THE EMERGENCE OF MEANING

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ABSTRACT

The objective of this thesis is to describe the manner in which meaning emerges through inquiry. It does not seek a specific theory of meaning because it acknowledges the fact that the referential and contextual theories conjoin to provide a useful theory apart from the inquirer. The study is quite theoretical and the methods used are those recognized as standard research procedures.

The study posits a possible model for neurological activity from which the conclusion drawn is that all things which are meaningful are things which produce, through sensory impingement upon the brain, mechanical equilibrium; and mechanical equilibrium is viewed as being identical with emotional equilibrium. Human goals are defined simply as the states of mechanical entropy created by the sensory input which the neurological system reduces to equilibrium by the anti-entropic nature of matter. The state of dynamic equilibrium is the state of meaningfulness to the human. The homeostatic dimension of the model explicated is considered a part of the organic entity and not a substitute for the whole of it.

The conclusion of the study argues in favour of a process (complex adaptive) model as the logical derivative from the homeostatic model and as the most suitable means of describing the nature and emergence of meaning throughout inquiry.

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Of those things claimed to be self-evident truths, none is more justifiable than a student's indebtedness to scores of teachers, many of whom make contributions of which they are never aware, and for which most are never credited. I am grateful to many; but to Gordon R. Eastwood, Professor and Head, I owe special thanks, for he provided singularly important gifts: the freedom and encouragement to undertake this kind of study, and the benefit of his scholarship. Each is the mark of a selfless man -- a man of very large perspective.

QUALITY AND QUANTA

THE FOUNDATIONS OF REDUCTIO AD ABSURDUM

Arguments against mechanistic explanations of human behaviour are generally founded upon the notion of classical physics. The absurdity of infinite regression arises from the assumption that all things are infinitely divisible, qualitatively; and that the charge on electrons should vary slightly from one electron to another within a given system. It was this concept of lineal regression which gave rise to the Boltzmann problem in thermal equilibrium. Weisskopf sums it up well:

> One main feature of classical physics is the divisibility of each process. Every physical process can be thought of as consisting of a succession of partial processes. Theoretically at least, each process can be followed step by step in time in space. The orbit of an electron around the nucleus may be thought of as a succession of small displacements. The electron of a given charge may be thought of as consisting of parts of a smaller charge. This is the point to be discarded if one wants to understand what we see in nature: quality, specificity, and individuality.[1]

It is because of the simplicity of a single atomic system that the parameters of identity can be specified. In seeking fundamental building blocks of complex structures, physicists attempt to locate that entity or system which, if reduced beyond a certain limit, ceases to be a whole. For example, it seems a curious thing that light has all the characteristics

1 Victor F. Weisskopf, "Quantity in Physics", in Danial Lerner, ed., Quantity and Quality (New York, Free Press of Glencoe, 1961) p.57. BD241Q3

of both waves and particles. Micro analysis shows that there is indeed a real particle within a light wave; but the attempts or activities necessary to test that fact destroy the wave nature of light. In other words, a photon is indivisible: one half a photon does not exist. It may be possible to divide a photon but the result would be a particle which would have no resemblance to the original photon. The important point is that at least at atomic levels of analysis, there is a point of inseparability of form and content, and that point is physically determinable. There exists only one unique state of lowest energy for each kind of atom. This is in complete contradistinction to the situation in a classical planetary system. Clearly, then, infinite regression is not an inevitable result or is even a concomitant of reduction because reduction is not a method of isolation but of integration by which internal relations are examined for their inclusion in larger systems.

An interesting ponderable is the proper polar opposite of quality. Usually, it is conceived to be quantity as evidenced by the preceeding footnote title. There is not quite enough justification in this chapter alone to support it, but this thesis asserts that quanta opposes quality, not quantification. The quantum state is the unique form and the parameter of identity. Quantification is merely a system of symbolism used for comparative purposes. This is why qualities cannot be reduced to quantities in the measurement sense: nothing is reduced by comparison. Because of the polarization

of quanta and quality, one can be reduced to the other and, in fact, are inseparable. If this point alone can be made palatable, the thesis has paid its way.

Another basis for the charges of infinite regression is the apparent polarities of holism and individualism. It is as Ernest Gellner says:

> To the individualist, his own position appears so true that it barely needs the confirmation of actually carried out eliminations, whilst he gleefully points out that in practice the holist can and does only approach his institutions, etc., through what concrete people do, which seems to the Individualist a practical demonstration and implicit confession of the absurdity of holism. By contrast (and with neat symmetry) the holist sees in the fact that the individualist continues to talk in holistic terms a practical demonstration of the unworkability of individualism, and he certainly does not consider the fact that he can only approach groups and institutions through the doings of individuals to be something which he had implicitly denied and which could count against him. Both sides find comfort in the actual practice of the opponent.[2]

The result is a conflict between the reductionist and the anti-reductionist. For the typical reductionist, causation is an index of existence; he refuses to accept a whole as a cause. Hence, a construct cannot affect the material realities of parts. In other words, the idea that a whole is constituted by its parts plus their relations is irreconcilable with the individual's ontology. The individualist accepts the truism that a whole is made up of its parts and that nothing can happen to the whole without something happening to at least

2 Ernest Gellner, "Holism versus Individualism", in Readings in the Philosophy of the Social Sciences, May Brodbeck ed., (New York, Macmillan Co, 1968); p.256.

some of its parts, or to their internal relations. This, says Gellner, leads to the misleading conclusion that:

> Explanation in history and in social studies must ultimately be in terms of individual dispositions.[3]

The holistic argument against individualism is somewhat the reverse: if something is a cause and cannot be reduced, then in some way it must independently exist.

One of the philosophical problems with reduction is that forceful, formal arguments seem to remove all doubt that reduction is possible.[4] However, actual attempts at reduction within a significant context, rather than in isolated examples, encounter no small resistance. Such is the case with that section of this study called Models of Thought. The kind of reduction used there is only partial and temporary in the heuristic sense of explanations. Gellner, for instance, points out that:

> Phenomenalism is supported not by the plausibility or success of actual reductions but by the force of the arguments to the effect that there must be a reduction, whilst at the same time the interesting arguments against it as cogently indicate that phenominalist translation can never be completed.[5]

It is the kind of paradoxical conflict which raises the suspicion that the crux of the matter is pure versus applied mathematical methodology. Perhaps a reconciliation of the

3 Gellner, op.cit. p. 257.
4 J. W. N. Watkins, "Ideal Types and Historical Explanation" in Readings in the Philosophy of Science, H. Feigl and May Brodbeck, eds. (New York, Appleton-Century-Crofts, Inc., 1953) p. 736.
5 Gellner, op.cit. p. 256.

problem can be obtained from extracting the isomorphs of the generic relations of each form. Some remarks of J.W.N. Watkins give a clue to part of the difficulty of avoiding unprofitable regressions. He says:

> The social scientist can continue searching for explanations of a social phenomenon until he has reduced it to psychological terms.
> ...
> Individualistic ideal types of explanatory power are constructed first by discerning the form of typical dispositions, and then by demonstrating how these lead to certain principles of social behaviour.[6]

It could be argued that Watkins is attempting to analyze generically different things. However, the more important point is the implied causation of the statement. It is difficult to remove the notion or concept of causation; but once it is expunged, an interesting perspective results.[7] The only alternate when retaining causation is total random and chance encounters of all things. This latter choice results in a repetitive, cyclical sequence of events and hence, posits a totally predictable universe and of all events within it. In any case, the ontology inhering in this thesis (and supported later in "Origin of Forms") eliminates the suggestion of willfulness of matter.

The concept of causation seems to present an image of lineal or sequential progression which therefore provides the opportunity for mathematically computing all

6 J.W.N. Watkins, op.cit., p. 736
7 See, for example, the segment "Reproduction of Forms."

possible future orders of things in a rather mechanical and certain fashion. But, in fact, causation is something derived; it comes from historical study of elements and events, not from the inquiry into the unknown. Consequently, the treatment given causation and explanation by Brodbeck[8] adequately translates the ordinary usage of cause to the proper form of specification given through explanation by laws.

The conclusion then is that what are often considered inadequacies of reduction arise mainly from the use of Aristotelian logic implicitly although perhaps denying it overtly. The transition from Newtonian mechanics to Einsteinian relativity is only sixty years old and took some three hundred years to come. The change is widely acknowledged but sparsely appreciated. There can be little doubt that infinite regressions result from reduction only when a classical physical universe is postulated as the only universe, tacitly or otherwise. The modern foundations of reductio ad absurdum are found in Aristotle; and unless an Aristotelian cosmology is adhered to, the problem of regression does not arise.

8 May Brodbeck, ed., Readings in the Philosophy of the Social Sciences (New York, Appleton-Century-Crofts, Inc., 1968); pp.375-87.

SYSTEMIC IRREDUCIBILITY

No study is without its first principles, its presuppositions. This is particularly true of inquiries into meaning. If nothing is meaningful in isolation, then a context is demanded. The context used necessarily constitutes the observer's ontology or metaphysical perspectives. Nominalist views preclude the necessity of context, and although they are antithetical to this study, they do provide the important linguistic function of ascribing symbols to existential properties. In the previous section, the nature of symbols representing systems was discussed. It would be much too complex a procedure to choose a base spatial point of reference and then begin to describe sodium as a particular material configuration with certain pieces of matter at certain points and so on. The task would eliminate conversation because of the complexity of having to list in sequence what the mind perceives in parallel, simultaneous fashion. Language requires sequence on a lineal scale for communication and coherency. But the brain receives say, the sodium atom's geometry simultaneously as an 'image' and not in discrete form of lineal packages. Therefore, nominalism is essential for the sake of economy. The sodium configuration as perceived is simply labelled sodium and no attempt is made to unpack the symbol (except when it is a new learning situation.)

A sort of first principle conditioning the nature of this segment of the thesis is expressed by Green and Goldberger when they say:

> The creed of the biochemist today is that all phenomena which characterizes life processes can be described in chemical and physical terms and that the principles of chemistry and physics which apply to the inanimate world are equally valid for the world of life.[9]

Concluding their text, they further say:

> The cell is, more correctly, an expression of a universal set of mechanistic principles and of a unique molecular architecture and structural pattern.[10]

The simplest form of identification, nominalism, seeks to classify by means of separation and by emphasizing differences. As the only philosophical process, it would lead necessarily to gross fragmentation and chaos. It would lead to gross fragmentation and chaos simple because encyclopedic lists take no account of the relations of things. Of course things would not fragment existentially. Fragmentation is a mental process: it is the mind which seeks meaning. Nominalism is a necessary step in the process of establishing identity. And if something called meaning were not important, then nominalism would be a sufficient approach. But identity means something more than simply name. Understanding depends upon organization and naming does not organize. It is impossible to speak of different relations as the criteria for the establishment of identity without simultaneously acknowledging the

9 David E. Green and Robert F. Goldberger, Molecular Insights into the Living Process (New York, Academic Press, 1967) p. 2.

10 Ibid., p 7.

existence of the matter which establishes the parameters of the relations. Consequently, at different levels of material analysis, different material structures will be required. When examining possible differences among generative elements of a larger structure such as cells of the human, the molecular and atomic structures become the major point of examination. In this way, it is possible to examine the whole by examining the parts and the relations to produce an integrated and meaningful perspective.

