CHAPTER XII

ON ORDER

The fundamental importance of the subject of order may be inferred from the fact that all the concepts required in geometry can be expressed in terms of the concept of order alone. (237) E. V. HUNTINGTON

Dimensions, in geometry, are a development of order. The conception of a *limit*, which underlies all higher mathematics, is a serial conception. There are parts of mathematics which do not depend upon the notion of order, but they are very few in comparison with the parts in which this notion is involved. (455)
BERTRAND RUSSELL

The notion of continuity depends upon that of *order*, since continuity is merely a particular type of order. (454) BERTRAND RUSSELL

Logistic may be defined as *the science which deals with types of order as such.* (300) C. I. LEWIS

The branch of physics which is called Elementary Geometry was long ago delivered into the hands of mathematicians for the purposes of instruction. But, while mathematicians are often quite competent in their knowledge of the abstract structure of the subject, they are rarely so in their grasp of its physical meaning. (529)OSWALD VEBLEN

We often think that when we have completed our study of *one* we know all about *two,* because "two" is "one and one". We forget that we have still to make a study of "and". Secondary physics is the study of "and"— that is to say, of organisation. (149)
A. S. EDDINGTON

. . . the geometry of paths can be regarded as a generalization both of the earliest part of elementary geometry and of some of the most refined of physical theories. The study of the projective, the affine and the metric geometry of paths ought to result in a comprehensive idea of what types of physical theory it is possible to construct along the lines which have been successful in the past. (529)
OSWALD VEBLEN

What I wish to emphasize now is the need of logistic studies which will make it possible to say more definitely than is yet possible in this field what is assumed, what is proved, and how the group of theorems and definitions hang together. (529)
OSWALD VEBLEN

Memory, in fact, is nothing but the reinforcement and facilitation of the passage of the nervous impulse along certain paths. (411) HENRI PIÉRON

But before dealing with the brain, it is well to distinguish a second characteristic of nervous organization which renders it an organization in levels. (411)HENRI PIÉRON

This affective repercussion seems to take place at the penultimate stage of the nervous system and governs complicated reflexes or instinctive reactions. (411)
HENRI PIÉRON

Furthermore, there are even symbols of symbols, evocative of images only in the second degree, by means of primary stations of the co-ordination centres. (411)HENRI PIÉRON

In this way it is seen that the order in which a given group of stimuli taking part in a stimulatory compound are arranged, and the pauses between them are the factors which determine the final result of the stimu-

lation, and therefore most probably the form of the reaction, and we know already that different intensities of the same stimulus can be differentiated very accurately, one definite intensity being connected with excitation and another with inhibition. (394) I. P. PAVLOV

Whoever studies Leibniz, Lambert and Castillon cannot fail to be convinced that a consistent calculus of concepts in intension is either immensely difficult or, as Couturat has said, impossible. (300) C. I. LEWIS

The relation between intensions and extensions is *unsymmetrical*, not symmetrical as the medieval logicians would have it. (300) C. I. LEWIS

The old "law" of formal logic, that if α is contained in β in extension then β is contained in α in intension, and vice versa, is *false.* The connection between extension and intension is by no means so simple as that. (300) C. I. LEWIS

I do not suggest explicit confusions of this sort, but only that traditional elementary logic, taught in youth, is an almost fatal barrier to clear thinking in later years, unless much time is spent in acquiring a new technique. (451)

BERTRAND RUSSELL

Section A. Undefined terms.

We can now introduce a structural *non-el* term which underlies not only all existing mathematics, but also the present work. This *bridging* term has equal importance in science and in our daily life; and applies equally to 'senses' and 'mind'. The term in question is 'order', in the sense of 'betweenness'. If we say that *a*, *b*, and *c* are in the order *a*, *b*, *c*, we mean that *b* is *between a* and *c*, and we say, further, that *a*, *b*, *c*, has a different order from *c*, *b*, *a*, or *b*, *a*, *c*, . The main importance of numbers in mathematics is in the fact that they have a definite *order.* In mathematics, we are much concerned with the fact that numbers represent a definite ordered series or progression, 1, 2, 3, 4 , .

In the present system, the term 'order' is accepted as *undefined.* It is clear that we cannot *define* all our terms. If we start to define all our terms, we must, by necessity, soon come to a set of terms which we cannot define any more because we will have no more terms with which to define them. We see that the structure of any language, mathematical or daily, is such that we must start implicitly or explicitly with undefined terms. This point is of grave consequence. In this work, following mathematics, I explicitly start with undefined important terms.

When we use a series of names for objects, 'Smith, Brown, Jones'. , we say *nothing.* We do not produce a proposition. But if we say 'Smith kicks Brown', we have introduced the term 'kicks', which is not a name for an object, but is a term of an entirely different character. Let us call it a 'relation-word'. If we analyse this term, 'kicks', further, we will find that we can define it by considering the leg (objective) of Smith (objective), some part of the anatomy of Brown (objective), and,

finally, Brown (objective). We must use a further set of terms that describes how the leg of Smith 'moves' through an 'infinity' of 'places' in an 'infinity' of 'instants' of 'time', 'continuously' until it reaches Brown.

When 'a donkey kicks a donkey' there may be a broken leg; but that is, practically, the only consequence. Not so when Smith kicks Brown. Should Brown happen to be a royal or a business man in Nicaragua or Mexico, this might be considered 'a mortal offense of a great sovereign nation to another great sovereign nation', a war might follow and many non-royals or non-business men might die. When a *symbolic* class of life enters the arena, semantic complications may arise not existing with animals.

