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UNIFICATIONISM AND SOCIAL THOUGHT: A COMPLEX SYSTEMS PERSPECTIVE

by

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1) Towards a New Paradigm

An important trend in most liberal democratic societies in modern times has been an increase in the degree of multi-culturalism. This has led in turn to a relativizing of traditional values as indigenous traditions and worldviews have come up against the alternative worldviews of numerous (often vociferous) minority groups. The basis for value judgments has thus been seriously eroded to the point that it is now widely agreed that traditional values and ethics, to command allegiance in society, need to ground themselves in some way with reference to empirical reality. This makes ethics contingent on what empirical reality is perceived to be; and in turn on (essentially) scientific standards of what constitutes appropriate method. In this regard the quantitative analytic methods developed in the context of the physical sciences have, for better or for worse, come to be applied well beyond their natural boundaries in many areas of social science and even in the humanities.

Thus it is to be expected that important paradigm shifts in the physical sciences will have in due course, a knock-on effect in other areas, including those where questions of value rather than of fact are primary. An important such shift has been going on, particularly in the last ten years or so, under the impact of so-called dynamical systems theory (which may be more familiar to

conference participants under the associated headings "chaos theory," "fractal geometry," "non-linear science," "catastrophe theory" and "bifurcation theory"). The consequences of this have already been far-reaching in many scientific fields and are by now well-documented.[1] However, the last few years have seen the rise in importance of a further, potentially even richer paradigm, under the titles "synergetics" and "self-adaptive complex systems." This paradigm encompasses dynamical systems theory as a special case. But its application extends to the modelling of systems whose "components" or "members" are not determined in their behavior by some global dynamical laws, but rather possess a certain measure of autonomy. In other words, it appears to lend itself in a natural way to the study of the life sciences, economics and even the social and political sciences and has indeed developed mainly in relation to problems arising in these fields. It is appropriate therefore that this ICUS committee give consideration to the ways in which these new paradigms might inform or influence our self-understanding - as agents in international political and economic systems, as citizens of our respective nations, as repositories of the fruits of millions of years of genetic evolution, as participants in a global ecology and/or as offspring of the Divine Being, created in His/Her image

In the present paper I shall offer first a brief sketch of some of the important discoveries and claims made by the advocates of the "dynamical systems" and "self-adaptive complex systems"

paradigms. Next I will seek to elaborate a number of broad conclusions which I believe flow from viewing society as a complex system. In particular I shall deduce what I would suggest are some of the necessary conditions for the maintenance of a viable social order. The possibility of reinterpreting and evaluating existing social theories from a complex systems perspective is also mentioned, particular consideration being given to Unification ontology, which is seen to be in a number of ways in close harmony with this new perspective.

2) Dynamical Systems Theory

By a "dynamical system" I will mean here a system whose state can be described at any time by a vector of variables $\underline{x}(t) = (x_1(t), x_2(t), \ldots, x_n(t))$, where the way each variable varies with time depends only on the instantaneous values of the variables and (possibly) the time itself. Time here can be taken as continuous or discrete. If the value of each of the variables $x_1, x_2, \ldots, x_n$ is specified at some initial time t_0 by setting

$$\underline{x}(t_0) = \underline{x}_0 \qquad (1)$$

then solving the dynamical system corresponds to finding the value of $\underline{x}(t)$ at all successive times. For example, if a dynamical system specifies the velocity of air at each point in this room and $\underline{x}_0$ is the position at time t_0 of a dust particle, then $\underline{x}(t)$ represents the position of the particle for $t > t_0$.

An interesting feature of such systems is that even with rather simple functional dependence on $\underline{x}$ and t, the evolution of the system can be very difficult to calculate, even with the assistance of the most powerful computers. The reason for this is that the system can become "chaotic" in the sense that two trajectories with starting points arbitrarily close (say $\underline{x}_0$ and $\underline{x}_0+\underline{dx}$, with $|\underline{dx}| << 1$) apparently bear no relation to one another after some finite time has expired; this even though the individual trajectories do not "diverge" in the sense of any of the variables x_i increasing or decreasing without limit.

Typically in a physical context we distinguish system variables (which vary with time) from system parameters (which are fixed for any given realization of the dynamical system). If the system parameters are given by a vector $\underline{u} = (u_1, u_2, \ldots, u_n)$, then more generally we should think of the dynamical system as specifying the rate of change of the x_i as a function not only of the x_i and t, but also of the u_i. One of the most important questions asked in dynamical systems theory is then: "How does the nature of the associated trajectories change as we modify the underlying system parameters?" Qualitative changes which occur as a system parameter increases or decreases past some critical value are called "bifurcations." Often a system whose behavior is rather simple and well-ordered at some given parameter setting will, after a series of bifurcations, become chaotic in the sense above. Clearly this means that the system is then fundamentally

unpredictable. Nonetheless, all is not lost, for it has been found that, if we are willing to restrict our attention to sufficiently long times, certain *statistical* properties of the orbits become very regular and can be calculated precisely by computer.

One of the most significant modern developments of dynamical systems theory was the recognition that, even though a system may in practice have a very large number of "degrees of freedom" or "dimensions" (i.e. needs a very large number n of variables to describe its state), the *qualitative* dynamics are often represented well by a much simpler system with very few degrees of freedom (small n). For example an early pioneer in the field of chaos E.N. Lorenz, in trying to understand the unpredictability of the earth's atmosphere, constructed a computer model with only three variables (his procedure was equivalent to analyzing a musical tone by ignoring all but the first harmonic) and found that he was able to generate chaotic behavior on his computer.[2] Corroboration of the validity of his approach came later in the experiment of Albert Libchaber who examined the convection of liquid helium in a small cell[3]: the statistical properties of the "chaotic" motion he observed turned out to be the same as those of an extremely simple dynamical system - even simpler than that proposed by Lorenz. Since then the dynamical systems approach of mimicking the chaotic behavior of a complex system by means of a simple set of equations has spread like wildfire, colonizing in the process most areas of the physical sciences. Not only that, many novel applications in

describing such phenomena as cardiac disorders, the incidence of catastrophes - natural and economic - and fluctuations in price indices have been documented too. And since most of the successful applications of the theory have been by analogy, rather than by direct quantitative correspondence, with real systems, the question arises of whether fruitful application of such ideas might also be found in the social science arena.