The quantum state is that state of equilibrium a system of matter assumes beyond which further qualitative divisibility is impossible. The quantum state exists so long as disturbing factors are weaker than the required excitation energy for changes to higher quantum states. There is a relationship between the spatial dimension of the system and the amount of energy required to produce a higher quantum state. For this reason, it takes very little energy to change the quantum state of a macromolecule (and this will be very important later in this study) while it takes thousands of times more energy to produce a change within an atomic nucleus. It is for this reason that classical physics failed to explain why total entropy or chaos did not result when the temperature of a system was increased: a temperature increase of a few degrees is sufficient energy input to change the quantum state of molecules; but a massive amount of energy is required

to change the quantum states of atomic nuclei. Again, this is an example of how Aristotelian metaphysics failed to properly explain a physical state simply because its assumptions were incompatible (through, perhaps, lack of experimentation) with environmental realities. Such statements as "heavy objects fall faster than lighter objects" clearly lacked any experimental activities or support. It is also the unique behaviour of energy translations which helps the understanding of Fred Hoyle's theory of the pulsating universe. At very low temperatures, the molecules of every substance form one big unit. There is evidence to suggest that matter is somewhat "anti-entropic". W. Ross Ashby, Director of the Burden Neurological Institute says in conclusion to his study that:

> The primary fact is that all isolated state-determined dynamic systems are selective: from whatever state they have initially, they go towards states of equilibrium.
> The states of equilibrium are always characterised, in their relation to the change-inducing laws of the system, by being exceptionally resistant.
> (Specially resistant are those forms whose occurrence leads, by whatever method, to the occurrence of further replicates of the same form -- the so-called 'reproducing' forms.)
> If the system permits the formation of local equilibria, these will take the form of dynamic subsystems, exceptionally resistant to the disruptive effects of events occurring locally.
> When such a stable dynamic subsystem is examined internally, it will be found to have parts that are co-ordinated in their defence against disturbance.
> If the class of disturbance changes from generation to generation but is constant within each generation, even more resistant are those forms that are born with a mechanism such that the environment will make it act in a regulatory way against the particular environment -- the 'learning' organisms.[11]

11 W. Ross Ashby, Design For A Brain (The origin of adaptive behaviour), (London, John Wiley & Sons, Inc., 1952); p.238.

Consequently, it is possible to conceive that over very long periods, all matter tends to seek equilibrium and form one big unit; and that galactic matter contracts to form one giant mass. But at some point in the contracting process, the internal temperature and pressure rise high enough that entropy begins to increase. The result is a sort of plasma effect of disintegration. The big bang theory originated from evidence of the expansion of matter through the universe. It may be that eventually the rate of expansion will slow and begin to reverse. The important point here is that neither quality nor quanta progress to infinity on a lineal scale as implied by classical mechanics. This lineal scale is evident in Aristotle's hierarchies of things from stones to gods. Although the content of such a hierarchy is no longer assumed correct, the form is very much alive in the refusal to accept certain modes of reduction for purposes of identification or complete specification.

The qualitative identity of an atomic system can be described explicitly by the amount of energy required to change the quantum state of its system. Consequently, it is possible to define the boundaries of a system by the same means; and group identity, therefore, can be measured by the amount of entropy its relations can tolerate before changing. Once the internal relations have changed, the identity of the system has changed too. If any element is removed from the system either an entirely new system is created or, no system

exists at all. This means that a system may be composed of elements which could 'bond' in some way that would produce two systems of identical natures. But in matter, this kind of redundancy does not occur. It is possible to have two systems conjoined of course; but they always are, or should be, recognized as two systems. An example of this is the chemistry of calcium hydroxide and the addition of hydrochloric acid. In molecular terms:

$$Ca(OH)_2 + 2HCl \dashrightarrow 2HOH + CaCl_2$$

The calcium hydroxide is a system or, a molecule. The acid may then be regarded as the energy input function required to divide the system or to reduce it. The result is not a number of mini-systems of calcium hydroxide. But it is precisely this kind of conclusion, derived from classical mechanics, to which many philosophers and social scientists could come should they fail to examine closely their analogies. The ionic representation of the above might further clarify the molecular equation and its relationships to systemic irreducibility:

$$Ca^{++} + 2OH^- + 2(H^+ + Cl^-) \dashrightarrow Ca^{++} + 2Cl^- + 2H^+ + 2OH^-$$

These are the components of the molecules and each can exist independently (which seems to contradict the holistic attitude of the study; but it is said to be independent because its external relations are potential, not kinetic, and because

independent existence, however meaningless, may be very real) and can therefore be classed as a system. However, none is systemically similar to the larger system which was reduced. The molecular qualitative identity has been destroyed. In the case of the OH^- ions, there is a very good chance that if certain other ions come within certain distances, they will bond to form a stable system which has a qualitative identity different from each of the parts. It will be an identity different from, not in addition to the identity of the parts. The ions do not wilfully seek other ions for systemic development but, in a sense, they can be said to be less stable in their isolated form than they are as part of a larger system.

The conclusion of this topic is that the parameters of a system are paramount to the specification of qualitative identity. If identity is lost by reduction, it is clear that a system existed. It is not always an easy task to detect a system. It is for this reason that analogy as a conscious methodology of inquiry has been scorned as some "form of weak reasoning." A system then, is a qualitative entity whose reduction results in its loss of identity as a system; and no system can be reduced into sub-systems of the same qualitative nature as the original.

ORIGINS OF FORM

At the top of the quantum scale, chaos reigns. This is the level of proton gases at extremely high temperatures with kinetic energies of many millions of electron volts. Except for the elementary particles of protons, neutrons and electrons, there is no significant differentiation: the state of entropy is extremely high. This is the nature of the fusion or plasma state. When kinetic energies are less than a million volts, protons and neutrons assemble into atomic nuclei. But even at this stage of differentiation, electrons and nuclei move quite randomly, without order. At lower temperatures of only a few volts, electrons fall into regular states around the nuclei and it is at this point that the standard physical and chemical qualities emerge. By reducing the temperatures even further, atoms begin to form simple molecules and the variety of chemical compounds increases rapidly. These compounds are as distinct and specific as atoms but are less stable. Again, the quantum state of a molecule requires much less energy for a change than does an atom. When energy is reduced to a few hundredths of an electron volt, say room temperature, most molecules begin to form liquids and crystals. It is in this region of delicate temperature balance wherein giant molecules are formed. The diversity of matter increases to include that of living organisms.

The form of anything is unique. That is, there is no substantial difference between two sodium chloride molecules. Therefore, the form of a thing is its generic identity. It remains invariant except under special circumstances. For example, sodium chloride is an ionic compound which means its parts can retain their individual identities and, consequently, change quantum states. It is here that form takes on a special significance. A Gestalt view sees the Na and the Cl of sodium chloride within the compound NaCl. The perception is in error. Only NaCl, a non-reducible qualitative state exists. If, for example, the C and the O 'components' of CO_2 were studied independently of one another and their structures memorized, it would be impossible to recognize either C or O in the CO_2 compound. If the quantum state of NaCl is changed, obviously, something else results; but there is no justification for perceiving the result of the quantum state change as having partial relationships with the original compound. In other words, the qualitative identity of NaCl must not be perceived as Na plus Cl but simply and irreducibly as NaCl. The symbolic similarities serve useful chemical purposes, but they also seem to condition an inaccurate philosophical interpretation. The Na and Cl symbols indicate that the system NaCl will, when subjected to certain energy inputs, generally change to the quantum states of Na and Cl, neither of which has

any systemic resemblance to the original compound. If there were, the poor soul who liberally sprinkled salt on his fish and chips would meet an unpalatable and untimely end because both are very poisonous materials. When Na and Cl are conjoined, the result is always an atomic pattern of 'z' relations where 'z' is some unique pattern. Since this resultant pattern seems invariant, the NaCl designation is convenient; it could be XaPh. An electron in Na is not qualitatively different from an electron in Cl; but its position and the number of such particles is unique to each. Hence, since the product cannot be reduced to its parts, it cannot be more than the sum. Form is unique.

REPRODUCTION OF FORMS

Obviously, nothing as mindless as molecules could be considered to have the ability to plan structural differentiation and multiplication. However, it is quite likely that billions of molecules tend to gather into systems and of the millions of systems so formed at random, some require higher energy inputs than others to destroy their identity. At this point of molecular bonding, the term reproduction still seems inadequate. Nevertheless, it does seem that certain molecular structures are more stable than others and these survive environmental changes. Atoms of carbon, hydrogen, oxygen and nitrogen combine in a variety of ways and the product is a series of nucleic acids, amino acids and protein. These are the giant (or macro) molecules which tend to retain their identity and so appear to propagate themselves. As the entropy of a system decreases, molecular bonding increases. The massive number of molecular combinations provide the opportunity for these amino acid combinations to exist and because of their greater propensity to stability than other combinations their numbers increase. Once these enzymes exist, they condition the type of molecular structures to follow. Desoxyribo nucleic acid (DNA) has been found to be one of the most important giant molecules. It is simply a quirk of matter that the DNA chain has the stability it has and the flexibility of response to energy changes that it has.

Because of its relatively enormous size, the number of possible quantum states of DNA is very great compared with the situation of simple atoms or molecules. The structures that are identified as organic matter require temperatures low enough to perpetuate the formation of macromolecules and temperatures high enough for the supply of energy necessary for changes in quantum states. Weisskopf makes an interesting observation on this process:

> If we proceed downward on our quantum ladder to zero temperature, life decays, and all matter forms a big crystal in which many of the existing varieties are preserved but are frozen into inactivity. Everything is then found in its lowest state, a state of high specificity but without change or motion. This is the stage of death.[12]

Of course, Weisskopf is speaking in relativistic terms with regards to motion. An EEG reading of the brain after death shows that motion has been reduced to the atomic level, a level from which no recovery can be made by the human organism. The change in energy states has changed such that the molecular activity is either completely deceased or totally random. But the activity of complex molecule building is stopped and the specificity which constitutes consciousness no longer exists. From these observations, it becomes apparent that the measurement of quantities is a static process while the measurement of qualities is a dynamic process. This is why perturbations of qualities, change their identities.

12 Weisskopf, op.cit., p. 66.

That is, identity is a product of a dynamic state of equilibrium while nominal death is static equilibrium. Perhaps it is not entirely non sequitur to suggest at this point that motion is an inherent property of matter and not simply a direction of travel that continues until interrupted.

The basis for this assumption is of course the foregoing discussion of molecular differentiation. A dualist may agree to the above argument but still ask what puts the molecules in motion so that such sequences can take place. Since motion is always observed, relative to something, it is not unreasonable to conclude that motion is an inherent qualitative characteristic of matter. Hence, it is not mind which drives molecules through space but the very nature of matter. If stasis were the natural tendency or quality of matter, absolute zero, the point at which atomic motion ceases, would not be so difficult to reach. And obviously, the seemingly homeostatic brain model to be argued later seeks not a static concept of equilibrium but a dynamic equilibrium. The inherent property of motion then, is crucial to any physicalistic system of inquiry. Without its assumption, free will would be the only alternate.

The misunderstanding which generally accompanies criticism of a non-Gestalt analysis is not that such an analysis is not systematic but that the objective of the process becomes submerged in a host of irrelevancies generated

by a fear of fragmentation. In the same way, the uses made of certain terms seems to condition or elicite a negative attitude from the listener or reader. For example, the use of the terms 'choose' and 'selection' are easily misinterpreted. It is a peculiarity of human language that makes the examination of its own process of behaviour a rather difficult task. The distinction of the problem is pertinent in the discussion of 'propagation' or 'reproduction' in the molecular sense.

It is simpler to speak of molecular reproduction in order to convey the dynamic state of building and bonding that does take place systematically. It would be ridiculous to speak of human reproduction in the molecular sense only because it is generally conceived as a process of two organic systems rather than two inorganic parts which 'reproduce'. The variety of behavioural acts necessary for human reproduction are generally those things involved in the popular concept of reproduction. However, the biological phenomenon which actually initiates genetic activity is not an activity among systems but among parts. Hence, the statement that wholes are grammatically reduced through a dialectical process only to emerge as parts of a more inclusive perspective takes on an additional significance. And it is only by moving continuously from the macro to the micro and from the micro to the macro scales that inquiry assumes a

dynamic form, an equilibrium in progress. Two humans may 'choose' to reproduce; but only certain molecular structures of matter will combine to generate or 'add up to' the system known as a human being. In some concluding remarks, Green and Goldberger treat the same sort of problem of word usage in describing inorganic behaviour:

> One must never forget, however, that no actual selection of molecules per se is involved in the evolutionary process. Similarly, Nature does not design molecules with any foreknowledge of their possible usefulness. When one speaks of the process by which the molecules of the cell are designed one must keep in mind that the final product is the result of numerous and random variations, each of which was tested by selection for or against retention (at the population level).[13]

Dealing with problems in bioenergetics, the authors note that:

> Living systems do not depend upon macro devices for achieving these transformations. All biological transformations take place at the level of single molecules. There are no large mechanical contrivances to be found in cells. Even muscle is not a single contrivance but, rather, the sum total of millions of components, each of which is individually undergoing specific molecular rearrangements and these are the basis of the performance of the overall system. Energy transformations in living systems lie in the domain of molecular changes, not of macro mechanical contrivances. [14]

The final statement is worth keeping in mind because it represents a fundamental principle to be developed later in "Models of Thought".