In the relation terms, the statement, 'Smith kicks Brown', has introduced still further symbolic complications. It involves a full-fledged metaphysics, as expressed in the terms 'moves', 'infinity', 'space', 'time', 'continuity', and what not. It must be emphasized that *all* human statements, savage or not, involve a structural metaphysics.

These relational terms should be elucidated to the utmost. Until lately, the 'philosophers', in their 'Jehovah complex', usually said to the scientists: 'Hands off; those are superior problems with which only we chosen ones can deal'. As a matter of history, 'philosophers' have not produced achievements of any value in the structural line. But the 'mere' scientists, mainly mathematicians and mathematical physicists, have taken care of these problems with extremely important structural (1933) results. In the solutions of these semantic problems, the term 'order' became paramount.

Perhaps this example of an analysis of the statement, 'Smith kicks Brown', shows the justice of the contention of this work that no man can be 'intelligent' if he is not acquainted with these new works and their structural elucidations.

We see that no statement made by man, whether savage or civilized, is free from some kind of structural metaphysics involving *s.r*. We see also that when we explicitly start with *undefined* words, these undefined words have to be taken on faith. They represent some kind of implicit creed, or metaphysics, or structural assumptions. We meet here with a tremendously beneficial semantic effect of modern methods, in that we deliberately state our undefined terms. We thus divulge our creeds and metaphysics. In this way, we do not blind the reader or student. We invite criticism, elaboration, verification, evaluation. , and so accelerate progress and make it easier for others to work out issues. Compare the statement of Newton, *'Hypotheses non fingo'* (I do not make hypotheses), in his *Philosophiae Naturalis Principia Mathematica*, when he pro-

ceeded some very doubtful hypotheses; and such works as produced by Peano, Whitehead, Russell, and others, in which not only all assumptions are stated explicitly, *but even the assumptions,* given in single *undefined* terms, are listed. It is not assumed here that even Peano, Whitehead, Russell, and the others have fulfilled this program entirely. It is quite probable that not all of their assumptions are stated explicitly. However, a very serious and revolutionary beginning has been made in this direction. We have still far to go, for at present even mathematicians disregard the threefold relational character of mathematics, and, by a semantic confusion of orders of abstraction, make structurally *el* assumptions false to the facts of 1933; namely, that mathematics exists 'by itself', detached from the producers, Smith and others. This procedure reminds one of the old *N* 'I do not make hypotheses', proffered just at the moment he begins to legislate about the structure of the universe and to postulate his 'absolute space' and 'absolute time' 'without reference to any external object whatsoever'. This, of course, was structurally unascertainable, and so was a mere figment of his imagination, inside of his skin, and may become a pathological semantic projection when externalized by *affective* pressure.

That we must all start with undefined terms, representing blind creeds which cannot be elucidated further *at a given moment,* may fill the hearts of some metaphysicians with joy. 'Here', they might say, 'we have the goods on the scientists; they criticize us and reject our theories, and yet they admit that they also must start with blind creeds. Now we have full justification for assuming whatever we want to.' But this joy would be short-lived for any reasonably sane individual. In mathematics, we deliberately assume the minimum, and not the maximum, as in metaphysics. The undefined terms selected for use are the *simplest* of our experience; for instance, 'order' (betweenness). Also, in experimental sciences, we assume the least possible. We demand from a *scientific* theory, according to the standards of 1933, that it should account for all relevant facts known in 1933 and should serve as a basis for the *prediction* of new facts, which can be checked by new experiments. If metaphysicians and 'philosophers' would comply with such scientific standards, their theories would be scientific. But their old theories would have to be abandoned and their new theories would become branches of science. Under such structural circumstances, there is no possibility of going *outside* of science, as we can enlarge the bounds of science without known limits, in search for structure.

It must be pointed out that no set of undefined terms is ultimate. A set remains undefined only until some genius points out simpler and

more general or structurally more satisfactory undefined terms, or can reduce the number of such terms. Which set we accept is determined, in the main, by pragmatic, practical, and structural reasons. Out of two systems which have many characteristics of usefulness. , in common, we would and should select the one which assumes least, is the simplest, and carries the furthest. Such changes from one set to another, when scientific, are usually epoch-making, as exemplified in mathematics.

It is important to realize that this semantic attitude signalizes a new epoch in the development of science. In scientific literature of the old days, we had a habit of demanding, 'define your terms'. The new 1933 standards of science really should be, '*state your undefined terms'*. In other words, 'lay on the table your metaphysics, your assumed structure, and then only proceed to define your terms in terms of these *undefined terms'*. This has been done completely, or approximately so, only in mathematics. Yet, probably no one will deny that the new requirements of science (1933), no matter how laborious, are really desirable, and constitute an advance in method, in accordance with the structure of human knowledge.

In the present work, this method will be employed practically all through. Of course, names for objects may be accepted without enquiry. So we have already a large vocabulary at our disposal. But names alone do not give propositions. We need *relation-words*, and it is here where our undefined terms become important. Up to this stage of the present work, I have accepted, without over-full explanation, the vocabularies made by the linguists of exact science, whom we usually call mathematicians. There is an enormous benefit in doing so, because, no matter how imperfect the mathematical vocabulary may be, it is an extensive and developed linguistic system of similar structure to the world around us and to our nervous system 1933. (See Part V.)