So what are the insights offered by the dynamical system approach? One of the most important discoveries has been the existence of low-dimensional "strange attractors" in high-dimensional complex systems. To understand what is meant by this phrase, we should first introduce the concept of "phase space." Here we mean that each variable in the vector $\underline{x}(t)$ is thought of as a coordinate in an n-dimensional generalization of Cartesian 3D-space. Thus, as t increases, the trajectory "moves" through phase space just as a projectile moves through physical (3D) space. The interesting thing about chaotic systems is that, at large times, large portions of the phase space are found to be virtually unpopulated; furthermore, the statistical distribution of trajectories (e.g. the proportion of time spent in any given region of phase space) is found to be totally independent of the time t and of the initial condition (2). In other words, the long-time asymptotic behavior of *all* trajectories of a given system can be understood statistically by considering only *one* trajectory (the "ergodic" property), and involves only a very limited region of the

phase space (the so-called "attractor"). Indeed, by suitably redefining the variables, it may be that almost all of them can, for large enough t, be ignored, so the dimension D of the attractor may be much smaller than the dimension n of the associated dynamical system.

Another important feature of "attractors" (the reason they are often called "strange") is that they typically have fractional dimension D, e.g. D = 2.5 which means that if we tried to measure the *surface area* of the attractor the result would be infinite, yet the *volume* would be zero (see Fig. 1). Fractional dimensions are possible on account of the so-called "fractal structure" of the attractor, that is its being possessed of geometrical features which repeat on ever smaller scales as we examine the structure of the attractor ever more closely (see Fig. 2). So "chaos" in the modern sense does not appear "at random" but subject to the stringent condition of some "self-similar" structure being possible on ever smaller scales in the system dynamics.

3) Complex Systems and Emergent Structures

As mentioned above, "dynamical systems" can be thought of as a special case of "complex systems." Although the latter term is used to describe so many diverse situations that no definition has yet been forthcoming, we can in general distinguish it from the former as follows: while the former label has tended to be applied to systems possessing rather small dimension and governed by

mathematical equations involving continuous functions, the latter has been typically used to refer to systems where large numbers of agents interact with one another within a network according to some (usually finite) set of rules governing local interactions. Also, while the former either diverge or tend asymptotically to some attractor, the latter can be more open-ended or evolutionary, leading (possibly) to ever new structures: indeed it is possible for the rules themselves to be allowed to evolve, giving the complex system a great deal of flexibility. Such open-ended systems have come to be known as "self-adaptive."

One of the most important phenomena associated with complex systems is that of "emergent structures," namely macroscopic structures or phenomena which emerge on the basis of local interaction of (microscopic) system components, but whose appearance is not amenable to prediction by direct analysis of the latter. In other words they can only be discovered and investigated empirically, either by computer simulation, experiment or observation. For example, the order and institutions of the market economy could never be predicted by attempting an examination of the economic needs and aspirations of each of the individual economic actors: these need to be understood on the basis of groupings (of producers and consumers) which emerge through their mutual interaction, and of post hoc economic indices, rules of supply and demand, etc. Such a situation is often referred to as "the whole being more than the sum of the parts" and appears to be

emerging as a hallmark of complex systems.

Some examples of applications which have been found for complex systems theory (self-adaptive and otherwise) are non-equilibrium thermodynamic phenomena, hysteresis phenomena in magnetization, the modelling of the genesis of life through self-catalytic sets of proteins, the self-evolution of a fully automated administrative scheme for a gas supply pipeline, examination of the limitations of Darwinian evolutionary models by computer simulation of the mutation and exchange of genes, non-equilibrium models of the economy capable of shedding light on stock market crashes, etc., computerized neural networks simulating brain activity, simple self-regulating ecological systems, and models of urban evolution.[4]

4) Society as a Complex System

Given the success of complex systems theory even in describing social phenomena, let us consider how the theoretical constructs of section 2 above need to be modified if they are to be applied to the modelling of the social order or some aspect thereof. We could then think of each x_i as representing an individual person (or group), whence it should be considered not as a single variable but rather as a cluster of variables, indicating the "state" of that individual (or group). For example, if in a model attempting to assess likely voting patterns in some region, each x_i might be taken to represent an individual voter, associated with which would

be information like income, social class, educational background, preferences in relation to key issues, etc. Although it becomes impossible to make the previous distinction between system parameters (which can be adjusted by the system operator) and system variables (which evolve in accordance with the laws of the system), we can distinguish artificially by only considering phenomena occurring on some finite time-scale.[5] System variables varying on longer time-scales (e.g. social traditions) can then be usefully viewed as system parameters. Laws or statutes too can reasonably be interpreted as system parameters, changes in the law representing a re-setting of the system, with new dynamics possibly emerging as a consequence: likewise, different laws existing in different geographical locations can be viewed as parallel realizations of similar dynamical systems with non-identical parameter settings.

An extensive analysis of such an approach has been made by H. Haken and has been termed by him "synergetics."[6] He describes the rapidly changing variables as controlled by a "slaving principle," meaning that their qualitative behavior is found to be largely governed by the values of "order parameters" - Haken's term for our slowly changing variables. His argument is that, as in our discussion of general dynamical systems, the qualitative dynamics of the system - and in particular any changes or "bifurcations" - can be understood by consideration only of the order parameters. Thus he is able to accomplish a huge reduction of the dimension of

the problem with which we must deal. The price we must pay is of course a loss of detailed quantitative understanding. But Occam's razor is on our side; and, more importantly, arguments have been put forward suggesting that *all* self-organized systems beyond a very minimal level of complexity are such that they can be understood even in principle *only* in terms of "emergent structures." It is important to remember here that the order parameters are *not* independent of the system but will eventually change in accordance with the gradual evolution of the system, i.e. they are subject eventually to a feedback influence from the "enslaved" variables (much as political leaders in a democracy are in the long term always obliged to confront their electorate).