13 Green and Goldberger, op.cit., p.56.
14 Ibid., p. 138.

A SUMMARY OF POSSIBLE CONCLUSIONS

It is impossible to disclaim an existential state for meaning without first demonstrating that ideas are material; that form is inseparable from content; and that the existence of mind apart from mental events is irrelevant to human behaviour. In attacking the first of these demonstrations, it has been necessary to examine some of the assumptions inhering in various ontological perspectives of quantity and quality because like form and content, quantity and quality are inseparable. Consequently, the discussion of reduction does not eliminate the dangers of regressions: it points out the inevitability of some reductions and for their necessity; but, at the same time, it cautions against the idea that everything must be reduced to some primary matter. Above all, it aims at showing that the distinction among Newtonian mechanics, Planck's quanta and Einstein's relativity theories must be integrated rather than separated. This is important because an historical perspective of modern physics assists in perceiving the interrelatedness of quality and quanta such that each can be reduced to the other. Therefore, given that one is reducible to the other, it can be concluded that a qualitative state is properly described by the postulation of its quantitative elements and their relations. However, since one reduces to the other, the emergent state of meaning is the product of the reduction-expansion process inherent in inquiry. It is

because this is the true nature of meaning that a referential system of meaning works unfailingly, assuming a consistent philosophical principle of integration of things. Without a context, a thing makes no sense whatever. As is argued in the chapter "Models of Thought" the only context possible when considering the nature of meaning is the neurological context. It makes no sense whatever, insofar as meaning to someone is concerned, to speak of meaningful relations of a context that is not simultaneously mental as well as objectively material or existential.

Realizing then, that quanta and quality are reducible to themselves, it becomes an important matter to realize the irreducibility of a system if coherency among elements to be reduced is to be maintained. For example, a sociologist may be studying group behaviour for some purpose. Should he fail to see the systemic parameters of his group and, perhaps, sub-groups, his study becomes hopeless. It is not enough to merely make classifications of groups: their qualitative natures must be specified quantitatively so that any qualitative change can be measured. If the study of group behaviour is approached with the attitude that a sub-group is simply fewer members, errors compound. The relations which specify one group's identity must be isomorphic with the relations of the sub-group or else the study takes, unwittingly, a new turn. One loses hold of his method of integration. The

problem, then, is well represented by the ionic models of calcium hydroxide and acid; and it can be concluded from those observations that if meaning emerges from the study of wholes, then the wholes must be examined by the process of reduction so that the boundaries of systemic irreducibility are found. Then the relations of the elements can be perceived as the qualitative nature of the whole -- again, the process of reduction and expansion wherein meaning emerges.

This position on meaning leaves the question of a "beginning of things" rather unanswered. Not unlike Topsy, the universe of things just grew. From the segment on the "Origins of Form" it is not unreasonable to conclude that even as meaning emerges, it is a function of the constant reduction and expansion of things. Hoyle's latest theory of the origins of the universe certainly is compatible; and this study does argue that ideas are material. This, tied together by the comments in "Reproduction of Forms" serves to point out that the differentiation process at the atomic level accounts for all differentiations at the macro level. An interesting aside here is to note in anticipation of some adverse comments concerning the inclusion of Hoyle's ideas is that when it is considered that universal material and that of human organic substance appear in every way identical, it would seem most incongruous if both groups of matter failed to adhere to the same physical laws of behaviour. Thus, to compare galactic matter and its behaviour with human behaviour probably makes vastly greater sense than to draw conclusions

about humans from the study of rodents. This is so because if the process of differentiation is the qualitative identity of the organism, it is rather obvious that the qualitative states of rodents and humans is different. How then, can more than grossly superficial analogies be made between systems whose essential properties differ? There is much greater similarity in the relations of galactic matter and atomic configurations and the atomic and molecular structures of humans than between the organic behaviours among animals.

Regress is non-existent in the process of reduction-expansion because the irreducibility of a system without changing the qualitative nature is impossible (hence, since a change is physical or, quantitative, the two quanta and quality are inseparable) and so, if the parameters given for a system are correct, further reduction would change the inquiry; it would not constitute an explanation of any kind.

Finally, when the introspective nature of language is considered, it can be deduced that the crux of the problem in the specification of meaning lies in this matter of ordinary language being a short code just the same way as conceived by Turing. It is a macro device for the description of micro events. The neurological introversion of language or, cognition, could operate in no other way. Because of these relationships, the precision of form is lost in the clumsy utterance of content. It is possible to conclude that all

people perceive in precisely the same way and in fact, have the same mental perceptions of the same object; however, the use of ordinary language, affected differently by different cultures, produces an expression of the perception much different from each other. Within a single culture or even within a single community, the use of ordinary language will present a different perspective of the same object because of the ineptness of the short code nature of language, not because each person sees differently. To argue otherwise is to argue that the behaviour of matter differs from person to person. It is interesting to note that the Whorfian hypothesis is not widely accepted, but its converse is; and yet, after the stage of primary language development, it is very likely that the language itself does, to some significant degree, condition the ways in which further perceptions are described. (This is a slight modification of the Whorfian hypothesis: there is little evidence that an established language pattern does more than condition the language to be used in a further description, thus giving the impression that the perceptions themselves have been conditioned by language habits.

MODELS OF THOUGHT

INTRODUCTION

There is a vast literature dealing with brain structure. Neurophysicists, like most scientists, are not prone to interpolating their results to produce speculation as to the possible significances of their research except insofar as limited speculation may assist in the revelation of some relational significance among certain biological elements. There have been few attempts to postulate models of the entire thinking mechanism. The rationale seems to be that once a complete description has been given of the brain and all its elementary relations made clear, a model will be superfluous. At the same time, educators suggest all sorts of objectives for students and society at large, including in their exhortations such things as intelligent thinking, rational behaviour, creative thinking, imaginative planning, transfer of learning, open-mindedness and a host of other qualitatives. Of course, there is concensus as to the meaning of these things; but there is little or no knowledge of how they might be effected. Opinions seem to contend that knowledge of brain structures may become important and may have value, but at present, humans must be studied holistically, not additively. Man is more than the sum of his parts. Actually, man may enter into external re-

lations, but, apart from self-perception, he can be no more than the sum of his parts. But, rather than begin another argument about the nature of parts, wholes and organic sums, suppose a model of the thinking process is presented. If it is reasonably useful and successful as a model, it should be of considerable assistance in integrating the diversity of theories concerning human conduct. Human problems seem to be a quagmire of polarities. Why this is so can be dismissed as simply being the nature of humans; but it may be possible to gain a greater understanding of this nature by producing a workable model of the thinking processes.

Since the literature describing the physical structure of the brain is rich and abundant, it would serve no purpose to describe in any detail the biological mechanisms. In any case, a description will emerge to some extent through the process of explaining the ways in which certain organic processes take place. This form of explanation will be considerably hypothetical since its main objective is to posit a series of possible orders by which biological organization becomes both the form and the content of information structures. The major objectives of this chapter are to:

a) present a much simplified model of the brain, and

b) to convince the reader that the metaphysical assumptions of the study are operable within the contexts of this model.

THE MEDIUM IS THE IDEA

The first objective is that of overcoming the popular idea that ideas have some existential nature that is non-material and apart from the brain process. A major key to this concept lies in Marshall McLuhan's dictum that the medium is the message. Actually, McLuhan is saying nothing not already said adequately by Aristotle and other ancient scholars. Aristotle did not have television sets and the like from which to formulate his ideas, but he did have access to literature; and his Poetics make it clear that a separation of form and content results in chaos, an incommunicable mass. What is learned from Aristotle's work and from the modern systems theorist's conclusions is that meaning is a function of organization and that it is impossible to have an organization of something which is not material. The usual argument to such a view poses the question of how humans seem to be able to sit back rather objectively and consider ideas. The assumption of such objectivity is that the brain only ponders ideas as they float past and that an idea cannot have material form. It is another example of dualism with its infinite regression of observers. Fortunately, there is a growing body of experimental data which supports the first sub-thesis of this study that ideas are the particular structures of certain molecules within the brain. They are

not simply the medium of expression or a representation of an idea, they are the ideas.

The dualist position arises nearly every time the concept basic to this thesis is raised. It appears that every dualist will agree that physiological events are always in constant conjunction with mental events. This being so, there is no need to complicate matters by trying to work with non-material things as causes. If non-material causes do exist, then they must be studied through overt, material events. Either way, the inquirer must admit that he has only one kind of reality at his disposal -- the rest is inference. It is in this sense that Aristotle viewed form and content and for these reasons he knew them to be inseparable. Form must conjoin content insofar as a human observer is concerned. Accepting this point of view and continuing the perspectives of the segment "Origins of Form," in the first chapter, it follows that the neural structure turned out by sRNA must be the idea not just some representation of it. The mental event and the material event are one and the same. Those qualities said to be human attributes are the quantum states of molecular combinations. It is this kind of view which assists in the development of new and improved computing machines. It is the study of neural activity which aids computer development and not the reverse.

Comparison of the brain with computers invariably fails except on a most superficial level because the differences are more numerous and significant than are the similarities. Walking and flying are similar in that a subject moves from one point to another. Physical movements are involved in both cases. But a subject that can fly requires a different physiology from one that cannot fly. Similarly, it is quite debatable whether a brain computes or does something quite different. Obviously, the brain has certain digital characteristics such as the nerve impulses. But it cannot compute in the sense of a computer wherein twelve or more places of decimal of accuracy are commonplace. Analogue computers lack the accuracy of digital machines but their speed is greater and they are particularly suited to certain kinds of problems. If there were significant similarities between the brain and computers, it would be logical to assume that neurons function in a manner similar to the electronic components of a computer. The fact is that an electronic component has about the same proportion of intricacy as a logging spar to a jeweller's screwdriver. It is not unreasonable to view the matter from the point of comparing ways in which a computer can compete with the brain, but not the converse. The point may seem minor; but most advocates of a non-mechanistic theory take the point of view that a mechanist uses the computer as the model.

A neuron possesses the simple on/off characteristics of many mechanical devices and of many electro-

chemical devices. It has many more operational characteristics as well. The on/off feature of a neuron is a feature only of an axon of a neuron. The increase of output frequency with input amplitude, the ability to add and subtract different inputs, the effects of time coincidence on the summing properties, the variable threshhold characteristics and many other properties all indicate that neurons exceed by a considerable margin the electronic components of a computer and further, indicate that comparisons of the brain with a computer are valid only insofar as they are made on the basis of what is hoped for in the development of more sophisticated machines. However, the fact that one entity is not really comparable with another does not diminish the possibility that each is a member of the same species: machines.

Probably the only valid reason for comparing the human brain with computers is the fact that the computer carries out certain functions which only the brain in humans is capable of doing. There is no valid reason why computers should not evolve to equal human thinking abilities by means which are totally foreign to the neurological processes. But the important point is that nothing is refuted in mechanism if only shortcomings or inexplicables are cited. It is the inadequacies wherever they may be with what is postulated that must be pointed out, not the inadequacies for areas not yet explained. Otherwise, it is like saying man will never

produce a travelling device to carry him to Mars because there is no propulsion device to cover such long distances. Therefore, the theory of rocketry is haywire and should be abandoned because it fails to explain how man can get to the outer fringes of the solar system.

INTER-NEURAL ACTIVITY

Coming back more directly to the assertion than an idea or, more appropriately, an information bit is the material form within the brain, it will become clearer through a brief description of a part of a neuron's activity. The surface membrane of a neuron is generally semi-permeable. The interior of the cell has a negative potential of approximately 70 millivolts relative to the cell's exterior. When this potential is raised to something like -60 millivolts, the membrane becomes permeable and the potential can be generated by any external signal received through the human sensory apparatus. And it begins a process of signal propogation (or, reproduction). Thus, when certain degrees of excitation reaches a part of the cell called the soma, the cell fires, electrically, and a wave of such excitation passes along the axon. Each cell has a certain number of output channels called dendrites. When the input function reaches a certain level, a threshhold level, the neuron fires.

It would appear then, in this simplified but informatively complete description, that at some point information is represented entirely by a material structural process. Perhaps in order to really 'prove' this point it would be necessary to identify a particular molecular structure and show that without it, the information bit which it rep-

resented also did not exist in the consciousness of a human. Obviously, that is not yet possible; but it is possible to state definitely that no non-physical entity or force of mediation is in evidence.