Some of the most important undefined terms which play a marked role in this work are 'order' (in the sense explained), 'relation', and 'difference', although we could define relation in terms of multidimensional order. There is a remarkable structural characteristic of these terms; namely, that they are *non-el*, and that they apply to 'senses' as well as to 'mind'. It is, perhaps, well to suggest that, in future works, the terms selected should be of the *non-el* type. Since these terms apply equally to 'senses' and to 'mind', we see that in *such* terms we may attempt to give a 'coherent' account of what we experience. The expression 'coherent' implies 'mind', and 'experience' implies 'senses'. It is amusing to watch this peculiar circularity of human knowledge, many instances of which will appear later on. Thus, there was great difficulty

in expressing organism-as-a-whole notions; we had to grope about in establishing the beginnings of a suitable vocabulary before we could approach problems which were antecedent in order.

It is necessary to notice a rather curious structural similarity between the $\overline{N}$ and $\overline{A}$ systems. In both cases, we deal with certain velocities about which we know positively that they are *finite*. The velocity of light in the *N*-system was assumed to be infinite, although we know it is not so, and so 'simultaneity' had absolute meaning. The $\overline{N}$ systems introduced the finite velocity of light by ordering events, which happens to be true to facts, and thus 'simultaneity' lost its absolute character. Likewise in the *A*-system and language, the velocity of nervous impulses was assumed to be infinite, to spread 'instantaneously'. And so we had most perplexing 'philosophical' rigmaroles about 'emotions', 'intellect'. , taken as independent separate entities. When we introduce explicitly the finite velocity of nervous impulses (on the average, 120 metres per second in the human nerves), we are able to reach a perfectly clear understanding, *in terms of order,* of the spread of impulses. Some 'infinite velocity' does not involve *order*. Conversely, by considering the order of events, we introduce finite velocities. We shall see later that 'infinite velocity' is *meaningless* and so all actual happenings can be ordered. The above is an important factor in our *s.r*.

Let us give a rough example. Assume that Smith has had a bad dinner. Some nervous impulse, originating from the bad dinner, starts going. At this stage, we may call it an 'undifferentiated' nervous impulse. It travels with *finite* velocity, reaches the brain-stem and the approximately central part of his brain, which we call the thalamus; is affected by them and is no longer 'undifferentiated' but becomes, let us say, 'affective'. In the cortex, it is affected again by the lessons of past experiences. It returns again to the lower centres and becomes, let us say, 'emotion'; and then anything might happen, from sudden death to a glorious poem.

The reader must be warned that this example is rough and oversimplified. Impulses are reinforced and 'inhibited' from a complex chain of nervous interconnections. But what I wish to show by this example, is that, by accepting the *finite* velocity of nerve currents, in terms of *order,* we can build up a definite vocabulary to deal, not only with the 'organism-as-a-whole', but also with the different stages of the process. This is important because, without some such *ordinal* scheme, it is structurally impossible to evade enormous verbal and semantic difficulties which lead to great confusion.

In the analysis of the above example, only the structural and *methodological* aspects are emphasized. No attempt is made to legislate for neurologists or to instruct them how they should define and use their terms.

Section B. Order and the nervous system.

We know that, structurally, not all parts of the nervous system are of equal phylogenetic age. The ventral part of the brain, the thalamus (in the rough), which is of most interest in this connection, is older than the cerebral cortex. By the term 'thalamus' I denote all the subdivisions and most important appendages which we need not mention by their technical names. In man, both the thalamus and the cerebral cortex are much enlarged and have a complex structural cyclic inter connection. The cerebral cortex is a term applied to a superficial layer of grey nervous tissue covering the cerebral hemispheres. It is called the 'new brain' by Edinger. The higher correlation centres in the cerebral hemispheres can act only through the agency of the lower centres, the brain-stem, and the thalamus. In other words, the cerebral cortex, the functioning of which is connected chiefly with the higher associations, is of such structure that no nervous impulse can enter it without first passing through the lower centres of the ventral parts of the brain and brain-stem.

In the lower vertebrates which lack the cerebral cortex, the sub-cortical mechanisms are adequate for all simple exigencies of life and simple association processes, these sub-cortical mechanisms being older phylogenetically than the cerebral cortex, yet younger than some still more ventral parts.

The brush-like connections between the nerves are called synapses, and although a nerve-fibre seems to be capable of transmitting nerve impulses in both directions, the nervous impulse can seemingly pass the synapse in only one direction; so a nervous polarity is established whenever synapses are present.[1]

The following diagram and explanations are taken from Professor Herrick's *Introduction to Neurology*, pp. 60, 61, 62, 63, 69, 70. In the quotations I retain the spelling but change Herrick's Fig. 18 to my Fig. 1; all but one word of the italics are mine.[*]

[*] I quote here from the Second Edition of the *Introduction to Neurology* an account of the classical theory of reflex circuits which is quite satisfactory for my purpose. In his later work (see my bibliography), Professor Herrick forcibly points out the limitations of the reflex theories as *partial patterns*, as opposed to the activity of the organism-as-a-whole. In the Fifth Edition (1931), the chapter on reflex circuits has been entirely rewritten, and the *non-el* attitude is expressed very clearly. I am much indebted to Professor Herrick for drawing my attention to this rewritten chapter.