So let us suppose that society can be viewed as a self-adapting complex system (hereafter SCS). What are the consequences of this for our way of "doing" social science? Most immediately, it requires an explicit acknowledgement at the outset that society exists as an integrated whole, although it may, and apparently does, prove possible to model aspects thereof by considering only certain macroscopic variables. Different disciplines will emerge as different sets of variables are considered in order to study different phenomena. The possibility that different sets of variables are considered in different disciplines (or subdisciplines) to model the same phenomena is not in contradiction to such a view. Indeed it is to be expected since any complex phenomenon requires in principle *all* variables of the system to be

considered. Since this is impossible in practice, we are *always* reduced to considering a subset of the possible variables (or combinations thereof) which must be chosen with an eye to modelling those aspects of the phenomena at hand which it is hoped to understand or explain. Since it is now coming to be accepted that, contrary to the arguments of reductionists, many complex phenomena in physics can *only* be modelled in this way, the methodological gap between the physicists and the social scientists, who have of course already been proceeding in this manner for a long time, is considerably reduced. Further, since much work in dynamical systems now focuses on qualitative modelling, the equation, commonly made in the past, of "scientific" with "quantitative" analysis is proving itself to have been of limited value. This too may come as welcome news to many social scientists.

So we find that our SCS perspective gives us a lot of flexibility in relation to methodology. But what conclusions can we draw in relation to the more delicate issue of human values? To proceed we argue as follows. Obviously a fundamental requirement of any social order worthy of the name is that it possess stability, in the sense that it maintain its integrity and be capable of evolving smoothly in response to patterns of modernization such as new technologies, demographic shifts, changing fashions, the emergence of radical ideologies, scarcities of natural resources, environmental crises, etc. From the viewpoint of dynamical systems, such stability is associated with three possible scenarios: a) the

system stagnates; b) the system becomes periodic (or quasi-periodic); c) the system possesses a strange attractor. It is my suggestion that an adequate model of society must basically be of the third type, but with elements of the second in the sense that, for any given time-scale of analysis, there will be processes that can be taken as cyclic (the enslaved variables) but which in the long term will evolve under the influence of the slowly-varying order parameters. In other words, an evolving social system should be thought of as chaotic in the dynamical systems sense, but only marginally so.[7]

Having thus postulated the existence of an underlying "social attractor" with associated order parameters and enslaved variables à la Haken, what *prescriptive* conclusions can we draw? K. Mainzer, in an epilogue to his excellent recent survey of complexity theory, takes a conservative view, warning that any such conclusions will necessarily be conditional:

> ... ethical consequences [of the theory of complex systems] strongly depend on our knowledge about complex nonlinear dynamics in nature and society, but they are not derived from the principles of complex systems. Thus, we do not defend any kind of ethical naturalism or reductionism. Dynamic models of urban developments, global ecologies, human organs, or information networks only deliver possible scenarios with different attractors. It is a question for us to evaluate which attractor we should prefer ethically and help to realize by achievement of the appropriate conditions.[8]

Although Mainzer seeks here not to prejudice the issue, he clearly has in mind a consequentialist ethics. While I would agree that, insofar as we seek to glean insight from our SCS viewpoint in

relation to human values, we must lean in a consequentialist direction, I would add that deontological ethical systems should also be respected from an SCS perspective as being themselves emergent structures, the wholesale abandonment of which could lead to a breakdown of a hitherto stable attracting structure.[9]

But I would also like to take the argument one step further and suggest less pessimistically that, rather than employing our SCS model merely as a tool in conjunction with some independently-derived ethical code, it is possible to turn the situation on its head and use our model instead as a basis for the evaluation of proposed ethical systems, or at least to suggest some basic constraints that they should satisfy. For, by reflecting on our experience of which modes of society have shown themselves to be viable in the past and present, we can draw conclusions about what are the necessary features of society for the continuance of the (supposed) underlying attractor. And, since we have associated the existence of an attractor with the establishment and maintenance of a stable social order, it can then be argued that the protection of those values which allow the attractor to persist should be given priority as being prerequisite for the realization of other contingent values, i.e. those whose implementation requires a preexistent ordering of society.[10]

Notice how it is at this last stage we make the transition from descriptive to prescriptive mode: that is, we apparently

derive an ought from an is. Our prescriptions are of course conditionally dependent on two types of claim. The first is the claim that there is an attractor underlying our SCS which ought in turn to be maintained in some form; then there are further claims about what particular conditions are necessary for the maintenance of the attracting behavior. The first claim seems inherently plausible, although there could be much debate about the nature and/or degree of complexity of the attractor. For an adequate understanding one would probably want to distinguish static and quasi-static aspects of the attractor, i.e. those which are features of any advanced social system capable of self-sustenance and those which can be taken as static for the "foreseeable future," but should more strictly be viewed as being in a state of slow flux. Our main difficulties lie with the second type for, so long as the fundamental nature of what we are claiming "is", namely the SCS and its attractor, remains largely unknown (and possibly even unknowable), any "oughts" which we derive must remain conditioned by that uncertainty. Nonetheless, I shall argue that significant progress is possible within this framework.[11]

5) Properties of the Attractor

For example, from the work of Max Weber, Arnold Toynbee, Friedrich von Hayek and others it is hard to dispute the importance historically of a strong religious basis for society to prosper. We can also understand something of the mechanism: a thriving society requires a willingness to sacrifice, which requires in turn an end

worth sacrificing for. Thus the success (for a time) of atheistic communist society can be understood, as Nikolai Berdyaev expounded, by the quasi-religious status which the communist party and its leaders assumed, the messianic vision which they promulgated through their Marxist-Leninist scriptures, and so on. The decline of communism too can be understood as a loss of faith which reached up to the top echelons of power.