An interesting example comes from a paper written by F. Gros in which he says that the role of sRNA is:

> Clearly to serve as an adaptor for specific amino acids, that is, to put them in front of the appropriate coding unit present in the template RNA. This has been [confirmed] by the experiments of Chaperville and associates (1962). As we shall see later, the synthesizing capacities of ribosomses can be programmed by the addition of specific polyribonucleotides prepared enzymatically. [15]

This is a rather significant assertion and Gros continues to explain. He says that, as an example, when the appropriate copolymer (poly UG) is used, cysteine is selectively incorporated into a protein product because if sRNA "charged" with radioactive cysteine is added to the system, radioactive cysteine will be found incorporated into a protein linkage. Further, he says that:

> If the sRNA-bound cysteunyl residue is chemically reduced in situ into alanine, this alanine will become incorporated in the place of cysteine, although the naturally occurring alanyl-sRNA intermediary does not function as a precursor for the polypeptide synthesis under the conditions of programmation imposed in the experiement.[16]

What this all adds up to is that structure of matter at the

15 F. Gros, "The Cell Machinery" in Macromolecules and Behaviour, John Gaito ed. (Appleton-Century-Crofts, Inc. 1966) pp.8-9.

16 Ibid., p. 10.

atomic level is crucial in information coding. In biological terms, it means that since the primary structure of proteins is determined by the genes as determined by Ingram and Pauling in 1949, that it must be admitted (in view of the preceding) that the assembling process of amino acids has to take place on an RNA template and that this template is a copy of DNA. Gros says that the true active template is a messenger RNA which carries the genetic information from DNA to the cytoplasmic protein particles. Again, information is carried and moved by physical structures and not by some non-physical mediating force or entity. Here is a definite case of information being carried by physical structure and in which the information is destroyed (according to Gros' example above) if the structure is changed.

From "Origin of Forms," it can be concluded that oxygen is not oxygen because it is composed of matter which is somehow different from all other matter. It is composed of the same matter which forms the composition of <u>all</u> elements. The only thing different between an atom of oxygen and an atom of carbon is the organization of the matter comprising both (which includes, of course, number). It follows therefore, that if matter is differentiated by structure only, then similar structures differ from one another only in one really significant way: two atoms or particles of matter cannot simultaneously occupy the same space. Generic identity of carbon atoms may be possible by classification through structure; but individual identity is

possible only insofar as one atom alone can occupy a particular location in space. If it were possible to see a micro level of existence, it may be that individual identification could be made by the same surface irregularities humans use to distinguish among themselves. This would be a result of the difference between a quantum state and a quantum level. Within each quantum level, there may be a possible range of possible quantum states. Thus, atoms of the same species exist but differ slightly from one another in much the same way humans do. But such distinctions would be unimportant at the atomic level because it represents the level of minimum system existence. If an atomic system is disrupted, the atom as such ceases to exist. Similarly, if human societies are disrupted, they would cease to exist. The changing of individual relations within a system changes the qualitative identity of that system. If new particles are added to any given atom, an entirely new qualitative state exists. And if certain numbers of humans are added to a given human social community, it acquires a new identity. Additions cannot be made indefinitely. If in any institutional structure large numbers of humans are added, the structure becomes unstable and more laws -- and enforcement of those laws -- are required to retain the system. If certain numbers of elements are added to an atomic structure, it becomes unstable and finally disintegrates, producing two roughly

equivalent structures or one which has the quality of the original and one which has some other quality. However, the analogy of bonding in atoms and in human communities is in error because substructures are not comparable with suprastructures. The system of the atom and the system of the human are quite different things. There may be, however, some significant relations between molecular activities and human relations.

At the risk of appearing redundant, it may be well to restate somewhat the earlier comments about the nature of the inseparability of atomic form and content. Consider again the structure of an atom of oxygen and an atom of carbon. Each is composed of a certain number of electrons, protons and neutrons. If all the particles of the oxygen atom and all the particles of the carbon atom were thrown into a bag and mixed, and if they were then placed on a table for identification, it would be impossible to tell which protons belonged to the carbon atoms and which belonged to the oxygen atom. The same is true of the other particles. In other words, there is no qualitative difference among electrons found in any system or among protons and neutrons found in any system. The only differentiating quality at the atomic level is the structure (pattern, location and number). Consequently, it is impossible to have a separation of form and content for they are one and the same thing. That is, of course, if the reader accepts the thesis that there is nothing which is not material. Content becomes the linguistic description of

form for reasons of communicative economy and conceptual manipulation. Knowing then, that humans are composed entirely of atomic structures and matter, it is not a difficult task to see that human identity is a matter of form and physical location. Naturally, this kind of definition seems to engender animosity in many because it fails to account for the vast array of human emotions which each feels is particularly his special perceptions. What should be clear by now is that perceptions are probably very nearly identical in all people but the mechanism for conversion to speech for communication fails to retain all the intricacies of the molecular structures which contain the complete set of information bits of the perception. Actually, the rider must be inserted that perceptions would be the same in all people if each could perceive from the same physical location. This is the real short coming of ordinary language. The neural mechanism contains complete information of what the senses perceive; but the convolution necessary for language to represent this information necessarily 'quantizes' the information for oral transmission. The result is a less than accurate conveyance of the stored data.

As for the special identity of humans individually, there is nothing outside of genetic codes which distinguishes one person from another and even these differences cannot be said to be unique. The social identity of a person is something quite different from the type of identity

posited in this thesis. Social identity is a function of behaviour. It cannot be determined a priori except by means of group pattern analysis as effected by commercial enterprise in marketing analysis. At the population level the group identity can be predicted within certain limits and if the environment is controlled to some degree. But this kind of identity is really behaviour and it is from this behaviour that people generally adduce their "special identity." The conclusion then, is that how something behaves is the only way of specifying its social identity. It may take a lot of the romance out of being human, but for a vast number of social, scientific and philosophical objectives, it works.

PARALLEL AND SIMULTANEOUS PROCESSING

The opposite to parallel is serial. Most computers today are of a serial nature and are generally referred to as digital machines. The other major type is the analogue computer. There are many respects in which the brain is like a digital machine. Digital machines are governed by strict and logical rules. All of their operations are composed of patterns of alternate actions organized in highly repetitive sequences. When the term memory is used in machine technology, the referent of the term is usually a bank of tapes, disks or some such device on which is recorded vast numbers of bits of information. The bits can be organized into data. When a comparison is made between the brain and the computer, the analogy of each member's memory unit is incorrect. The tape banks of a computer serve the same function for a machine as a library serves for a human. The 'in process' memory of a machine does exist, but compared with that of the brain, it is rather small. When a machine requires data in its memory tapes, it must be instructed by some programme or mechanism to run through to the tape storage, scan all bits and select specific material from specific addresses. Except for genetic storage in humans (and there is good reason for not viewing this as a memory function in the popular sense of memory), there is no such localized memory bank or data storage area.

The problem of explaining the nature of memory within the human brain is not an easy task. It is an area which easily lends itself to fitting theories to facts instead of trying to construct a theory out of the known elements. Admitting this, invites anew the charge that even the mechanist sees the difficulties of explaining brain processes in terms of material events. However, such criticism would simply be another way of saying it is better to construct a theory in ignorance of real data than "to look through the telescope" as Galileo noted; and that is a position quite different from one which calls on the heuristic devices of caloric or phlogiston. So long as phlogiston was never worshiped, it retained the potential of assisting the development of empirical knowledge. So it is with attempts to formulate hypotheses about the thinking process. There are many knowns, and there are many more unknowns. But perhaps, the major task is to try to formulate some of the possible relations of the knowns in order to produce a plausible model for neurological activity. Of all the possible explanations derived thus far, none has come to grips with the memory function with any great degree of satisfaction. One reason for this is the fact that attempts to explain thinking as a somewhat random activity or process immediately and inevitably run into the wall posed by the question of free will.

It is not difficult to present a good thesis against any concept of free will on a sociological basis.

But when asked for explanations of how humans seem to be able to recall "at will" various facts as they may relate to a given problem under consideration, the task cannot be hidden by subtle social analogies and differences immersed in philosophical discourse that become most difficult to detect in logical arguments. Logic may be useful in finding ways to connect or relate things; but it does not of itself verify the truth or accuracy of the models so constructed. First principles can be argued in philosophical discourse; but explanations built from material facts have no first principles: the model either works or it does not. The key to human memory seems to lie in what is becoming to be recognized as the most complex and cleverest mode of operation of the brain: its capacity to process distinct data simultansously. Computerologists study the problem under the heading of parallel programming.

John von Neumann[17] estimates that human memory capacity in terms of bits of information over a period of sixty years would be of the order 2.8×10^{20} while a modern digital computer may have a capacity of about 10^6 or 10^7 bits. It would appear that the human has the edge. However, retrieval is a major human problem, not a machine problem. There is strong evidence suggesting that any and all sensory inputs into humans are permanently recorded. Assuming the existence of free will, it would not be unreasonable to expect that given a few moments of time, any and all data could be recalled

17 John von Neumann, The Computer and the Brain (New Haven: Yale University Press, 1958).

at will. All must agree that such is not the case. But the problem plaguing humans also plagues computers in their present design. It is because of the necessity for serial programming and searching that makes it impossible to have a computer with infinite memory capacity. Even though all the data known to man can be stored on tapes for a computer, it has to run through it all in order to select relevant data. Humans seem to have the advantage of scanning much data simultaneously. Infinite regression would result if human storage were serial. If, like a computer, there were a mind to tell the brain what address to search for required memory data, the "mind" would have to have similar storage mechanisms to store the "addresses" of data in order to instruct the brain and so on. If a computer had all the possible chess moves in its memory, and if it began a game when the solar system began, it would still be pondering the first move when the sun deteriorated to a red giant. Serial programming is limited. Hence, not only would infinite regression of analysis result if human memory were a serial storage mechanism, recollection of data would be an extremely slow process. Modern computer components can recover their states within nanoseconds. The human nerve cell recovers in a matter of milliseconds. The difference is very significant. This is one major reason why computers can calculate so quickly. Nerve impulses in humans travel up to two hundred miles an hour. They travel at the speed of light in a computer. Therefore, it is illogical to suppose a particular memory mechanism or storage area in the

brain. This very conclusion is a major clue to some of the possible ways memory is handled.

In all likelihood, the next major generation of computers will be composed of machines which will revolutionize man and his universe for they will be some sort of compromise between digital and analogue devices. The combination will be a type which can scan vast amounts of information and analyze relationships for analogous structure and give not opinions but statistically probable solutions. And it is not inconceivable that machine scientists will succeed so admirably that they will produce machines with many of the faults of human processes. The nature of the parallel structuring is not too well understood to date. It is possible to say that RNA facilitates memory in humans but it does not itself constitute a storage mechanism. The bits of input data appear to be stored throughout the whole of the neuron maze. As a result, the human does not "willfully" probe a storage location for data but in fact constantly probes all areas of the brain. Assuming there are some ten billion neurons and that each neuron may have as many as fifty to a hundred axon connections, the combinations for searching rival the complexity of the North American telephone wiring network.

When a special stimulus is received, that data which has the greatest structural similarity is integrated and processed. That is, given a stimulus of some data, certain

electrical activity may be more frequent along certain axons than along others and the consequent is filtered through the reticular formation. A slightly esoteric educational implication of this is that studies are not undertaken by the young to acquire knowledge in the traditional sense but really to acquire the required amount of data which will randomly interact and, depending upon the amount of stimulation, cause to be produced certain forms of behaviour classed as more or less intelligent. And it could well be the physiological justification for the thesis that the order in which ideas are acquired does not affect their understanding. Thus a reader can scan a book in a totally random fashion and acquire the theme and any other dimension a reader normally acquires. Again, this ability seems to argue against serial operations in the brain, an almost necessary procedure for dualistic theories. The only argument against this is that the process of communication does require a certain sequence to be followed if in fact the listener or reader is going to gain some understanding of just what the encoder wanted to communicate. On the other hand, so long as all the parts of a sentence are there, the brain quickly unscrambles them, It is not unlike the experiments of wearing special glasses to reverse everything the brain normally "sees". Within a short space of time, everything appears normal.