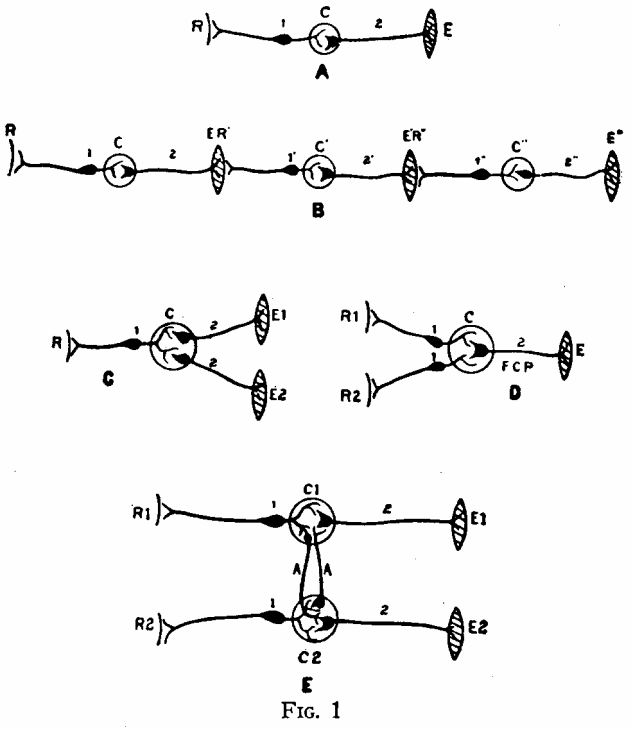

FIG. 1

Diagrams representing the relations of neurons in five types of reflex arcs: A simple reflex arc; B. chain reflex ; C, a complex system illustrating allied and antagonistic reflexes and physiological resolution, D, a complete system illustrating allied and antagonistic reflexes with a final common path , E, a complex system illustrating the mechanism of physiological association A,A, association neurons; *C,C',C",C*1, and C2, centres (adjustors); *E,E',E", E*1, and *E*2, effectors, *FCP*, final common path; *R,R',R",R*1, and *R*2, receptors.

'The structure of the simple reflex circuit is diagrammatically illustrated in Fig. 1, A. The receptor (*R*) may be a simple terminal expansion of the sensory nerve-fiber or a very complex sense organ. The effector (*E*) may be a muscle or a gland. The cell body of the afferent neuron (1) may lie within the center (*C*) or outside, as in the diagram.... A simple reflex act involving the use of so elementary a mechanism as has just been described is probably never performed by an adult vertebrate. The nervous impulse somewhere in its course always comes into relation with other reflex paths, and in this way complications in the response are introduced....

'Separate reflex circuits may be so compounded as to give the so-called chain reflex (Fig. 1, B). Here the response of the first reflex serves as the *stimulus* for the second, and so on in series. The units of

these chain reflexes are usually not simple reflexes as diagrammed, but *complex* elements of the types next to be described.... The chain reflex . . . is a very common and a very important type. Most of the ordinary acts in the routine of daily life employ it in one form or another, the *completion of one stage* of the process serving as the *stimulus* for the *initiation of the next*....

'Figure l, C illustrates another method of compounding reflexes so that the stimulation of a single sense organ may excite either or both of two responses. If the two effectors, *E*1 and *E*2, can cooperate in the performance of an adaptive response, the case is similar to that of Fig. l, A, with the possibility of a more complex type of reaction. This is an allied reflex. If, however, the two effectors produce antagonistic movements, so that both cannot act at the same time, the result is a physiological dilemma. Either no reaction at all results, or there is a sort of physiological resolution (sometimes called physiological choice), one motor pathway being taken to the exclusion of the other. Which path will be chosen in a given case may be determined by the physiological state of the organs. If, for instance, one motor system, *E*2, is greatly fatigued and the other rested, the threshold of *E*2 will be raised and the motor discharge will pass to *E*1.

'Figure l, D illustrates the converse case, where two receptors discharge into a single center, which, in turn, by means of a final common path (*FCP*) excites a single effector (*E*). If the two receptors upon stimulation normally call forth the same response, they will reinforce each other if simultaneously stimulated, the response will be strengthened, and we have another type of allied reflex. But there are cases in which the stimulation of *R*1 and *R*2 (Fig. l, D) would naturally call forth antagonistic reflexes. Here, if they are simultaneously stimulated, a physiological dilemma will again arise which can be resolved only by one or the other afferent system getting control of the final common path.

'Figure l, E illustrates still another form of combination of reflexes. Here there are connecting tracts (*A*, *A*) between the two centers so arranged that stimulation of either of the two receptors (*R*1 and *R*2) may call forth a response in either one of two effectors (*E*1 and *E*2). These responses may be allied or antagonistic, and much more complicated reflexes are here possible than in any of the preceding cases....

'It must be kept in mind that in higher vertebrates all parts of the nervous system are bound together by connecting tracts (internuncial pathways).... These manifold connections are so elaborate that every

part of the nervous system is in nervous connection with every other part, directly or indirectly. This is illustrated by the way in which the digestive functions (which normally are quite autonomous, the nervous control not going beyond the sympathetic system, . . .) may be disturbed by mental processes whose primary seat may be in the association centers of the cerebral cortex; and also by the way in which strychnin-poisoning seems to lower the neural resistance everywhere, so that a very slight stimulus may serve to throw the whole body into convulsions. . . .

'Our picture of the reflex act in a higher animal will, then, include a view of the whole nervous system in a state of neural tension. The stimulus disturbs the equilibrium at a definite point (the receptor), and the wave of nervous discharge thus set up irradiates through the complex lines determined by the neural connections of the receptor. If the stimulus is weak and the reflex path is simple and well insulated, a simple response may follow immediately. Under other conditions the nervous discharge may be inhibited before it reaches any effector, or it may irradiate widely, producing a very complex reflex pattern. . . .

'The mechanism of the reflex should not be regarded as an open channel through which energy admitted at the receptive end-organ is transmitted to be discharged into the effector organ. It is rather a *complex* apparatus, containing reserves of potential energy which can be released upon the application of an adequate stimulus in accordance with a pattern determined by the inherent *structure* of the apparatus itself. In other words, the nervous *discharge* [italics of Professor Herrick] is *not* a mere transmission of the energy of the stimulus, but it implies *active* consumption of material and release of energy (*metabolism*) within both the nerve centers and the nerve-fibers. The energy acting upon the effector organ may, therefore, be different in both kind and amount from that applied to the receptive end-organ. The response likewise involves the liberation of the latent energy of the effector (*muscle or gland*), the nervous impulse serving merely to release the trigger which discharges this reserve energy.'