From the perspective of Unification Thought, another significant property of the attractor can be adduced. Attractors in general have fractional dimension which implies a self-similar dynamical structure: whorls within whorls within whorls, etc. In the Unification view the family acts as the basic unit of society which is projected onto larger and larger dimensions to create the social order:

> From the perspective of Unification Thought, human relationships are the projection of the relationships among family members at home... From this viewpoint, family ethics is the basis of all ethics. If family ethics is applied to society, it becomes social ethics; if applied to corporations, it becomes corporate ethics; if applied to the state, it becomes state ethics.[12]

Without some such pattern in society it seems the fundamental structure of the attractor is destroyed and the stability of the system as a whole stands to be lost:

> In the family today, however, order between parents and children, husband and wife, and brothers and sisters is neglected or ignored. As a result, the family has become disordered. That is the cause of the collapse of the social order. The family, which originally should have been the basis of the social order, has become the starting point of the collapse of the social order.[13]

In a similar way we can argue that a market-based economic system appears to be a prerequisite for a viable social order in the modern world. The recent collapse of communist economic orders in almost every corner of the globe and the continuing efforts of all less-developed countries to "catch up" with the capitalist economies through pursuing market strategies bear clear testimony to the truth of this claim. The empirical evidence for such a view is summarized well in F. Fukiyama's "The End of History and the Last Man." From our SCS perspective we would point out a further reason for the failure of communist economies: their attempts to dispense with the intermediate autonomous structures in society associated with private economic activity, which structures gave the attractor its fractal nature. The resulting emaciated "attractor" focused excessively on activities in association with national goals at the expense of private goals, insufficient recognition being given to the interrelationships among the two, and it ultimately ceased to be an attractor, i.e. the trajectory of the SCS escaped to another region of the phase space - one where free enterprise was tolerated. The economies of less-developed countries on the other hand can be viewed as in a transient phase approaching at various rates the attractor of a fully-developed capitalist economy.[14]

Again following Fukiyama, we can argue that a democratic political system appears to be another prerequisite for a stable SCS. While authoritarian regimes have fared well during the initial

phases of development towards a fully-fledged capitalist system, they have continually confronted legitimacy crises. For they could only justify their authoritarian rule as a response to some national emergency: if the emergency continued, then they were eventually forced to admit they had failed in their policies; and if the crisis were overcome, their basis for legitimacy disappeared with it. The "attractiveness" of democracy is always difficult to explain, but even viewing it, as Winston Churchill did, as the "least worst" system, it is understandable that, democracy having emerged to give people, possibly for the first time, a say in the running of the affairs of their nation, they would not easily give up this right. Thus, democracy seems to have established itself for the foreseeable future as a necessary component of the attractor for any stable SCS.

A third and more subtle aspect of liberal democracies which Fukiyama identifies and which would appear to be a necessary feature of the attractor for a stable SCS is the principle of universal recognition. This he identifies as the critical distinction between the Lockean and the Hegelian perspectives on liberal democracy: the former is content to recognize the *rights* of each individual to protection of himself and his property under the law; the latter insists that this is not enough and that the individual is entitled to expect also her *dignity* to be upheld, that is recognized by each other individual. Fukiyama explains, using the concept of "thymos" (that essential nature of each one of

us which seeks the realization of value, both in our own eyes and in the eyes of others), why it is that the Hegelian version of the liberal democratic ideal which has proved the more enduring, in other words has become embedded in the attractor of the SCS.

This clearly raises questions about the preoccupation, prevalent especially in Western societies, with "legislatible" human rights. This is frequently criticized by representatives of Oriental and Mid East societies who argue for the priority of social order: but of course they too seek to impose their values legislatively. It would appear that a stable basis for universal recognition resting on a principle not of power but of human dignity has not yet emerged. And if, as I here imply, it is an "emergent" phenomenon, then to realize it we must necessarily look not to legislative power and the positing of grand schemes, but rather to a quiet revolution in our way of conducting social and business relationships, interacting with our families and friends, expressing our opinions etc., so as to respect more fully the essential dignity of others (probably at the expense of asserting our own "rights"). Unification Thought would of course strongly concur with such a perspective and elaborates in detail.[15] I would suggest too that our activities in this conference and the WFSC as a whole constitute an important step in this direction, as we recognize mutually the value and importance of contributions from diverse disciplines, philosophical perspectives, races, religions, and cultures.

Another issue which has been much discussed in relation to the ideal social order is the role (if any) which government should play. Again our SCS perspective gives us a handle. For, in considering what gives the SCS its integrity, we have concluded that it is the relationships, institutions, conventions, traditions, etc. which govern human relations in society. In deciding what role government should play in our ideal social order, the questions we have to ask ourselves are whether these relationships (a) are capable of arising spontaneously and (b) are self-regulating once having arisen. We would obviously have to argue here case by case, but it seems likely that, wherever one put the dividing line, one would have to agree that some types of relationships arose and/or are maintained spontaneously, others only through the intervention and/or continuing involvement of government. It is hard to see either how government, which would itself have to be viewed, at least to some degree, as an emergent structure, could be extricated from the present social order without severely compromising the structure of the attractor. So the case seems to be strong in favour of some limited form of government.

Note we avoid here the positing of any primeval "state of nature" prior to the emergence of government, or other similarly artificial philosophical construct. We merely argue from the present evidence to the foreseeable future. The price we pay is that the type of government (if any) advocated by our theory

becomes conditional on circumstances. But the flexibility our methodology here allows would appear to be a strength rather than a weakness, the advantage being that, rather than prescribing from the outset what role government should play, it suggests how government should evolve.

But, while our theory supports an ongoing involvement of government in protecting existing structures, it does not I believe support so unequivocally the interventionist role which governments have arrogated to themselves in modern times. For there is the ever-present danger that government will, in attempting to solve perceived social problems, supplant other institutions and structures which have arisen spontaneously and organically under the influence of the attractor: in solving one problem, "instabilities" may be created elsewhere, with attendant calls for increased government involvement there, and so on until the attractor's integrity becomes undermined and a social crisis emerges, the consequences of which are unknowable. My view in this regard reflects that of Hayek in that I would argue for a government role in problem-solving only insofar as it appeared that existing structures were incapable of resolving a situation satisfactorily. Such a view has indeed become popular recently in European politics under the title of "subsidiarity," which can be interpreted as a reaction to the burgeoning regulative powers of the European Union and its interference in too many issues affecting people's everyday lives. From our SCS viewpoint we should

probably support such a reaction.[16] Interestingly our conclusions here parallel those of the socialist theorist Jürgen Habermas in that he too has misgivings about the encroachment of "big government" into the social arena: he however would be less convinced of the "attractiveness" and/or stability of the existing social order.

6) A Closer Look at the Complex Dynamics

So far we have talked about the structure of the attractor in general global terms: what one might call a macroscopic analysis. This can only take us so far. For in so doing we have avoided dealing directly with the fundamental (microscopic) dynamical processes giving rise to the attractor in the first place. Such a general analysis can only give rise to general conclusions. To go much further it becomes necessary to postulate a more detailed model (or models) of the system itself, beyond what can be perceived by consideration only of global emergent phenomena. In other words we need to introduce more explicit theories concerning the nature of human beings, of human relations, and of the dynamics governing them. Depending on the theories adduced, it may then become possible to suggest suitable ways that the SCS might be modified or regulated to reduce social tensions, antisocial behavior, etc. and thereby to increase the attracting power of the underlying attractor and so avoid needless unfruitful excursions into unviable regions of the phase space.