Clearly, someone with a great amount of experience would classify information in some pattern as received;

but this would be because certain receptor patterns have been conditioned by that experience. In the case of an infant, the input would be stored in a rather random fashion. There would be no prior experience of context to which it could be related. Memory may be a function of a certain cortical layer; but it seems to be rather diffuse. It is only logical that since the human brain does in fact process many bits of dissimilar information simultaneously that memory must be a function of many major neurological elements diffused throughout the brain. The inability of recall seems to justify this concept rather than weaken it. It would be tricky indeed to explain memory as a will function when everyone constantly has difficulty retrieving certain pieces of information for a specific problem. The computer has to be told to recall data from its tape library; but in the case of its 'in process' memory, no instructions need be given because the nature of the problem solving task givenit (or, the sensory inputs) automatically define the connections it will make of such data. Consequently, if the human memory is of similar form, then only external stimulation can excite the necessary elements to be accepted by the reticular formation.

The function of the reticular formation is of two basic types: ascending and descending. It is entirely possible that the reticular formation is the major control mechanism which determines in a rather indirect way whether or not the brain has 'remembered' the proper data. There is

evidence to indicate that it is a greater input channel than control of output.[18] For example, the brain may attempt to channel all excess activity through the reticular formation (descending) while external stimuli are constantly received to control this feedback process which in fact is allowed to be manifested as overt behaviour. Suppose a subject is asked to solve a problem. The brain is stimulated into specific activity. A "memorized" answer may be allowed to pass because it produces the strongest reaction or restores equilibrium. If the problem cannot be responded to in that fashion, then many elements seek unity through some electrical processes and the information is fed through the reticular formation which in turn inhibits or facilitates depending upon the incoming signals. Unfortunately, such gross simplification fails to provide a satisfactory explanation of what is obviously a vastly more complex series of operations. But, it is important to the understanding of the memory to grasp the general operation of the whole neurological process. It is not unlike describing the operation of an automobile engine by saying that fuel is fed into the engine wherein it ignites and causes the drive shaft to revolve which causes the rear wheels to rotate which causes the vehicle to move in one direction. Such an understanding hardly qualifies anyone as a mechanic; but a mechanic would say that such an explanation was somewhat simple, not necessarily incorrect.

18 Mary A.B. Brazier, Brain Function, RNA and Brain Function Memory and Learning Volume II (LosAngles, University of California Press, 1964); pp. 186-194.

The most advanced computers have memory systems not in the form of memory tape libraries. They are, in fact, like the brain in some respects in that they are combinations of digital and analogue procedures.

Rotating cores in a computer can be used to act as the simple binary components of computation. They can also be used to store information and even to do both together. The degrees of rotation can be used to contain data. Even in transistors, flip-flop action takes place by reversing fields. The result is a physical approximation of integration that makes very complex machine behaviours possible. In the human nervous system, processes going through the system may alternate between digital and analogue in character. Nerve impulses are the digital parts which may generate certain chemicals within a muscle. This phenomenon is a member of the analogue class which in turn may be the origin of a train of nerve impulses which are due to its being sensed by special inner receptors. When these impulses are generated in this form, the result is the switching back to digital operation.

THE IMPORTANCE OF PATTERNS

Consider the DNA molecule. Remove one part of its giant molecular structure and what is left has no resemblance to DNA. It will not function as DNA but more importantly, because of the changed structure, no scientist will classify it as DNA. An atom of hydrogen differs from an atom of oxygen only in the number of protons, neutrons and electrons each has. All oxygen atoms of the same isotope form have the same numbers of each sub-particle. Similarly, all oxygen atoms and molecules have the same shape, the same geometry. It is important to realize that the shape of the molecule is dependent upon the type of bonding propensity that each class of atoms has. Thus, the molecular geometry is, in a sense, predetermined by the kind of atoms which it is composed of because those atoms will only bond in a certain design during the formation of molecular structures. The geometries referred to here are those of the most stable form possible. Hence, ozone would not be considered a molecule of oxygen because although it is possible, it is less stable than the common molecule. Again, it is significant that water is the result of a combination of oxygen and hydrogen. The proportion of each is certain and necessary. Water is an interesting example of the holistic/summative argument. It is a soluble conflict because neither side will deny the

the irreducible qualitative nature of the hydrogen and oxygen atoms. To be logically consistent, a dualist of the mind/body school would have to contend that there was some mediating device of a non-physical nature which caused the interaction of hydrogen and oxygen to produce water. Even if there were such a mechanism, it should be obvious that it operates in direct conjunction with operations performed on the parts such that any separation of the H_2O complex results in "not water". Therefore, an atom or molecule is a system the nature of which prohibits the removal of any part without the inevitable destruction of the system's identity. Therein lies a clue to the significance of analogy and of rules for isomorphic relations.

The removal of a human's arm does not change the identity of the human. It may change the description somewhat; but that entity called 'Z' still exists. It is not at all like the removal of an electron from an atom of oxygen. Nor is it at all like the changing of quantum states as described by Professor Weisskopf, mentioned earlier. A change in quantum state produces a change in the qualitative specificity of 'Z'. The most obvious difference between the two operations is that if there is no qualitative change in essential identity, then the two systems are not analogous. A human arm is not a system but a conglomerate of systems[19].

19 Compare with Green and Goldberger, op.cit., p. 7.

If there is no difference among elements except in that their number of electrons, protons and neutrons differ, then all matter can be said to be the result of particle differentiation by structure or organization and not by kind. In other words, there is a rather significant relationship between the parts and the whole which a group of parts comprises.

A SUMMARY OF POSSIBLE CONCLUSIONS

Chapter I set out the general philosophical perspective upon which the elements comprising the thesis were organized. It may be considered as the general theory of integration of the study. This, Chapter II, sets out the principles of integration and creates the specific environment or context for the central thesis. It deals with what is essentially the human dimension of the question of emergent meaning. Where Chapter I argues the necessity of a context for meaning, this chapter has argued that insofar as meaning is concerned, the neurological context is feasible. Because only a material world is considered possible by the argument in "The Medium is the Idea", it must be concluded that human identity is primarily a matter of physical location. Doubtless, such a definition of the self would strike most as meaningless: the romance and poetry of human emotions seem to vanish with such a view. Why that should be is incongruous: pigmentation and wave reflection theories of vegetable colours hardly destroy the aesthetic of hue of roses. However, the object here is to find a way not of explaining something human by extraordinary means like the reduction of human behaviour to that of rodents, but to work out a rationale for and with a single, homogeneous material. How easy it is to define something by saying what it is not; but the only finite, positive way of

explaining exactly what something happens to be, for purposes of identification, is to simply point it out. A good example of this is the DNA molecule. Until March, 1969, it was part of an elaborate theory. Now it has been photographed. Atoms and molecules are not easy to distinguish among because their behaviour patterns do not appear to vary much, one from another. Human behaviour patterns are not significantly different to the untrained eye either. Of all the properties each may possess, the only one which is unique is that of location.

From "Parallel and Simultaneous Processing," it is reasonable to conclude that since meaning is not a machine-like operation like the stomach or liver, it is a diffuse process and that, as a result, supports the hypothesis that the perception of patterns is of vital importance to thinking and that information is most likely stored by means of the various quantum states produced by sRNA mechanisms. This tacitly supports the general model of thought this study presents. One of the more important possible conclusions is that since digital neural operations for memory (recollection) must be largely ruled out as far too time consuming, thought cannot be a very willful process at all; it must, in fact, be multiple, discrete responses to external and internal mechanisms wherein the reticular formation, by the nature of its structure, permits only homogeneous inputs to pass, as manifested in behaviour.

From the discussion in "Inter-Neural Activity," it is apparent that brain activities are both digital and analogue in character; and it seems that digital operations are primarily concerned with signal generation whereas analogue operations account for that behaviour which is considered intelligent or thoughtful. It is likely, therefore, that this form of neural activity is what makes analogy so important for the establishment of what is generally called meaning. The host of statements of the form "is like a...," "functions like...," or "is something between a...and a..." arise from the essentially analogous nature of mental operations. The brain seems to owe its success to its analogue nature and meaning is thus a matter of the relation of things. Consequently, it can be deduced that relations should be a major study of any curriculum.

If the model concept presented here is accepted, it can only be concluded that Herbert Feigl was too restrictive when he said:

> If by "mind" or "mental life" we mean the immediate experiences and the thinking of persons, then no matter what we have learned from recent atomic and quantum physics, the puzzle of the relation between the mental and the physical remains one for logical and epistemological examinations.[20]

An argument over the composition of the moon after the summer of 1969 will forever be pointless: material facts of geological

20 Herbert Feigl, "Matter Still Largely Material," in The Concept of Matter, Ernan McMullin ed.(Notre Dame, Notre Dame University Press, 1963); p. 562.

analysis will reveal the truth. Similarly, problems which necessarily involve the brain cannot be solved without reference to the latest material facts. As the final chapter argues, meaning is a state of being, and not a state of things. This model attempts to describe, for it is based upon the assumption that what is adequately described requires no explanation: the form is the content. Somewhere in his writings, C.S. Peirce said that men's minds must have been attuned to the truth of things to discover what they have discovered. And he dwelled upon the idea that people think logically and that they think logically. This chapter has said little more than that really. It is because the brain operates logically that things called relevant or pertinent information bits are sorted from the irrelevant.

It must also be remembered, the earlier argument against the comparison of humans with either rodents or galactic matter. The latter was preferred for reasons which, hopefully, are now clearer. The basic assumption there was that there is little reason to suppose one set of laws governing the behaviour of matter in the human body and a different set of laws governing the same kind of matter in the galaxy. Similarly, the RNA mechanisms seem to be able to produce material images of things neurologically, and, because they are material, they too must follow the universal laws of matter and assume what is called a logical form and interconnect in a manner which is compatible with the material

universe of which they are made. Logic, therefore, is not a product of man's innate spiritual genius but of the inevitable fate produced by the natural state and behaviour of matter. It is for this reason humans so easily assume that logic is synonymous with truth. So perhaps Herbert Feigl is right after all: the puzzle of the mental and physical is a matter for logical and epistemological examination. But it would not do to come this far and not speculate a little as to the precise characteristics of the brain model that the foregoing suggests conceptually.

Based upon the foregoing, it is not unreasonable to predict that sensory inputs result in motion among certain neurological pieces. This motion, in turn, results in various chemical and electrical activity, some of which is digital in operation and some of which is analogous in operation. In addition to external inputs, there are also internal stimuli. Both kinds of inputs account for all mental experience. The brain is not a machine which operates according to the principles of perlocutionary and illocutionary acts or commands. To the brain, there is no such distinction. It functions much as it does because of its structural nature and not so much because of external inputs. That is, there should be more cultural similarities among men than cultural differences since this brain model must be non-denominational. For example, ritual and sacrifice are common to almost all races and tribes although the form may vary somewhat.

The conceptual model supposed in this study is

a mechanism which seeks equilibrium. That is, all things which are meaningful are things which produce, through sensory impingement upon the brain, mechanical equilibrium; and mechanical equilibrium is viewed as being identical with emotional equilibrium. Consequently, the thermostat is a good, though crude, model of the general performance of the brain: contact with the environment provides the first principles on a nominalistic basis and hence goals; the goals are simply the state of mechanical entropy created by the sensory input which the neurological system reduces to equilibrium by the anti-entropic nature of matter. The state of dynamic equilibrium is the state of meaningfulness to the human. It is this automatic "search" for equilibrium which provides the human quality "motivation." Man searches not simply to know, but to become stable; and it is an infinite process because there is no such thing as static equilibrium apart from heuristic stipulations.

Karl Deutsch presents what may appear to be a suitable argument against this model, assuming that it is regarded as a homeostatic model:

> Homeostasis is not a broad enough concept to describe either the internal restructuring of learning systems or the combinatorial findings of the solutions. It is too narrow a concept because it is change rather than stability which we must account for.[21]

It is true that change must be accounted for; but that change

[21] Karl W. Deutsch, in Towards a Unified Theory of Human Behavior ed. Roy Grinker (New York, Basic Books, Inc., 1956) pp. 161-162.

can only be accounted by reason of the search for stability. Homeostatic concepts should not be regarded as behaviours resulting in stasis, but as behaviours motivated by the quest for equilibrium which is not brought about by a spiritual force but by the simple and real nature of matter which is anti-entropic. The fact is that change is an organic process described by mechanical models. It is in recognition of the fact that exclusive philosophies must give way to systematic philosophies that general systems theory emerged as a more inclusive model...not really as a philosophy but as a model for inquiry. Consequently, the homeostatic dimension of the neurological model explicated here should be acknowledged as a <u>part</u> of the organic entity and not a substitute for it.