It is necessary to warn the reader that the human nervous system is structurally of inconceivable complexity. It is estimated that there are in the human brain about twelve thousand millions of nerve cells or neurons, and more than half of these are in the cerebral cortex. Most probably, the majority of the neurons of the cerebral cortex are directly or indirectly connected with every cortical field. Were we to consider a million cortical nerve cells connected one with another in groups of only two neurons each, and compute the possible combinations, we would find the number of possible interneuronic connection-patterns to be repre-

sented by $10^{2,783000}$. What such a number is like is hardly possible to imagine. For comparison, it may be said that probably the whole visible sidereal universe does not contain more than 10^{66} atoms ![2]

Our present knowledge of the nervous system is limited as regards its complexities and possibilities, but we know many structural facts which seem to be well established. One of these is that the human nervous system is more complex than that of any animal. Another is that the human cortex is of later origin than, and in a way an outgrowth from, the more central parts of the brain (which establishes a structure of *levels*,). A third is that the interconnection of the parts of the nervous system is *cyclic.* A fourth is that the velocity of nerve currents is *finite.* The last fact is of serious structural importance, and, as a rule, disregarded.

Section C. Structure, relations, and multi-dimensional order.

In such an ordered cyclic chain, the nerve impulses reach and traverse the different levels with *finite* velocity and so, in each case, in a *definite order.* 'Intelligence' becomes a manifestation of life of the organism-as-a-whole, structurally impossible in some fictitious 'isolation'. To 'be' means *to be related.* To be related involves multi-dimensional *order* and results in *structure.*

'Survival', 'adaptation', 'response', 'habit formation', 'orientation', 'learning', 'selection', 'evaluation', 'intelligence', 'semantic reactions', and all similar terms involve structurally an ordered, interrelated structural complex in which and by which we live and function. To 'comprehend', to 'understand', to 'know', to be 'intelligent'. , in the pre-human as well as the human way, means the most useful survival adjustment to such an ordered, interrelated structure as the world and ourselves.

In this vocabulary, 'structure' is the highest abstraction, as it involves a whole, taken as-a-whole, made up of *interrelated parts,* the relations of which can be defined in still simpler terms of order. 'Knowing', in its broadest as well as in its narrow human sense, is conditioned by structure, and so consists of *structural* knowings. All empirical structures involve relations, and the last depend on multi-dimensional order. A language of *order,* therefore, is the simplest form of language, yet in structure it is similar to the structure of the world and ourselves. Such a language is bound to be useful for adaptation and, therefore, sanity; it results in the understanding of the structural, relational, multi-dimensional order in the environment on all levels.

We must stress the structural fact that the introduction of *order* as a fundamental term abolishes some fanciful and semantically very harm-

ful ‘infinities’. If an impulse could travel in ‘no time’ or with ‘infinite velocity’, which is a *structural impossibility* in this world, such an impulse would reach different places ‘instantaneously’, and so there would be *no order involved.* But, as soon as the actual order in which impulses reach their destination is found, ‘infinite velocities’ are abolished. We shall show later that ‘infinite velocity’ is a meaningless noise; here we stress only the point that it is a structural impossibility, as structure involves relations and orders, and order could not exist in a world where ‘infinite velocities’ were possible.

Conversely, if in our analysis we disregard order, we are bound to disregard relations and structure and to introduce, by necessity, some fanciful ‘infinite velocities’. Any one who treats ‘mind’ in ‘isolation’ makes a structurally false assumption, and, by necessity, unconsciously ascribes some meaningless ‘infinite velocity’ to the nerve currents.

We have dwelt upon this subject at such length because of its general structural and semantic importance. The first step towards understanding the theory of Einstein is to be entirely convinced on the above points. Newton’s disregard of order introduced an unconscious false to facts assumption of the ‘infinite velocity’ of light, which fatalistically leads to an objectification called ‘absolute time’, ‘absolute simultaneity’, and so introduces a terminology of inappropriate structure. A similar remark applies to arguments about ‘mind’ in an objectified, ‘isolated’ way. These arguments disregard the *order* in which the nervous impulses spread and so, by necessity, introduce a silent false to facts assumption of the ‘infinite velocity’ of nerve currents.

On empirical structural grounds, we know neurological and general facts on two levels. (1) Macroscopically, we have a structure in levels, stratified, so to say, with complexities arising from the general colloidal physico-chemical structure of the organism-as-a-whole. (2) The general sub-microscopic, atomic, and sub-atomic structure of all materials simply gives us the persistence of the macroscopic characteristics as the relative *invariance of function,* due to dynamic equilibrium, and ultimately reflected and conditioned by this *sub-microscopic structure* of all materials. Under such actual structural conditions, terms like ‘substance’, ‘material’. , and ‘function’, ‘energy’, ‘action’. , become interconnected— largely a problem of preference or necessity of selecting the level with which we want to deal.

On sub-microscopic levels, ‘iron’, or anything else, means only a persistence for a limited ‘time’ of certain gross characteristics, representing a process (structurally a four-dimensional notion involving ‘time’), which becomes a question of structure. With the 1933 known unit of

the world called an ‘electron’, which appears as an *‘energy’* factor, the relative persistence or invariance of dynamic sub-microscopic structure gives us, on macroscopic levels, an average, or statistical, persistence of gross macroscopic characteristics, which we label ‘iron’.