At this point we necessarily enmesh ourselves in controversy as we seek to adjudicate among the many competing (and often mutually contradictory) views which have been put forward. But as always, the price we pay to obtain prescriptive power from our theory is that we must introduce uncertainties through our postulates about the nature of the system itself.

For example, we could take our lead from Gerard Radnitzky and adopt his REMM concept ("Resourceful Evaluating and Maximizing Man"). This very dynamic view (which he has developed in a number of ICUS papers) gives a useful description of man's economic behavior and indeed is compatible with most of the prescriptions made in the previous section.

At the other extreme we might follow the Marxists and argue that true human nature can only emerge under the dictatorship of the proletariat: such a view, even if it had not been discredited historically, would clearly lead to very few conclusions about how our present society and social life could be enhanced, other than to suggest that they needed to be broken down. Clearly, if we want to maintain our SCS perspective we must eschew such radical ideologies.

Much more could obviously be said here about the compatibility of different philosophies with our SCS perspective and vice versa. Indeed it is my hope that conference participants better schooled

in this area might be encouraged to pursue this line of thought. However I would like to round off my presentation with a brief discussion of Unification ontology, which I believe yields some useful insights in relation to human values when reinterpreted in terms of SCS methodology.

7. Unification Ontology

a) Sungsang and Hyungsang

First should be mentioned the fundamental distinction made in Unification Thought between sungsang and hyungsang (hereafter SS and HS). These are defined as follows:

> *Sungsang* refers to the invisible, immaterial aspect of created things, such as faculties and nature. *Hyungsang* refers to the visible aspects of created beings such as mass, structure, and shape.[17]

Here "visible" might be more consistently rendered as "objectively measurable." But otherwise the definitions correspond quite closely to the distinction we made earlier between the interacting parts or the sum thereof (HS), and the emergent structures (SS). Unification Thought also indicates how the HS and SS in each created being possess a layered structure, the number of layers depending on the level of complexity of the being in question (see Fig. 3). Accompanying each new HS aspect is a new SS aspect, e.g. animals are distinguished from plants by their possession of organs in addition to cells, which addition gives rise to the faculty of animal instinct. We suggest that the new HS aspects can be equated with the sum of the contributing parts, whereas the new SS aspect

represents an emergent property.

b) Yang and Yin

Unification Thought also indicates how HS and SS each possess "yang" and "yin" aspects. While it must be admitted that the particular characterizations of yang and yin given in Unification Thought can appear a little arbitrary in places, its highlighting of a distinction between complementary parts and/or beings is I believe an important one. For clear links are now emerging throughout the natural sciences between the degree of heteronomy in a system and its capacity to support complex interaction. For example, the importance for evolution of the exchange of genes in sexual interaction is well-established. But also in physics, Grand Unification Theories (GUT's) suggest that at high enough energies (such as preceded the "big bang") all four fundamental forces become equivalent, so all energy homogeneous and isotropic. It is only with the breaking of symmetry (emergence of heterogeneity) at lower energies that the forces come to be distinguished and complex interactions (the genesis of our universe) start to occur. Further, in dynamical systems theory, bifurcations and chaos are very frequently found to be associated with a loss of symmetry in a given system. And, most interestingly, recent model computations have shown how a stable mode of interaction between disparate individuals or groups is achieved at a faster rate among individuals or groups operating diverse strategies than between those whose strategies are similar.[18]

c) Subject and Object

Closely related to Unification Thought's SS/HS and yang/yin distinctions are its categories of subject and object. Indeed the former are described in their interaction as examples of the latter. The difference between subject and object is described as that between principal and subordinate elements.[19] Their relationship is described as one of give-and-receive action initiated by the subject.[20] Unification Thought stresses that the relative positions are not necessarily permanent and that their flexibility is what lends dynamism to many kinds of relationship and activity. From the synergetic viewpoint, a possible interpretation of this distinction is to equate it with the distinguishing of order parameters and enslaved variables: which distinction would appear to be a necessary condition for complex behavior to emerge. An interesting corollary of such an interpretation is that, since there is no requirement in SCS theory that the order parameters for a social system be individual persons or groups of persons (they may be goals, laws, traditions, common interests, etc.), it ought also to be possible to identify the subject position in this non-personal way. Indeed subject and object positions *are* distinguished in such a way elsewhere in Unification Thought.[21] Also, frequent remarks by Rev. Moon to the effect that it is his expectation that all should live with Heavenly Law (Cheonbeob)or conscience (Yangsim), not the commands of leaders, as their ultimate standard clearly imply a similar line of thought. So, although it must be admitted that the categor-

ization has the scope of being misused in a one-sided way, Unification Thought does warn against this,[22] and its distinction would appear to be a valuable one capable of assisting in the analysis of the emergent structures and (possible) attractive behavior in complex systems.

d) Individuality and Connectedness

A further distinction is made in Unification Thought between, on the one hand, the concept of an "individual truth body" (hereafter ITB), which can be understood as any existing entity or being with SS/HS and yang/yin aspects manifest in some (possibly) unique manner (its "individual image"[23]) and, on the other hand, the concept of a "connected body."[24] The latter term describes the position of an ITB when it enters into a correlative relationship with another (or others). It is this capacity of an ITB to relate as part of a larger whole which enables higher structures to emerge. For example, cells must cooperate in harmony for an organ to emerge and function correctly within the body. Unification Thought stresses that the same ought to apply in human society. We would add from our SCS perspective that, while an unwillingness among individuals to go along with this injuction of Unification Thought for them to seek to serve the whole purpose need not necessarily be to their disadvantage, in the long term the integrity and subtle balance of the complex system stands to be unsettled by such behavior. A stable SCS in the social context would then presumably be one which integrated from the outset

constraints on individuals towards contribution to the whole in the way which Unification Thought advocates.

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1. For a popular account see James Gleick's classic "Chaos: Making a New Science," Abacus (1988), and for a more technical account "The New Scientist Guide to Chaos" ed. Nina Hall, Penguin (1992).