THE EMERGENCE OF MEANING

INTRODUCTION

The foregoing sections of this study have formulated several assumptions about the neural mechanisms. Although some of the hypotheses may not explain certain details of mental processes, none should fail to provide a possible rationale for the major principles of mental activity. Further, the objective of what constitutes qualitative identity has been reached and the inseparability of form and content has been demonstrated. The major objective of the study remains: to present a rationale for the emergence of meaning based upon the assumptions of the foregoing model of neural activity.

Theories of meaning range from referential systems to complex, pure mathematical logic and semantics. None of these types of theories give any detailed recognition to the human dimension of brain (as opposed to and in place of mind). It is simply incongruous that anyone should attempt to define systems of meanings without utilizing as best as is possible whatever data exists about the thing that has any reason to study a problem like meaning: the human.

In a referential system of meaning, the analyst seeks a system of classifications of referents which

are mutually exclusive so that some analogy can be made. However, the nature of a referent itself demands a context. And that context requires a context, ad infinitum. At least, that is the way it would appear to be, logically. But also logical is the observation that under such circumstances, nothing would ever be meaningful because regress was infinite. Since people claim things to be meaningful, they either prevaricate or a context is not necessary. Or, perhaps it may be that once something has reached a certain cognitive level, it needs no further contextualizing. But that is unsatisfactory because there appears to be no certain knowledge of what constitutes cognition.

Jean Piaget, the Swiss epistemologist, has made many formulations concerning the development of logical thinking in children. However, the formulations have been educed largely from studies of behaviour. Skilful analysis and classification of behaviour does not of itself demonstrate a sense of absolute cognition for a particular environment; it represents a solid analysis of what people do as the nervous system matures. It does not afford too many insights into the nature of how meaning emerges. Therefore, even if it proves impossible at this time to posit a good theory of meaning, it should be possible to explain why a good theory of meaning may be impossible to design. The obvious compromise at this point is to formulate or demonstrate just how meaning emerges in inquiry as sort of a product of an intellecutal process but which, when

analyzed statically, loses all sense whatever.

GENERIC NEUROLOGY

From the contents of the last chapter, the question might arise as to how the neurological model serves to explain the ways in which vast numbers of data can be stored in a short time. For example, by the time a human has lived fifteen years, it can perform a huge number of complex operations. But this does not mean, according to the neural model that there is a certain molecular structure for every operation or part thereof. W. Ross Ashby offers the behavioural clue to the answer;[22] and modern systems theory provides the intellectual environment or framework which differentiates human thought from all others.

A theory might emphasize activity in the development of intelligence. That is, children may respond in a variety of ways to their environment and constantly revise their perceptions of it until they agree closely with their physical surroundings. For example, a small child may think a sphere of clay may weigh more than the same amount made into a disk. This example of the concept of conservation is fundamental both to logical thinking and to the physical sciences. What is important is how the child acquires a concept like conservation because the acquisition of a concept demands concurrently some comprehension of meaning. There will come

22 See especially the work of Jean Piaget. The use of the term 'conservation' should not be construed as referential to Piaget's use of it although it is related.

a time when the child will form generalizations about the inverse relationships of things like levers and so on. A child's life becomes a great variety of experiences most of which are related in some way. It is through these relationships that one is able to comprehend concepts such as conservation. That is, by reducing the elements to their systemic relations, the child comes to understand the nature of the system. This may sound rather abstract for a child's activity; but it does describe the precise manner in which various concepts are 'interiorized'. The child usually is not aware of the rules which generalize and categorize his behaviour; but then, a proton seems to have no idea of just how complex its behaviour is either.

It would seem reasonable to conclude that since children will encounter vast numbers of problems of different kinds throughout life that an educator should seek ways of categorizing the behaviour potentials in order to anticipate every kind of major or significant problem a person may encounter. It was, perhaps, this kind of reasoning that inspired Benjamin Bloom's Taxonomy of Educational Objectives. There was a time too, when it was possible to programme a human with all known physical knowledge and to have one read in all the major works. This has not been true for many generations. It is the real contention of this thesis that anything which is neither systematic nor made systemic, is without meaning. Consequently, the preceding

conclusion as well as Bloom's encyclopedic work presents a limited and, ultimately, crippling perspective. No diminution of the importance of Bloom's work is intended; but it is well to caution the unwary from regarding it as an educational panacea. It is a good step, not an entire voyage. Clearly, then, if the encyclopedic approach is like trying to lift wooden pins with a magnet, then something else must be examined. The key probably lies in the characteristics of generic behaviour -- the genetic and learned programmes which, by their structural relationships, produce the phenomenon called meaning. That assumes, of course, that meaning is a product of a system as opposed to an isolated paradigm or to simple nominalism. It also points out that the term 'interiorize' arises from the fact that meaning arises from internal relations wherein their degree of specification is bounded by their external relations.

The term generic neurology refers to the key structures not made redundant by the principle of simplicity which represent the ordinary language class called concepts. From what von Neumann and others have said, it must be accepted that if the brain did not have a way of economizing, humans would be severely limited because the mechanical logistics of information retrieval and processing would simply take more time than humans live. Thus, organization is essential to all intellectual activity and ob-

viously, that organization must be systematic because relations can function only within systems. That is, the genesis of an idea is motivated by the internal relations of elements among the external relations of the total structure. Because a generic idea, or concept, embraces a large family, the resultant ideas and detailed products are many and complex. Consequently, the need for analysis of relations becomes apparent. Any discussion without first looking at isomorphism and some of its hazards can easily encounter difficulty. It is not sufficient to note that there is some kind of relationship among things; it is essential that the precise relations be stated lest huge errors in category be made.

THE GENETICS OF ISOMORPHISM

Some of the criteria for meaning and identification should be examined, particularly that of isomorphism. A conception of isomorphism is essential to the comprehension of this study; but it is not something which should go unexamined because it can be a very misleading thing.

Isomorphism is quite insufficient to determine something called meaningful relations among things. It is one dimension of several that are necessary in the development of meaning; but without a method of cognition, a way of knowing what is postulated or of verifying postulates, isomorphism can be complete but meaningless. Take, for example, some classical physics. Based upon all known data, scientists of the eighteenth century would have argued that communication from the moon would have been impossible because the transmission of sound required some medium through which the sound could travel. The relations of the assumptions which lead to this conclusion are isomorphic with the pertinent elements within the system of classical physics. They do not, however, agree with the physical facts. Sound does indeed require a medium through which to travel, but communication by voice is possible by using electromagnetic waves, a method not conceived in the eighteenth century. Therefore, a system

requires logic for general integration, isomorphic relations among its elements to provide the essential unity, and some testable recognition of the practical or physical phenomenon to which it refers. Again, without reduction to elementary, systemic parameters of physical or material objects, the entire explanation or theory remains devoid of any base for certainty which does not invite infinite regressions. Stipulative definitions for any purpose other than temporarily testing possible orders leads to the void of systematic chaos typical of theistic doctrines. In addition, the example of physics here points out the need to seek out the genetic structures among relations: those elements which represent first principles or, generic classes. In this case, the concept of communication rather than the idea of voice travel might have helped put researchers on to more profitable lines of thinking sooner than did take place. The specification of hierarchies is of the utmost importance; and specifying the 'quantum state' of a social phenomenon may not be easy.

The earlier model of neural structure and the segment on qualitative states by quanta certainly make clear the fact that the proportionality of relations among elements must be complete and perfect. It is incorrect to speak of the degree of isomorphism except in very special cases such as generic analyses or where searching for genetic similarities. Some physical structures are

very similar; but their behavioural characteristics can be very different. Move one part of a DNA chain and the result is a different qualitative entity. And, however subtle it may be, a change in one relation among many can change the entire quality of the system. Perhaps subtlty is best defined as the minimum disturbance necessary to change the qualitative nature of something but without making any appreciable difference to its external structure.

The balance between internal and external structures, methodologically speaking, is delicate and important. Walter Buckley speaks of the concepts of thermostatic controls in social relations and of the cybernetic concept of feedback mechanisms. Neither should be considered in any way other than as acting in discrete stages and not in continua. The thermostat is a good model of the tendency for a system to maintain equilibrium. But even thermostatic devices require limit switch controls to 'quantize' the information input. The manufacturer may be unaware of the reason for needing a limit switch, but the control won't do its job without it. Without such devices, the entropy of the system would increase rapidly until a plasma or chaotic state resulted. Similarly, whatever is conceived as a sociological feedback mechanism must embrace the concept of discrete behaviour. It makes nice jargon to

speak of feedback through social relations, but unless the context is methodology or is reduced to actual behaviours, it remains jargon for the pseudo-intellect. Due to the need, therefore, for the quantization of information transferred among societal elements, and from the discussion on the behaviour of macro-states, it can be concluded that the larger the system the more unstable it becomes. Methodologically then, it can be said that internal relations of a system (not just a collection of things, but of a system) demand large amounts of feedback information to produce anything more than a subtle change. However, the entropy of a large system can be increased easily by pressure on the external relations of the system. External relations require small information inputs to change their systemic quality. This, then, is a clue to the ways in which systems are built and how related systems are best described by isomorphism. In fact, it assists in the unravelling of some of the mysteries of the genetics of isomorphism. But it raises the problems of hierarchies. However, there is a close relationship between the energy requirements of a system and the qualitative identity of that system. Hence, it may be possible to formulate some very significant hypotheses about the nature of entropy and systemic parameters. For example, one very promising idea is that the parameters of a system or, the parameters of hierarchies are established by some measure of the systemic entropy.

Social relations are most stable at the level of the individual plus 'n' where n is very small, perhaps only one. An individual alone may disintegrate, so some small company may be required to establish equilibrium. Note that in a small system, equilibrium is established by adding something. So long as the system is controlled, that is, it cannot encounter similar elements, it will remain stable. For example, if a society were composed of only those who favoured the rigidity and restrictiveness of a people's democracy, the system would be stable. The elements would be homogenous. However, in human society, the intellect gives that dimension not found in other animal societies and, consequently, such isolation is not possible at this time except by laboratory intervention. Thus, any social system's entropy will increase because it inevitably tries to expand its external relations. Now, at this point, ordinary language seems to imply that within a society various groups merge and expand as though, abstractly, by design or will. But in fact it is not at all unlike the earlier example and discussion of molecular 'reproduction'. It does not take any will at all. The efforts and acts of individuals must not be confused with the abstraction of group or society. They are inseparable but not synonymous. The seeming paradox requires, for its resolution, the perception of relations - discrete

structures whose form constitutes their qualitative identities as well as their genetic similarities.

The perception of relations should result in the identity of the thing observed. If a human is a system but two humans are not two systems, what has changed by the addition of the second? This is the matter of systemic identification. The kind of system one human constitutes is very different from the kind of system which two constitute. The first is a conglomeration of matter, systematically arranged or developed; the second is a thing called a group wherein the lowest quantum state is one human. That is, the lowest quantum state of a group of people would be two; but the lowest quantum state of its components is one. It is in this sense that the term 'quantize' should be understood, and not in the mathematical or counting sense.

Finally, the physical size of an entity prohibits perfect isomorphism and therefore, the result of isomorphic analysis must always be an approximation and not a dualistic entity of sameness and difference. That is, the idea that the proportionality of relations is an adequate criterion for comparison is incorrect. Since meaning is a function of the transaction between perceived and perceiver, the comparability of relations must be considered together with the size of the perceived.

In the case of a $300,000 corporation and a $300,000,000 corporation, it is possible to find an almost perfect correspondence of most relations. However, the social effect of the giant compared with the social effect of the midget is remarkably different. It must be remembered that both entities are still parts of a larger structure and that therefore their absolute size is a significant relation of each but one which is incompatible with the others.

THE NECESSITY FOR ORGANIZATION

There can be little argument that without some kind of neurological structure and activity, and an environment to be perceived, there could be nothing called meaning. A theistic explanation might be provided, but that would be the assertion of a belief, not the presentation of a logical and substantive argument. In addition to the physical things like the brain and the environment, there appears to be something elusive to which is ascribed the 'creator' of meaning. The classic argument, of course, is that of mind and/or/versus body. It is 'mind' which becomes the hypostatization. But, without being redundant by presenting refutations for theories of mind, suffice to say that anyone should see the infinite regress inherent in this kind of hypostatization: what mind sees the mind that sees the...? Therefore, if an absolute entity of mind is logical to some as the explanation for cognition, then the same people should be able to see that it is just as logical to posit the brain as the ultimate or final point for cognition. There is no point in substituting one unknown (mind) for another (the process of cognition). Two unknowns do not make a known, especially when one unknown is irrefutable. Consequently, the next problem becomes that of examining the ways in which the human interacts with its perceptions.