The above should be thoroughly understood and digested. As a rule, we all identify orders and levels of abstractions and so have difficulty in keeping them separate verbally (and, therefore, ‘conceptually’). Thorough structural understanding helps us greatly to acquire these new and beneficial *s.r.*

Under such structural *empirical* conditions, a language of order, which implies relations and structure, as enlarged to the order of abstractions or level of consideration, largely volitional, becomes the only language which, in *structure*, is similar to the structure of the world, ourselves included, and so, of necessity, will afford the maximum of semantic benefits.

It should be understood that, on structural grounds, terms like ‘substance’ and ‘function’ become, in 1933, perfectly *interchangeable*, depending on the order of abstraction. ‘Substance’, for instance, on the macroscopic level becomes ‘invariance of function’ on the sub-microscopic level. It follows that what we know about the macroscopic (‘anatomical’) structure can be quite legitimately enlarged by what we know of *function* (structure on different levels). This interchangeability and complementary value of evidence is conditioned by structural considerations, and the fact that ‘structure’ is multiordinal. On gross anatomical grounds, we know a great deal about this structure of the nervous system. Because of experimental difficulties, very little is known of the structural sub-microscopic happenings, yet we can, speak about them with benefit in *functional* terms; as, for instance, of ‘activation’, ‘facilitation’, ‘resistance’, ‘psychogenetic effects’, ‘diffusion’, ‘permeability’, the older ‘inhibition’, .

In such a cyclic chain as the nervous system, there is, as far as energy is concerned, no last stage of the process. If there is no motor reaction or other reflex, then there is a semantic or associative reaction with ‘inhibitory’ or activating consequences, which are functionally equivalent to a motor reaction. At each stage, a ‘terminal’ receptor is a *reacting* organ in the chain.[3]

We know quite well from psychiatry how nervous energy may deviate from constructive and useful channels into destructive and harmful channels. The energy is not lost, but misdirected or misapplied. For instance, an ‘emotional’ shock may make some people release their energy into useful channels, such as concentrated efforts in some direction, which would have been impossible without this shock; but, in

others, an ‘emotional’ shock leads to the building up of morbid ‘mental’ or physical symptoms.

Since the nervous structure is cyclic in most of its parts, as well as as-a-whole, and since these cycles are directly or indirectly interconnected, mutual interaction of those cycles may produce most elaborate behaviour patterns, which may be spoken of, in their manifestations, in terms of *order.* As each more important nerve centre has incoming and outgoing nerve-fibres, the activation, or reinforcement, or diffusion of nerve currents may sometimes manifest itself in our *s.r* as *reversal of order* in some aspects. Neurologically, considered on the sub-microscopic level, it would only be a case of activation, or of diffusion, or of ‘inhibition’. , probably *never* a problem of reversed order in the actual nerve currents.

The semantic manifestations of order and reversed order are of *crucial importance,* for we are able to *train* the individual to different orders or reversals of orders. This procedure neurologically involves activations, enforcements, diffusions, ‘inhibitions’, resistances, and all the other types of nervous activities, which without the formulation of psychophysiology were all *most inaccessible to* direct training. The structural fact that order and reversal of order in semantic manifestation, which all are on the un-speakable objective level, have such intimate and profound connection with fundamental nervous processes, such as activation, enforcement, diffusion, permeability, ‘inhibition’, resistance. , gives us tremendous new powers of an educational character in building up *sanity,* and supplies methods and means to affect, direct, and train nervous activities and *s.r,* which we were *not able formerly to train* psychophysiologically. Perhaps one of the main values of the present work is the discovery of physiological means, to be given presently, for training the human nervous system in ‘sanity’.

The reader should be aware, when we speak of order and reversal of order, that we mean the order and reversal of order in the un-speakable *s.r*; but the neurological mechanism is of a different character, as already explained. Our analysis of the simple semantic manifestations involve *evaluation* and so *order,* permitting a most complex re-education and re-training of the nervous system, which were entirely beyond our reach with the older methods.

Experimental evidence seems to corroborate what has been suggested here, and the analysis, in terms of order, seems to have serious practical neurological significance, owing to *similarity of structure,* resulting in *evaluation,* and so appropriate *s.r.*

For our analysis in terms of order, we start with the simplest imaginable nervous cycle; but it must be explicitly understood that such simple

cycles actually never exist, and that our diagrams have value only as picturing the cyclic *order*, without complications. Let us repeat that the introduction of an analysis in terms of *order* or *reversal of order* in *the manifestation* involves, under educational influence, various other and *different actual nervous activities*, a class of activities which hitherto have always evaded our educational influences. For structural purpose, it is sufficient to make use of the distinction between lower and higher centres (a rough and ready distinction) and to consider the lower centres generally in connection with the thalamus and brain-stem (perhaps also other sub-cortical layers), and the higher centres generally in connection with the cortex. This lack of precision is intentional, for we need only sufficient structural stratification to illustrate *order*, and it seems advisable to assume only the well-established *minimum* of structure.

We have already mentioned the absolute individuality of the organism and, as a matter of fact, of everything else on objective levels. The reader need have no metaphysical shivers about such extreme individuality on the un-speakable levels. In our human economy, we need both similarities and differences, but we have as yet, in our *A*-system, chiefly concentrated our attention and training on similarities, disregarding differences. In this work, we start structurally *closer to nature* with un-speakable levels, and make *differences* fundamental, similarities appearing only at a later stage (order) *as a result of higher abstractions.* In simple words, we obtain similarities by disregarding differences, by a process of abstracting. In a world of only absolute differences, without similarities, recognition, and, therefore, 'intelligence', would be impossible.