2. See J. Gleick, op. cit., pp. 11-31.

3. Ibid., pp. 191-211.

4. See M.M. Waldrop "Complexity", Penguin (1992), R. Lewin "Complexity", Phoenix (1993), K. Mainzer "Thinking in Complexity", Springer-Verlag (1994) and extensive references therein.

5. A similar such approach is common in stability analyses in applied maths and physics and is known colloquially as "two-timing."

6. See H. Haken "Synergetics. An Introduction", 3rd Edn., Springer, Berlin (1983).

7. A fourth possibility which should be mentioned is that the evolution of society is fundamentally stochastic and cannot be conceptualized in terms of dynamical systems or complexity theory. This would mean that society can evolve continuously without any single pattern or trend ever emerging or dominating. While we cannot rule out such a possibility, and indeed we would explicitly

acknowledge that such aspects of society as, say, the development of new technology are likely to be continuously evolving in the sense of forever opening up new unexplored realms of phase space, we would argue that such a view in relation to the system as a whole is incompatible both with the evidence of so many converging trends in society worldwide and with the intuitive notion most of us possess that society is somehow "progressing," or at least that such a notion can be given some meaning. Furthermore, if society as a whole were in a process of continuous evolution, this would rule out any possibility of absolute values, all values being dependent on the region of phase space currently occupied, e.g. we would have to argue that slavery was morally acceptable 1,000 years ago, is presently not, but may again become so at some undisclosed future date. Clearly the espousal of such a view would be radically at odds with the spirit and goals of this conference.

8. K. Mainzer, op. cit., p. 294.

9. Such a mistake was I believe made by the Church of England's Board for Social Responsibility in its turnaround on the issues of premarital sex and divorce in the '60's. See further the paper by P. Badham in this committee.

10. The reader might at this point be tempted to view our SCS perspective as kind of social Darwinism. In a sense there is a parallel here, but we would warn against taking the analogy too far. For, while Darwinian selection is concerned with the viability

or otherwise of existing species in competition with one another, our model is of a society or societies in a continuous process of spontaneous evolution: while extinction of one particular mode of society always remains a possibility, it is a regrettable exception rather than the rule. Although models of society have come and gone, it is misleading to think of this process in terms of "extinctions." For, in the main, backward societies have not been destroyed, but rather have maintained something of their identity while being transformed by a process of emulating more successful models.

11. Our view here might be compared with the categorical imperative of Kant. There is indeed some similarity, but since the starting point in Kant's view is his principle that one should act only on the basis of those maxims which one would wish to become universal law and that one should treat all people as ends not means, differences in value perspective remain at the core. Or, as Max Horkheimer has put it: "There will be as many beliefs about what befits universal law as there are social groups." From the SCS viewpoint, the most important differences are rather ones of fact - concerning the nature of the attractor - and, to the extent that these differences are resolved, value prescriptions can be consistently deduced. Similarities exist too with the Hegelian view of social development which can in a sense be subsumed within the SCS perspective. His view of the forward movement of history as the self-actualization of "Absolute Spirit" with his own society as the

final stage in that process can be understood from an SCS perspective as a pioneering attempt to describe the structure of the SCS and its attractor: it should be supplemented rather than supplanted by other models describing other facets of the process of social development and of course needs to be more flexible about the final state (if any) towards which society is headed. Finally, we can compare our view with the interpretation of morals proposed by the linguistic analysis school, which would argue that, say, a profession that lying is bad is no more or less than an expression of the speaker's personal distaste, so cannot be judged either right or wrong. From our SCS perspective we would argue that judgment can be made - by considering the degree to which existing societies depend (and have depended) on the principle of honesty and drawing conclusions on that basis.

12. Essentials of Unification Thought, p. 208

13. Ibid., p. 206

14. We have described capitalist economies here as though they were in a static state, in contrasting them with communist and developing economies. This is of course only an approximation, since capitalist economies, like any self-regulating SCS, will continue to develop, albeit that the qualitative change is expected to be less once a certain level of maturity sets in.

15. See for example the chapters on Original Human Nature, Axiology and Ethics in "Essentials of Unification Thought".

16. A good example of this phenomenon is the so-called CAP (Common Agricultural Policy) whereby procurement of agricultural produce has been controlled centrally by the EU. The system was originally devised to ensure a continued supply of food resources in times of war or crisis, a consideration which has incidentally long been forgotten. Yet the budget has continued to expand annually (an unstable orbit?). The intermediate structures in the chain of procurement having been dismantled, market control was supplanted by political control (destruction of the attractor) and the laws of supply and demand cast to the wind - and it has proved well nigh impossible to reinstate them.

17. Essentials of Unification Thought, p. 43.

18. B.A. Huberman and N.S. Glance "Diversity and Collective Action" in "Interdisciplinary Approaches to Nonlinear Complex Systems", eds. H. Haken and A. Mikhailov, Springer Verlag (1993), pp. 44-64.

19. Ibid, p. 51.

20. Ibid., pp. 57-60.

21. Ibid., pp. 27-36.

22. Ibid, pp. 56-7.

23. Ibid., p. 62.

24. Ibid., pp. 66-70.

Legend

Fig. 1 The Lorenz Attractor

The trajectories of all solutions of Lorenz's system of three differential equations are, after an initial period, drawn towards an attractor. As the trajectory (part of which is shown in the figure) winds its way around this attractor, it comes to fill out a "surface" in xyz-space. But, since the trajectories are interwoven in the vicinity of the z-axis and cannot ever meet each other exactly, the surface cannot be simple but rather has infinitely many interwoven leaves. It is found that this surface in fact possesses an infinite surface area, yet occupies a negligible volume of space. In other words, it is not a surface at all but a "manifold" with a dimension somewhere between two and three. Calculations suggest a value of 2.05.

Fig. 2 Fractal Structure of Julia Set

The Julia set obtained by iterating the mapping $f(z) = z^2 - 0.12 + 0.8i$ in the complex z-plane has a fractal structure: the boundary of the dark core region in the figure has infinite length and zero area, i.e. a dimension between one and two. This is possible because of "self-similarity": in other words, if a small portion of the boundary is successively magnified (as shown), it looks the same, subject only to rotation and slight distortion.