It is quite likely that a frequent question pondered by students of ancient man was why it took humans so long to acquire certain skills and to invent various devices to assist his daily livelihood. It is a particularly difficult question for those who assert that humans have innate qualities such as creativity, intelligence and will power. The contemporary research of Piaget makes it quite obvious that humans are not born with logic systems except those essential for physiological survival. Like his utilization of the pharynx and buccal cavity organs for speech, a purpose unintended by the selective process, man's brain for use for anything beyond primitive survival is quite accidental and ancillary to its proper function. In conjunction with Piaget's findings, it is interesting to consider the observation that, within rather broad limits, students can have almost any kind of curriculum during their elementary-secondary years, and their general performance abilities would differ very little from one group to another. It would appear then that so long as a child has an enriched environment for a number of years, he will attain a certain level of social readiness or, intelligence. The appearance is totally deceptive.

Some of the current theorists of education assert that a classroom activity called 'sciencing' or some other kind of doing activity provides a good science

education. But, except for the presence of certain materials, such an environment differs in no significant way from the relations of that of primitive man. It might take a child a lifetime to learn a single step. Realizing this, but failing to admit its seriousness as a flaw, the same progressives supply instructions as to how the environment should be organized, and as to how a particular discovery should take place.

Take, for example, the field of industrial arts. In particular, consider the area of machine shop practice. If students were allowed to 'play', and assuming they did not kill themselves, the learning prospects would be severely curtailed. The skills and attitudes required in this discipline are well defined. The tangible nature of the field seems to have encouraged educators to forge ahead and establish parameters and criteria even though their discipline lacks none of the subtle sophistication of any arts subject or division of science. With such definition, it quickly becomes apparent that it would be ludicrous to create 'play' periods if in fact any particular objectives existed. By contrast to the industrial or scientific fields, the objectives of arts disciplines are generally so poorly defined that the instructor can proclaim 'development' no matter what the outcome. It is the kind of philosophy that produces the soup-can art

galleries, chaos which passes for theatre, and musicians who think they have created a whole new world when they rewrite Tchaikovsky with different coloured bars instead of standard notes. Unity of purpose alone is a poor guarantee of reaching objectives: the purpose must embrace a systematic methodology if the conceptual meaning is to be transmitted to the learner.

An interesting example of this can be found in the contrast of two religions. The Roman Catholic procedure consists of elaborate structures which are most carefully organized to create a vast matrix such that when one is properly involved within, the meaning and absorption is complete. It is not simply the ritual which holds its followers; it is the careful, systematic perspective given in a manner that leaves no room for argument for the newcomer. Contrasted with this is the simplicity of the Presbyterian sect. Spartan is an accurate term to describe all aspects of Presbyterianism. Notwithstanding that it is a religion, it offers considerable appeal to the intellect; but a developed intellect must precede indoctrination. Catholicism daily attracts new members; Presbyterianism loses a few every day: the ostentatious system is lacking in the latter.

The student who first enters a machine shop or a science classroom encounters an array of equipment

quite foreign to him. In fact, much of it could well be related to many familiar objects; but externally, they appear significantly different from characteristics of his standard environment. Before he can begin to subordinate the equipment to himself rather than be subordinate to it, he must learn what it is and what it can do. By using the 'sciencing' approach, he can spend four months playing around or, by working with guidance, can invest a few weeks in orientation acquiring information that is paradoxically minor and very important. In either case, some system for organization is required. The student must classify his observations in a useful form; that generally precludes the encyclopedic classification which normally takes place under the 'sciencing' format of hit and miss. The classification cannot be encyclopedic because nominalism is sterile. The classes must be related if an expanding perspective is to be generated. And, of course, this distinction is essential between a simple equilibrium model and a process model.

The next step requires the student to do things with the available equipment. In addition to various devices, the student must also be provided with an intellectual environment. Unfortunately, in most classes, that environment takes the form of data and procedure sheets which ultimately produce cataloguers of information. It is a form of organization; but none can argue successfully that

meaning emerges from lineal, isolated listings. Consequently, the organization must be systematic which necessarily implies the necessity of relatedness. Out of relatedness comes meaning. But again, in either case, organization by the learner is required. It is the one facet of activity in constant conjunction with all human intellectual endeavours. It is the omniscient nature of organization that seems to point up its importance in the emergence of meaning.

The organization fallacy consists of the belief that organization means strict, cement-like structures, immune to change and impervious to reason. Only those who are excessively endowed with these characteristics could really cling to such a notion. Organization means nothing more or less than 'the relations of things'. Because of this, and, in support of the principle of consistency, the possibility of an absolute rather than an infinity of things must be accepted. The polar opposite of absolute is not, as is commonly thought, relativistic but infinite. An infinite universe can have boundaries or, as Einstein asserted, a universe may be finite but without boundaries. Consequently, in sociological terms, discourse may focus around concepts like 'controlled freedom' as the reconciliation between freedomless order and orderless freedom. Only a reconciliation of opposites is possible: a resolution requires the anihilation

of the qualitative identity of one or both polarities. And another point about this fallacy is the fact that organization is not a function of external but internal relations. It is an important point. Changes come from within a society, not from without; and it is the individual himself who must impose order upon his perceptions. They are not ordered for him. The loss of freedom is the loss of the opportunity to organize. Thus, orderless freedom becomes license and freedomless order becomes tyranny. Either way, the individual has nothing without a certain balance of organization.

A SUMMARY OF POSSIBLE CONCLUSIONS

The critical point at which meaning emerges is that at which parts and wholes are perceived to merge to form some systematic equilibrium. This is best understood by examining an earlier statement: wholes are grammatically reduced through a dialectical process only to emerge as parts of a more inclusive, associated perspective. This statement is the cornerstone upon which the general thesis is built. An appreciation of its portent should highlight its methodological significance. If the boundaries of parts were easily specified, the problems of relatedness, hierarchies and, ultimately, meaning would be greatly simplified; but theory must acknowledge fact and the fact is that nothing is static nor can it be so perceived. Motion is inherent in all things; and all systems are dynamic. Consequently, the boundaries of parts are constantly shifting and changing -- in some cases existentially and in all cases, perceptually -- making their specification almost as difficult as specifying the qualitative boundaries of an individual self. At the same time, no discussion of parts and wholes would be complete without a brief (and, again, simplified) recount of the Ising model[26] of co-operative behaviour. Its purpose here is to demonstrate

26 D. Lerner, ed., Parts and Wholes (New York, Free Press of Glencoe, 1963); pp. 137-52.

the complexity of establishing the necessary hierarchical boundaries within social systems. And, co-operative behaviour is really a problem of order-disorder transitions. If meaning relys upon referents and contexts, then it may be said to rely upon systems the measure or description of whose entropy reveals its essential form. Back then, to some more physics.

If a piece of iron is heated to a high temperature, it is not magnetic. But, as it cools, there comes a point (the Curie point) at which it suddenly becomes magnetic. Below the critical point, the elementary magnets in any area of the metal spontaneously line up with one another so that a large majority point in the same direction. This seems like a common place event. Millions of elementary magnets within any domain suddenly line up uniformly. It is a fine example of co-operative behaviour, and represents a very simple model. The degree of order increases rapidly as the metal is cooled. At absolute zero, the order is total. The explanation of this behaviour is anything but simple.

Suppose the whole chain of particles is described as so many pointing up and so many pointing down. The degree of magnetization depends upon how many point in the same direction. Edward Purcell, in his paper,

"Parts and Wholes in Physics" describes the situation as:

> A society in which everyone wants to do what everyone else does, but in which each man has a view only of his nearest neighbour on either side.[26]

Now as the domain is cooled, alignment begins. If two elements are parallel, energy is given off; and if two are in opposition, there is a positive energy state. That is, pairs that try to get into the lowest energy state will tend to be parallel. Interestingly enough, Ising found that as the system cools down, nothing suddenly actually happens; there is no discontinuity in the behaviour of the system. The seemingly simple model took about five or six major physicists to produce a formula for magnetization, a process of co-operative behaviour. Countless other scientists probably worked on the problem as well. The point of the Ising problem, as Purcell notes, is that the only physics involved is the assumption that the nearest neighbours prefer to be parallel with one another and that even this conceptually simple model is astonishingly subtle and complex to reconcile. He concludes his remarks by saying:

> I suggest that the astonishing stubborness of the Ising problem stands as a sober warning to anyone who attempts to carve a path of rigorous deduction from the part to the whole.[27]

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26 Edward Purcell, "Parts and Wholes in Physics" in Parts and Wholes, op.cit. p. 139

27 Ibid., p. 152.

Indeed, it is a cogent warning. The explanation of how something as simple as elementary magnets organize to point in one direction reaches unusual heights of complexity. It is reasonable to conclude that attempts to generalize social behaviour are even more difficult. But the Ising model does help methodologically by simplifying the relations between the entropy of a system and its behaviour and of the relations between the parts and the system. One obvious advantage in the model is that its universe is quite finite. Part of the difficulty in analyzing a social structure is determining the outer parameters which have significant relations with the key parts. Considering the model carefully, one readily concludes that there is no evidence of individuality and yet no evidence of group or social cohesion. Rather 'uncognitively', the elementary magnets have formed a system by arranging themselves in a certain order. The temperature is the external input and, depending upon that input, order of various degrees results. There seems to be, in fact, no cognition at all within the system.

Now, the question arises as to whether the human is a sub-system or an elementary particle within the larger, social system. If he is a subsystem, then he must be considered as a continuous variable, constantly affecting his environment. If he is an elementary particle of the social system, that is, not cognitively aware of it, then his behaviour becomes highly predictable if there is

a method for measuring or describing the entropy of the system of which he is a significant systemic part. Since, in the first case, he is a continuous variable, the environment also continuously affects the sub-system. The result must be descrete perceptions otherwise life would be one constant psychedelic buzz. There is no way in which the human can be isomorphically mapped as an elementary particle to a larger, social system, therefore, human cognition must be both discrete and continual. For example, item B has a certain qualitative identity as perceived by A. If, as Piaget's studies indicate, A revises his perceptions until they agree with physical reality, then he will see the unique physical structure of B. There is no meaning for the perception except insofar as it has certain similarities to other experiences and certain differences from other experiences. Meaning is not absolute, it is infinite, depending upon the kinds of enculturation experienced by the observer. The important thing is the methodology used by all humans, The human destructs a perception into its components, seeks the relations of its parts with one another and with past experiences, and then recombines the perception as part of a larger perspective.

By means of a constant contraction and expansion, a more inclusive perspective is obtained. There is no finite meaning. It is a case of infinitely expanding

parts and wholes: parts into wholes and wholes into parts ad infinitum. Based upon the neurological model here and the assumption of infinity for meaning, it is impossible for the human to conceive of anything absolutely finite. Even the concept of an elementary particle is not a finite concept. Polar opposites stand inseparably back to back, not at some arbitrary point some distance from each other. As a result, the process of inquiry is, methodologically, the search for parameters of parts which in turn, automatically determines the 'meaning' of a thing or system. It is in this fashion one can speak of a 'sine' function in meaning for the inquirer's awareness pulsates from part to whole and back again.

Those most acutely aware of these conclusions are the modern systems theorists. Once a finite objective for meaning is eliminated, the search becomes one of order and disorder. The entropy of a system, its hierarchies within hierarchies and the criteria for external and internal relations open a new horizon for inquiry. It is only through this perspective that one can explain and justify the educational objective of teaching for process rather than for product. Such phrases as teaching one how to learn remain rather static and platitudinous until perceived in the larger contexts of systems analysis. It is in this way that the analytic and systematic philosopher

combine to produce a technique of inquiry, each indispensable to the other.

