
72, great rhombicuboctahedron
90, truncated icosahedron
90, truncated dodecahedron
120, small rhombicosidodecahedron
150, snub dodecahedron
180, great rhombicosidodecahedron
1.2.2 forming facially regular **prisms** (i.e **not** spherically symmetrical)
N = 9, triangular prism
12, square prism (i.e cube)
15, pentagonal prism
18, hexagonal prism
21, heptagonal prism, **etc.**
1.2.3 forming facially regular **antiprisms** (i.e. **not** spherically symmetrical)
N = 6, triangular antiprism (i.e. octahedron)
16, square antiprism
20, pentagonal antiprism
24, hexagonal antiprism, **etc.**

1.3 Unequal face arrangement (regular face only)
1.31 Portions of 1.1 or 1.2.1 (14 forms)
1.3.2 Joining polyhedra from 1.1
Joining polyhedra from 1.1 or 1.2.1 to those from 1.3.1 (15)
1.3.3 Joining polyhedra to those from 1.2.2 (26)
1.3.4 Joining polyhedra to those from 1.2.3 (11)
1.3.5 Special cases (8)
1.3.6 Joining polyhedra from 1.3.1 and from 1.3.5 (18)
(N.B. These are **not** spherically symmetrical).

1.4 Concave regular forms
1.4.1 Elaboration of central symmetry by « stellation » (equal regular faces only)
N = 30, small stellated dodecahedron
30, great stellated dodecahedron

1.4.2 Elaboration of central symmetry by « faceting » (equal regular faces only)
N = 30, great dodecahedron
30, great icosahedron

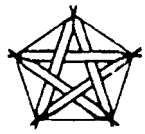
WITH TENSION ELEMENTS

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.

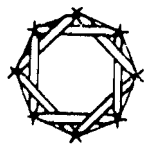
3. Strut ends overlap (but are only connected via tension elements), enclosing an area in the form of a regular polygon.
N = 3, triangle
4, square, etc.

4. Strut ends linked together to form a regular polygon; tension links from vertices to a common central point
N = 3, triangle
4, square, etc.

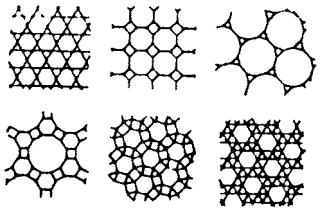
5. Strut ends linked together with struts overlapping; vertices linked by tension elements.
5.1 Forming a continuous circuit (for N odd)
N = 5, pentagram
7, heptagram, etc.



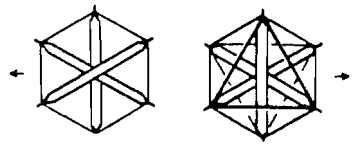
5.2 Forming independent overlapping (or interweaving) circuits
N = 6 (2 triangles)
8 (2 squares), etc.

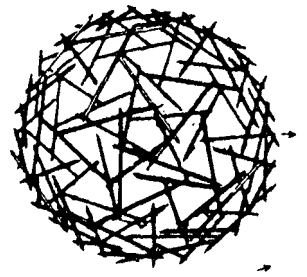


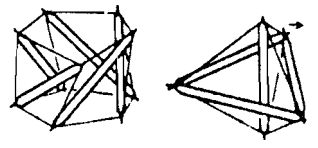
6 Regular polygon strut patterns linked together (e.g. as tesselations)
6.1 Same polygonal shapes
6.2 Same polygonal shape arrangement about each vertex

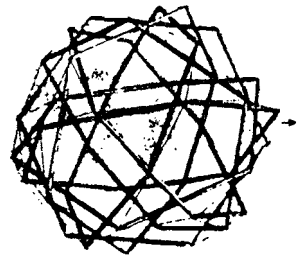


6.3 Various polygonal shape arrangement about each vertex
7. Strut ends linked so as to nest one regular polygon within another; the two polygons are linked by tension elements.

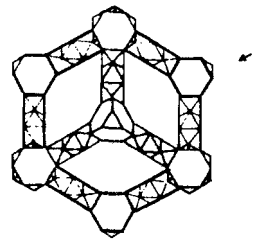








COMPOUND FORMS



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, square 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 c

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)

6 Regular polyhedral (or tensegrity) forms linked together (e.g. as cylindrical masts, arrays, etc.) (N.B. The compound form may be spherically symmetrical if the constituent polyhedral forms are appropriately chosen and linked)
6.1 Same polyhedral forms
6.2 Same polyhedral form-arrangment about link points.

6.3 Various polyhedral form arrangments about link points.
7. Strut ends linked so as to form regular polyhedra (or tensegrities) nested one within the other; the two structures are linked by tension elements.