It is possible to demonstrate how 'intelligence' and abstracting both started together and are due to the physico-chemical structure of protoplasm. All living material, usually called protoplasm, has, in some degree, the nervous functions of irritability, conductivity, integration, . It is obvious that a stimulus *S* does not affect the little piece of primitive protoplasm *A* 'all over and at once' (infinite velocity), but that it affects it first in a definite spot *B*. that the wave of excitation spreads, with finite velocity and usually in a diminishing gradient, to the more remote portions of *A*. We notice also that the *effect* of the stimulus *S* on *A* is not *identical* with the stimulus itself. A falling stone is *not* identical with the pain we feel when the stone falls on our foot. Neither do our feelings furnish a full report as to the characteristics of the stone, its internal structure, chemistry, . So we see that the bit of protoplasm is affected only *partially*, and in a *specific* way, by the stimulus. Under physico-chemical conditions, as they exist in life, there is no place for any

‘allness’. In life, we deal structurally only with ‘non-allness’; and so the term, *‘abstracting* in different orders’, seems to be structurally and uniquely appropriate for describing the effects of external stimuli on living protoplasm. ‘Intelligence’ of any kind is connected with the abstracting (non-allness) which is characteristic of all protoplasmic response. Similarities are perceived only as differences become blurred, and, therefore, the process is one of abstracting.

The important novelty in my treatment is in the structural fact that I treat the term ‘abstracting’ in the *non-el* way. We find that all living protoplasm ‘abstracts’. So I make the term abstracting fundamental, and I give it a wide range of meanings to correspond to the facts of life by introducing abstractions of *different orders.* Such a treatment has great structural advantages, which will be explained in Part VII.

As our main interest is in ‘Smith_n’, we will speak mostly of him, although the language we use is structurally appropriate for characterizing all life. ‘Abstracting’ becomes now a physiological term with structural, actional, physico-chemical, and *non-el* implications.

Accidentally, some light is thus thrown on the problem of ‘evolution’. In *actual* objective life, each new cell is different from its parent cell, and each offspring is *different* from its parents. Similarities appear only as a result of the action of our nervous system, which does not register absolute differences. Therefore, we register similarities, which evaporate when our means of investigation become more subtle. Similarities are read *into nature* by our nervous system, and so are structurally less fundamental than differences. Less fundamental, but no less important, as life and ‘intelligence’ would be totally impossible without *abstracting.* It becomes clear that the problem which has so excited the *s.r of* the people of the United States of America and added so much to the merriment of mankind, ‘Is evolution a “fact”, or a “theory” ?’, is simply silly. Father and son are never identical—that surely is a structural ‘fact’—so there is no need to worry about still higher abstractions, like ‘man’ and ‘monkey’. That the fanatical and ignorant attack on the theory of evolution should have occurred may be pathetic, but need concern us little, as such ignorant attacks are always liable to occur. But that biologists should offer ‘defences’, based on the confusion of orders of abstractions, and that ‘philosophers’ should have failed to see this simple dependence is rather sad. The problems of ‘evolution’ are verbal and have nothing to do with life as such, which is made up all through of *different* individuals, ‘similarity’ being structurally a manufactured article, produced by the nervous system of the observer.

In my own practice, I have become painfully aware of a similar discrepancy in the learned *s.r* of some older professors of biology, who quite often try to inform me that 'Life is overlapping', and that 'no sharp distinction between "man" and "animal" can be made'. They forget or do not know that, structurally, actual 'life' is composed of *absolute individuals,* each one *unique* and different from all other individuals. Each individual should have its individual name, based on mathematical extensional methods; for instance, x_1, x_2, x_3, . . . x_n; or $Smith_1$, $Smith_2$. , or $Fido_1$, $Fido_2$, . 'Man' and 'animal' are only labels for verbal fictions and are not labels for an actual living individual. It is obvious that as these verbal fictions, 'man' and 'animal', are not the living individual, their 'overlapping' or 'not overlapping' depends only on *our ingenuity,* our power of observation and abstraction, and our capacity of coining *non-el* functional definitions.

Let us see how adaption might work in practice. Let us consider two or three caterpillars, which we may name C_1, C_2, C_3, since each of them is an absolute individual and different from the others. Let us assume that C_1 is positively heliotropic, which means that he is compelled to go toward light; that C_2 is negatively heliotropic, which means that he would tend to go away from light; and that C_3 is non-heliotropic, which means that light-would have no effect on him of a directional character. At a certain age, C_1 would crawl up the tree near which he was born and so reach the leaves, eat them, and, after eating them, would be able to complete his development. C_2, and probably C_3, would die, as they would not crawl up the tree toward sufficient food. Thus, we see that among the indefinite number of possible individual make-ups of C_k (k=1, 2, 3, . . . n), each one being different, only those which were positively heliotropic would survive *under the conditions of this earth,* and all the rest would die. The positively heliotropic would propagate and their positive heliotropism might be perpetuated, the negatively heliotropic and non-heliotropic becoming extinct. This would only occur, however, in a world in which trees have roots in the ground and leaves on their parts toward the sun. In a world where the trees grew with their roots toward the sun and leaves in the ground, the reverse would happen; namely, the negatively heliotropic and non-heliotropic would survive, and the positively heliotropic would die out. We can not foretell whether, in such a world, there would be caterpillars; so this is an hypothetical example.

Experiments made with such caterpillars have shown that the positively heliotropic ones crawl toward the sun, even upon a plant which has been turned over, with the roots toward the sun. They crawl away

from food, and die. We see that the external *environmental* conditions determine which characteristics survive, and so we reach the notion of adjustment.