Finally, the only reason questions of infinite regression arise is that someone tries to find an absolute starting point of things. It is like wondering how the universe began. Probably, it always existed: there is no evidence or logical reason why there should have been a time when there was no matter at all. Its very existence should tend to produce the opposite speculation; and then there's the law of conservation of matter and energy: it still remains in good repute. The purpose of the earlier discussions on molecular forms and reproduction was to show that the entire universe could quite easily expand as described. So it is with humans on the problem of meaning. The basic referent for all meaning is some stipulation and from that first principle of stipulation, contexts and environments are built. The inquirer reflects upon the real and formulates a theory in response to his reflections. It is a process of moving from the micro to the macro and back again, indefinitely. As Dewey proclaimed, inquiry is a matter of action, interaction and then trasnaction. There are no absolutes, only infinities. The natural sciences constantly remind the social sciences of these facts. The simple thermometer is a good example. All meter scales are arbitrary insofar as their language is concerned. They all have the same proportions of

relations to what they compare. The result is a common language of heat and temperature. The measurements are meaningful only because they are systematized: the material world, within the context of temperature measurement, is organized into a system of interdependent relations. It is this way in which science works. The ultimate test of a scientific theory is whether or not its world view will mesh with other parts of the real system of materiality. Where the system lacks coherence or cohesiveness, revisions are made. Thus, even the first principles or stipulations are subject to change and, just as motion is an innate quality of matter, so change is an integral part of the dynamics of inquiry. And through it all, meaning hangs on precedent, upon earlier formulations and contexts. Meaning is not inherent; it is dependent. The concept of logic has been accepted without a fraction of the inquiry to which meaning has been subjected and yet, they are both members of the same class: each is a product of the way humans and their environments behave, not of how they should or could behave, but of simply how in fact they do behave. In fact, meaning and logic can be said to be one and the same thing.

In response to the implications of the neurological model, one might ask why different people profess different meanings for similar perceptions. This thesis asserts that all things are material; that humans

enjoy identical perceptions; and that only their physical location renders them unique. The last of these assertions is not entirely accurate: their behaviour generally is, in fine detail, probably unique. Again, if the laws of matter apply to human forms, why do both meaning and behaviour seem so diversified from one person to another? The common economics term ceteris paribus applies. If all initial experiences were identical, there would be no diversity. All unities, all systems rely upon diversity for their existence. As the discussion of molecular behaviour points out, differentiation is the natural device for structure formation. Consequently, all initial experiences must be different for social survival. Because initial experiences differ, the neurological contexts of people differ and therefore, the first principle assumption -- the neural core around which certain molecular chains build -- must differ. Inevitably then, since meaning depends upon both referent and context, the neural content of individuals must differ and hence, a diversity of meaning, one from another.

If, as this study asserts, meaning is a derivative of systematizing perceptions, then the referential and contextual theses of meaning conjoin to form what might be called a field theory of meaning. The inquirer first perceives; he then stipulates the first perception as the first principle or initial referent.

From then on, it is a matter building larger and larger systems. The logos or unifying principle of each system so developed, may be regarded as the generic root of each system and as that which is recalled and which is referred to as the product of memory. The neurological model in "Models of Thought" depends upon the brain's characteristic of parallel and simultaneous processing. It is the material form referred to in "Origins of Forms" and "The Medium IS the Idea" which also acts as the memory storage. Thus, a sensory input will cause all generic roots to seek systematic union and those that do are accepted through the reticular formation and are manifested in overt behaviour. None of this has anything to do with the assertion of truth: some perceptions compute systematically, others do not. This perspective of inquiry admits only to the term confirmation because truth, if not relative, is certainly infinite. The object of inquiry is the testing of possible orders of things and the consequent is measured for systemic integration. Consequently, inquiry is a process of continuously establishing equilibrium and thereby producing an ever larger perspective. The result is the emergence of meaning. The final question, therefore, is what model best describes this process through which meaning emerges?

MODELS FOR MEANING

As Sorokin's study[28] confirms, the history of inquiry is a profusion of models. The most frequent of a model's many possible uses is that of explanation by means of isomorphic mapping of relations between things. For example, language is a behavioural model of perceptions wherein the relations of things are measured by words. The words themselves lack any absolute virtue because their meaning is not inherent but a function of comparison -- the basic process of all measurement procedures. In fact, the very search for and use of models suggests rather strongly that however an inquirer determines meaning, it is not something knowable a priori. This in turn would suggest that ordinary language analysis, important methodologically because of the importance of form in analysis, is incapable of evaluating in terms of meaning because it relies upon form almost to the total exclusion of content. There is merit in each of the main theories of meaning; but each has limitations. Since meaning cannot be determined a priori, it is necessary to look beyond the immediate boundaries of ordinary language for the varieties of referents, contexts, behaviours and images of the external world. Each theory of

28 Pitrim Sorokin, Contemporary Sociological Theories (New York, Harper & Row, Publishers, 1928); Chapter I.

meaning will be founded upon some particular model each inquirer builds out of his perceptions. Although special ontological models may not be in vogue, their presuppositionary status to any form of social analysis cannot be ignored. Consequently, it is necessary to first adopt a social model as the basis of any coherent formulation of the nature of meaning. The implication of this conclusion is that all meanings can be and are represented by some model.

The earlier assertion that most major theories of meaning have merit is borne out by a quick glance at each. None can function without a referent; no referent is significant without a context; the behaviour of things or of people affect interpretations; and every perception can be described by the vague term 'idea'. The kind of criticism which such theories as the referential, contextual or behavioural suffer, generally fails to really defeat the theories because of the incompatibility of the philosophical dispositions of proponents and opponents.

Take, for example, a rather standard example used to argue against the referential thesis: the matter of 'Plato' and 'the author of the Republic'. An ordinary language philosopher might argue that both 'Plato' and 'the author of the Republic' refer to the same thing and since each is different, the referent cannot be the meaning. The logic or form of the argument is impeccable; but, as is often the propensity of pure analytics, the separation of content from form which

the argument creates, produces a faulty conclusion. It is clear that 'Plato' and 'the author of the Republic' are different from one another. The first refers to the inseparable form and content -- the individual, that which is essentially the man; and the second refers to a function or single aspect (attribute) of the man. These are two distinct categories and good examples of why analytic philosophers should heed the refinements offered by Gilbert Ryle in The Concept of Mind when he deals with mistakes in category. Since 'Plato' and 'the author of the Republic' are members of different categories, they cannot possible share the same referent. It is possible to utter the phrase 'the author of the Republic' to mean 'Plato the man'; but this is not simple reference but behavioural and ideational dimensions of the problem. Ordinary language is ordinary because of its simplicity in terms of referential economies. The ordinary language philosopher argues a priori but reverts to experience for his contradictions; it is incongruous at best.

Finally, it should be noted that only the opponents of a referential thesis argue that 'the author of the Republic' refers to Plato; and if any of them would analyze the possible contexts in which that phrase might arise as a substitute for 'Plato', they would find it rather difficult to continue with 'Plato' as the referent. In any case, since opponents of a referential thesis do not argue against the

referent as being the meaning, there should be no hesitation in accepting the concept inhering in the section "The Medium is the Idea." But it should be noted that this study does not accept simply that the referent is the meaning, although a referent is required in a suitable model.

The same class or form of arguments is used by opponents of models such as mechanisms and functionalism. The latter is generally rejected because it fails to account for feedback variables. It is like arguing that automobiles will never be able to carry six people because the first ones only carried two; and no model should be thought of as so complete as to never require modification. It appears too that most other models are rejected mainly because of their incompleteness or limited applicability. The point here is that a model should not be summarily rejected simply because it fails to account for unknowns which are also unaccountable by other models. The degree of its success and not its failure must be the criterion. It can be concluded therefore, that whatever model is chosen, it should:

a) unify the various theories of meaning which have merit.

b) be able to encompass complex environments -- linguistic or social.

c) account for the relations of things rather than simply enumerate.

d) provide the flexibility for continuous expansion while simultaneously providing the opportunity for a high degree of specification.

e) be either independent of some particular ontological perspective or dependent upon an open-ended universe of a consistent base.

Obviously, the required model will be open and relational rather than closed and fixed because it is a methodological model instead of a specific state explanatory model.

The precise nature of the model which chapters I and II point towards is best described as a complex of elements or units related in such a way that each unit is related to at least some other in a reasonably stable manner during any particular moment of time. The units or components may be variable. That is, according to the discussion on quantum states, the elements may be simple and stable (a relatively high energy state of high specification) or complex and changing (the relatively low energy state of macromolecules whose specification is more diffuse). Those relations which become stable for any given period of time may be regarded as the structural constituents of the model. It is this criterion which asserts the inseparability of the form and content and continuously conjoins the theoretical and the practical or 'real' (i.e., that to which the model applies). The product of this perception becomes the 'whole' or entity and it is

in this way the universe of meanings is perceived to be finite but unbounded: the ever expanding perspective generated by the perceptions of relations without end. Thus the model for meaning is open in the sense of criterion (e) above. It is at this point functionalism begins to play its part because distinction between boundaries and the total environment become largely a matter dependent upon the inquirer's objectives. It is these interdependencies which unify the various theories of meaning.

Chapter II concluded with the assertion that the homeostatic model best described the neurological environment in terms of its most general operations. But it should not be concluded that the homeostatic model is suitable without modification for environments external to the neurological environment. Indeed, there is good reason for introducing some additional terms.

The ordinary equilibrium model applies only to those systems which, when approaching equilibrium, lose organization from complex to simple, at which point they remain stable. In contrast to this, the homeostatic model represents those states of relatively complex organization which resist exogenous, disruptive forces. It would be inappropriate to think of human neurology in terms of the first, equilibrium, model for the complex behaviour exhibited by humans would be impossible. In fact, the equilibrium model

best represents death with its high state of specification and immobility. The homeostatic model, however, allows for complex, macromolecular behaviour of the brain processes and the consequent complex-state stability. What it fails to account for entirely is the interchange between the structures created by the brain and the external environment which impinges upon the brain. In other words, a social model is, or should be, more inclusive than something called a neurological model simply because the environment -- the number of variables-- is much larger. The only model which embraces the above required criteria and which can be logically derived from the homeostatic model is that which systems theorists call the process or complex adaptive model. This model applies to those systems which are characterized by elaboration, the evolution of organization. This process is best described by the term morphogenesis wherein forms are generated by continuously changing and evolving relations.

Seen in the context of chapters I and II, the process model describes the act of inquiry, accounting for all variables in such a way that the result is an 'expanded whole.' The intriguing problem with this kind of model is how it accounts for degrees of things. For example, since it is difficult to define those things which are systems and those which are not, how can the disparity between systemic identity and the existential nature of a material universe be discussed without falling into the abyss of dualism? The answer was

given in "The Medium is the Idea": organization is the logos through which the criterion of unity among theories can be met. It is impossible to speak in terms of degrees of substance or entities (systemic irreducibility) but there are varying degrees of organization. Hence, the quality of a thing, its essential identity can be described by an analysis of its organization, the substantial argument of chapter I. A complete description of the organization of the referent is the meaning of the referring terms. At this point, the behaviourist thesis assumes importance because although it is acceptable to say that "the whole is more than the sum of its parts," it is an acceptable way of saying nothing. An analysis of the systemic relations of parts describes the whole; and since reducing the whole to its parts says nothing of the behaviour of the whole, then the whole must be regarded as the quantum unit for study -- which is realy self-evident. That whole is then regarded as a part of a larger environment, and as such, is deemed to be irreducible. Hence, only the entity's behaviour is available for analysis. Of course, if this were really true, it would mean that the presupposition underlying the assertion would be that all humans are, molecularly, organized in precisely the same way and that only external stimuli motivate behaviour, without the benefit of feedback or storage mechanisms. But the earlier chapters do, in fact, argue for a kind of reduction based upon degrees of organization. Thus, the entire universe is conceived to be matter organized in

varying degrees wherein the human is but one point in the continuum of material organization. Hence, systemic reduction results in the awareness of relations, not in the qualitative destruction of the entity. For this reason, the term process is used; and again, the term process is descriptive from the micro level of atomic levels of organization through to the macro level of organization typical of social systems.

The process model, then, describes adequately the manner in which meaning emerges. The transition from the inorganic to the organic is simply a matter of organization, not of kind or quality. Meaning is the expansion of relations; it is neither absolute nor certain. In fact, the term meaning owes its existence to the temporary requirement of asserting parameters and systemic boundaries in a moment of inquiry. Meaning has the same form as the concept of time: both must be quantized, or made discrete; but each is infinite, the passage of which is marked by referents.

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