Fig. 3 Layered structure of sungsang and hyungsang in existing beings (reproduced from "Essentials of Unification Thought").

-50.000 < x < 50.000
-50.000 < y < 50.000
0.000 < z < 50.000

dx/dt = -10*x+10*y
dy/dt = -x*z+28*x-y
dz/dt = x*y-8*z/3

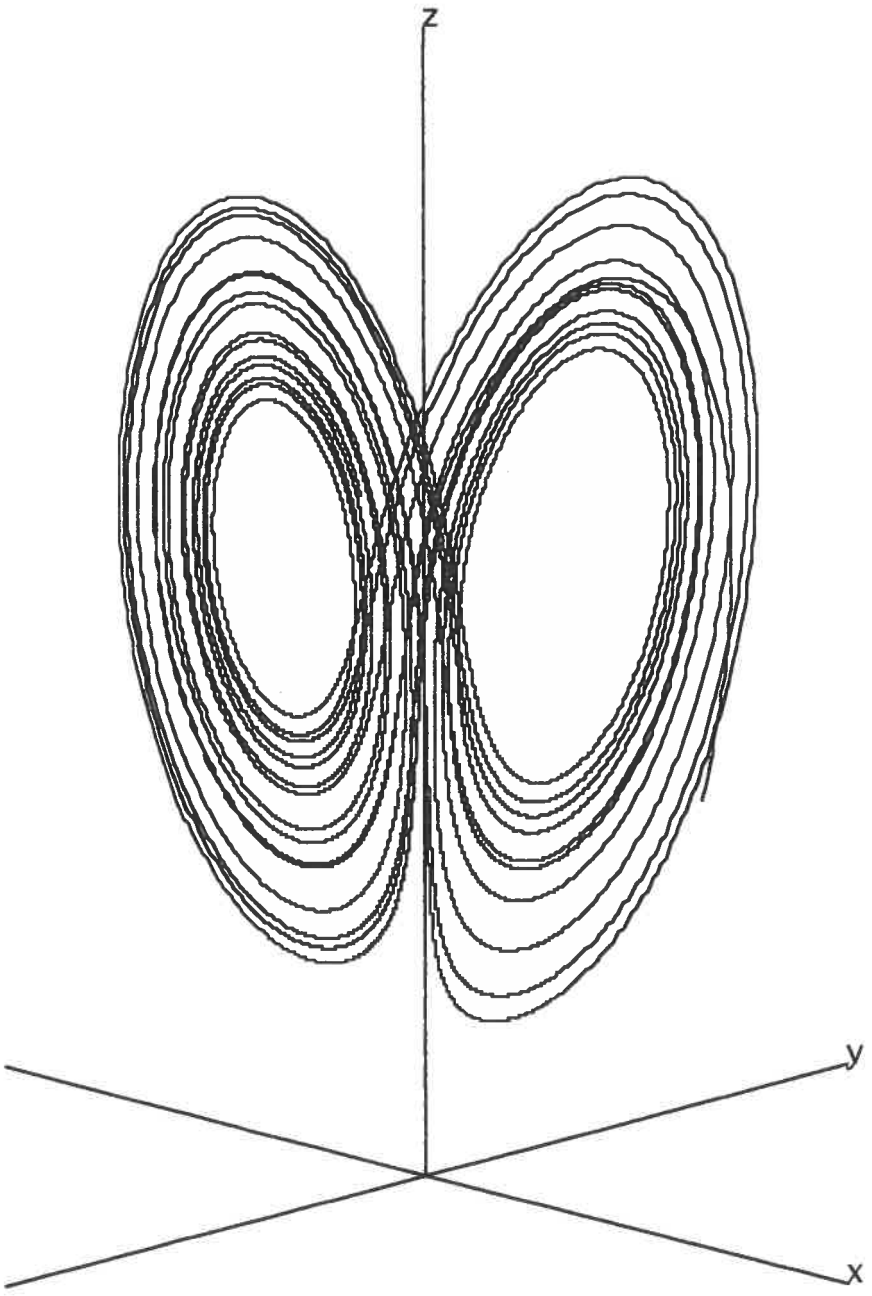

Fig. 1

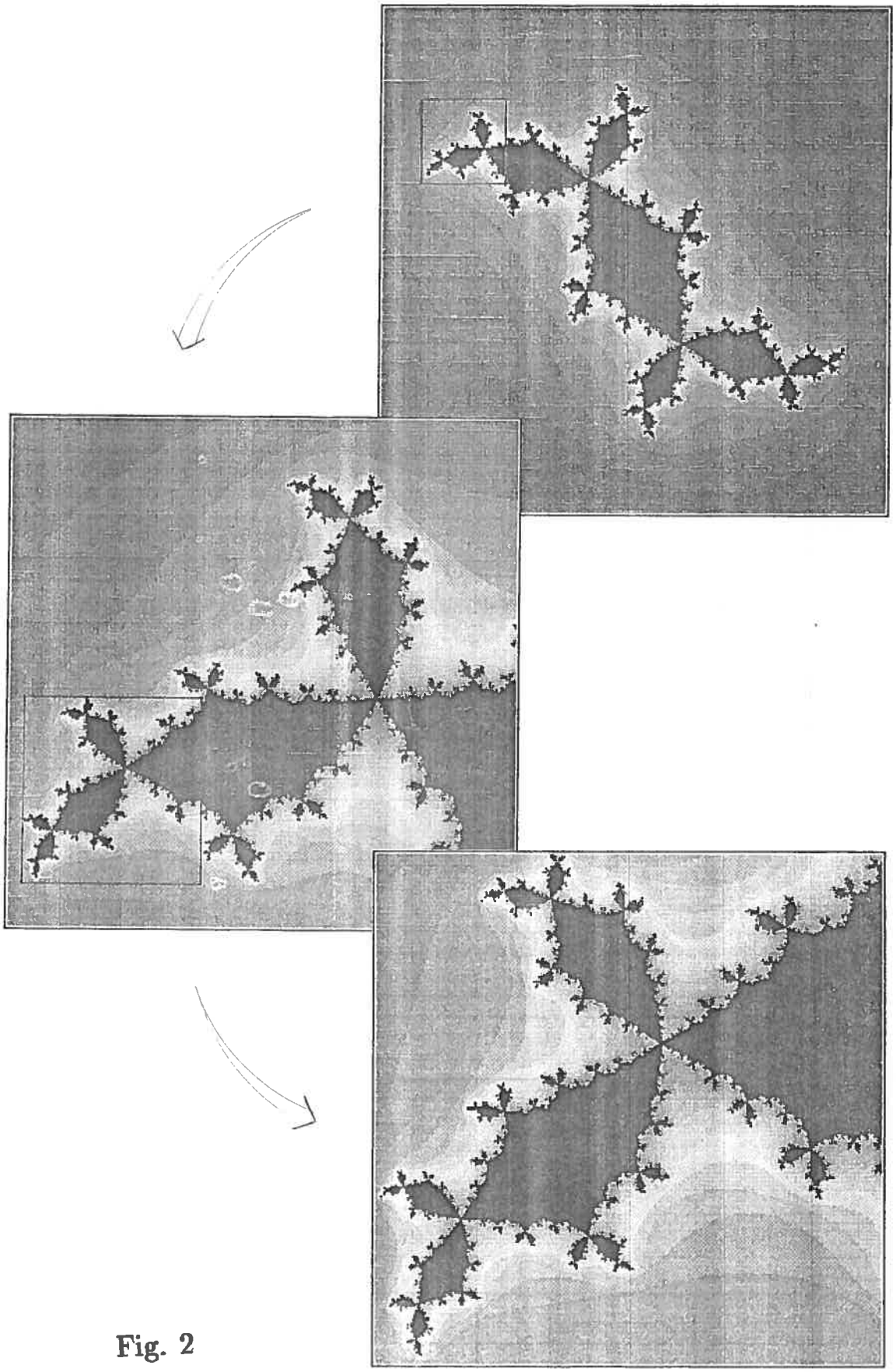

Fig. 2

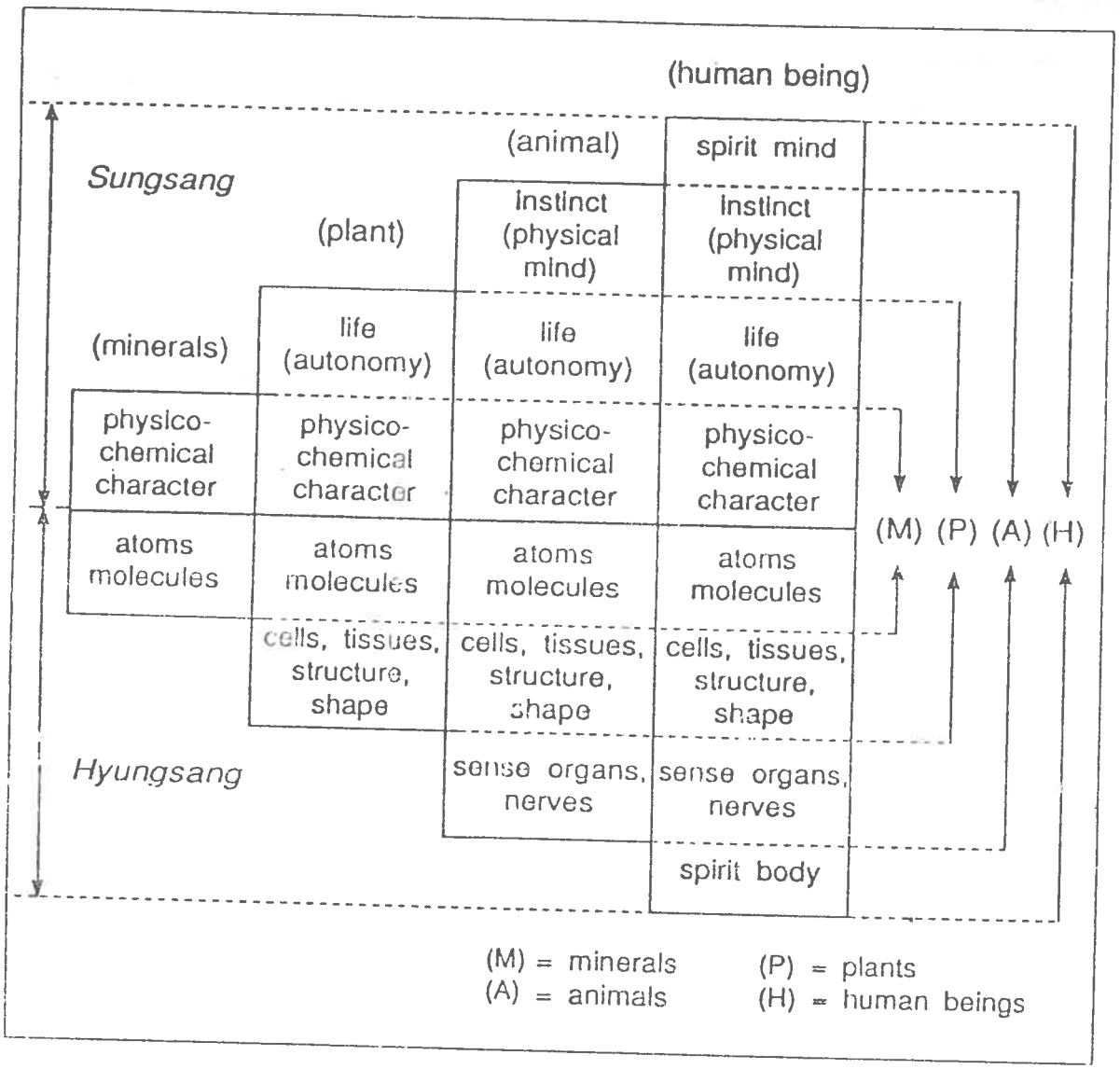
(human being)
(animal)
spirit mind
Sungsang
(plant)
instinct (physical mind)
instinct (physical mind)
(minerals)
life (autonomy)
life (autonomy)
life (autonomy)
physico-chemical character
physico-chemical character
physico-chemical character
physico-chemical character
(M) (P) (A) (H)
atoms molecules
atoms molecules
atoms molecules
atoms molecules
cells, tissues, structure, shape
cells, tissues, structure, shape
cells, tissues, structure, shape
Hyungsang
sense organs, nerves
sense organs, nerves
spirit body
(M) = minerals
(A) = animals
(P) = plants
(H) = human beings

Fig. 3