NOTES

1. A. J. N. Judge, "Representation, Comprehension, and Communication of Sets: The Role of Number," *International Classification* V, 3 (1978): 126-33; VI, 1 (1979): 15-25; VI, 2 (1979): forthcoming (paper originally presented at the 3rd UNU/GPID Network Meeting, Geneva, October 1978). The organizational implications of this argument have been developed in A. J. N. Judge, "Groupware Configurations of Challenge and Harmony; an Alternative Approach to Alternative Organization" (paper presented at a seminar on alternative organizations, European institute for Advanced Studies in Management, Brussels, June 1979).
2. Johan Galtung, Intervention at the Workshop on Human Needs, Berlin, May 27-29, 1978.
3. See Judge, "Representation," where this question has been examined at length to explore the nature of the intersection between the structure *in* such a field and the structure that tends to be imposed *on* the field as a result of constraints on our perceptual processes.
4. The following outline is based on points argued in Judge, "Representation," particularly with regard to constraints on representation in order for a set to be comprehensible.
5. Ibid.
6. Ibid.
7. > The individual then may experience his own being . . . as differentiated from the rest of the world in ordinary circumstances so clearly that his identity and autonomy are never in question . . . as having an inner consistence, substantiality, genuineness, and worth; as spatially coextensive with the body. . . . It is often difficult for a person with such a sense of his integral selfhood and personal identity, of the permanence of things, of the reliability of natural processes, of the substantiality of others, to transpose himself into the world of an individual whose experiences may be utterly lacking in any unquestionable self-validating certainties . . . (such as) an over-riding sense of personal consistency and cohesiveness.

   R. D. Laing, *The Divided Self; a Study of Sanity and Madness* (London: Tavistock, 1960), pp. 40-43.
8. In the study by J. G. Bennett, *The Dramatic Universe*, 4 vols. (London: Hodder and Stoughton, 1956-66), 3: 12, the author finds that

   > for purposes of practical utility, the systems fall naturally in groups of four. The first four from the monad (1-term) to the tetrad (4-term) help us to see *how* structures work. The systems from pentad (5-term) to octad (8-term) show *why* they work and how they enter into the pattern of reality. The third group from the ennead (9-term) to the dodecad (12-term) is mainly concerned with the *harmony* of structures: that is, the conditions that enable them to fulfill their destined purpose.

9. Ralph Abraham, "Vibrations and the Realization of Form," in *Evolution and Consciousness; Human Systems in Transition* Erich Jantsch and C. H. Waddington, eds. (Reading: Addison-Wesley, 1976), pp. 134-39.
10. See Judge, "Representation."
11. Erich Jantsch, "Evolution; Self-Realization through Self-Transcendence," in Jantsch and Waddington, pp. 34-70.
12. Marie-Louise von Franz, *Number and Time; Reflections Leading towards a Unification of Psychology and Physics* (London: Rider, 1974), p. 74.
13. Walter Pankow, "Openness as Self-Transcendence," in Jantsch and Waddington, pp. 16-36.
14. G. Spencer Brown, *Laws of Form* (G. Allen and Unwin, 1969), p. xix.
15. Katrin Lederer, "Reflections about Needs," Internal working paper for the workshop on needs organized by the Internationales Institut für Umwelt and Gesellschaft, Berlin, May 1978.
16. Without such "triggers" it is doubtful whether social innovators would have been provoked into articulating the needs significantly absent from conditions of slavery, torture, illness, poverty, and the like that satisfy the needs of some (cf. the efforts made to avoid exposing the Buddha-to-be to such conditions).

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17. Unlimited possibilities are not suited to man; if they exist, his life would only dissolve in the boundless. To become strong, *a man's life needs the limitations* ordained by duty and voluntarily accepted. The individual attains significance as a free spirit only by surrounding himself with these limitations and by determining for himself what his duty is.

    I Ching, trans. Richard Wilhelm (Princeton University Press, 1967), p. 232 (Limitation hexagram; emphasis added).
18. A. J. N. Judge, "The Territory Construed as a Map; In Search of Radical Design Innovations in the Representation of Human Activities and Their Relationships" (paper prepared in connection with the Forms of Presentation subproject of the GPID project of the United Nations University, Geneva, April 1979).
19. See Judge, "Representation"; see also A. J. N. Judge, "Organization and Lifestyle Design; Characteristics of Non-verbal Structural Language" (paper prepared on the occasion of the Internationale Konferenz Bedingungen des Lebens in der Zukunft und ihre Folgen für die Erziehung, Berlin, November 1978).
20. This section is extracted from Judge, "Territory," Part I.
21. William Irwin Thompson, *Darkness and Scattered Light* (New York: Anchor Press, 1978), pp. 20-24.
22. See Judge, "Representation"; also:

    > In the realm of ideas, man can count up to two and sometimes in specially favourable circumstances, as far as three. He has no notion at all of what would be required for entertaining richer combinations. This limitation applies not only to man's thought but also to his feelings and to his instinctive processes.

    J. G. Bennett, *The Dramatic Universe*, 1:21.
23. A. J. N. Judge, "From Systems-Versus-Networks to Tensegrity Organization; Transcending Duality through Tensional Integrity," *Transnational Associations* XXX, 5 (1978): 258-65.
24. See Judge, "Representation," regarding the work of Arthur M. Young, *The Geometry of Meaning* (San Francisco: Delacorte Press, 1976), and R. Buckminster Fuller, *Synergetics; Explorations in the Geometry of Thinking* (New York: Macmillan, 1975).
25. Judge, "Systems-Versus-Networks."
26. Ibid.
27. Judge, "Representation."
28. G. Tucci, *Theory and Practice of the Mandala* (London: Rider, 1960).
29. Judge, "Representation."
30. Bennett, *Universe*, 1: 31-48, 14-75.
31. Based on information in Anthony Pugh, *Polyhedra; a Visual Approach* (Los Angeles: University of California Press, 1976); Fran Harary, "Graph Diagrams," in Fran Harary, *Graph Theory* (Reading: Addison-Wesley, 1971); Anthony Pugh, *An Introduction to Tensegrity* (Los Angeles: University of California Press, 1976).