The practical result of these conditions is that the indefinite number of individual variations, although they undoubtedly exist, seldom come to our attention, as those variations which do not fit their environmental conditions become extinct; their variations do not become hereditary, and consequently we can seldom find them outside of a laboratory.

This shows, also, the permanent connection and interdependence of the facts of nature. The structural fact that our trees grow with their roots in the ground and their leaves upward is not an independent fact; it has something to do with the structure of the world and the position and the effect of the sun, . So the fact that we have positively heliotropic caterpillars of a special kind, and not negatively heliotropic ones, has something to do with the structure of the rest of the world.

To illustrate this interconnection and interdependence of nature still more clearly, let me suggest an hypothetical question. How would conditions, as they are on this earth, compare with those which would obtain, if it were, let us say, one mile greater in diameter ? Some try to guess the answer; yet this question cannot be answered at all. The diameter of this earth is strictly dependent on all the structural conditions which prevail in this world. Since it is impossible to know what kind of a universe it would be, in which this earth could be different from what we know, it is, of course, equally impossible to foresee whether on such a fictitious earth, in such a fictitious universe, there would even be life at all. Because the structure of the world is such as we know it, our sun, our earth, our trees, our caterpillars, and, finally, ourselves have their structure and characteristics. We do not need to enter here into the problems of determinism versus indeterminism, as these problems are purely verbal, depending on our orders of abstractions, the 'logic' we accept, and so, finally, on our pleasure, as is explained more in detail later on, and could not be solved satisfactorily in an *A, el* system, with its two-valued 'logic'.

According to the evidence at hand in 1933, 'Smith', appears among the latest inhabitants of this earth, and subject to the general test of survival, as already explained. The few thousand years during which there had been any 'Smith$_n$' are too short a period to test, with any certitude, his capacity for survival. We know of many species of animals, and also races of man, of which very little trace has been left. What we know about their history is mostly through a few fossils, which are kept in museums.

The external world is full of devastating energies and of stimuli too strong for some organisms to endure. We know that only those organisms have survived which could successfully either protect themselves from over-stimulations or else were under protective circumstances. If we look over the series of surviving individuals, paying special attention to the higher animals and man, we find that the nervous system has, besides the task of conducting excitation. , the task of so-called 'inhibition'. Response to stimuli, by survival, proved its usefulness. But to diminish the response to some stimuli or avoid stimuli, proved also to be useful, again by survival. It is known that the upper or latest layers of the nervous system are mostly such *protective* layers, to prevent immediate responses to stimulation. With the development of the nervous system from the simplest to the most complex, we see an increase in behaviour of a modifiable or individually adjustable type. In terms of *order*, and using the old language, 'senses' came first in order and 'mind' next, in all their forms and degrees.

If we speak in neurological terms, we may say that the present nervous structure is such that the entering nerve currents have a natural direction, established by survival; namely, they traverse the brain-stem and the thalamus first, the sub-cortical layers next, then the cerebral cortex, and return, transformed, by various paths. Experience and science in 1933 are showing that this is the order established under a heavy toll of destruction and non-survival in a system of adjustment, and so should be considered the 'natural' order, because of its survival value.

We all know in practice about a 'sensation', and a 'mental picture' or 'idea'. As 'sensations' were often very deceptive and, therefore, did not always lead to survival, a nervous system which somehow retained vestiges, or 'memories', of former 'sensations' and could recombine them, shift them. , proved of higher survival value, and so 'intelligence' evolved, from the lowest to the highest degrees.

Experience and experiments show that the natural order was 'sensation' first, 'idea' next; the 'sensation' being an abstraction of some order, and the 'idea' already an abstraction from an abstraction or an abstraction of higher order.

Experience shows again that among *humans*, this order in manifestations is sometimes *reversed;* namely, that some individuals have 'idea' first; namely, some vestiges of memories, and 'sensations' next, without any external reason for the 'sensations'. Such individuals are considered 'mentally' ill; in legal terms, they are called 'insane'. They 'see', where there is nothing to see; they 'hear', where there is nothing to hear; they are paralysed, where there is no reason to be paralyzed; they have pains,

when there is no reason to have pains, and so on, endlessly. Their survival value, if not taken care of, is usually nil. This reversal of order, but in a mild degree, is extremely common at present among all of us and underlies mainly all human misfortunes and un-sanity.

This reversal of order in its mild form is involved in identification or the confusion of orders of abstractions; namely, when we act as if an 'idea' were an 'experience' of our 'senses', thus duplicating in a mild form the mechanism of the 'mentally' ill. This implies nervous disturbances, since we *violate the natural (survival) order of the activities of the nervous system.* The mechanism of *projection* is also connected with this *reversal of order.* This reversal transforms the external world into a quite different and fictitious entity. Both ignorance and the old metaphysics tend to produce these undesirable nervous effects of *reversed order and so non-survival evaluation.* If we use the nervous system in a way which is against its survival structure, we must expect non-survival. Human history is short, but already we have astonishing records of extinction.

That such reversal of order in the manifestations of the functioning of the nervous system must be extremely harmful, becomes evident when we consider that in such a case the upper layers of our nervous system (the cortex) not only do not protect us from over-stimulation originating in the external world and inside us, but actually contribute to the over-stimulation by producing fanciful, yet very real, irritants. Experiments on some patients have shown how they benefit *physically* when their internal energy is liberated from fighting phantoms and so can be redirected to fight the colloidal disturbances. Such examples could be cited endlessly from practically every field of medicine and life. This problem of 'reversal of order' is not only very important semantically, but also very complex, and it will be analysed further on.

The reader should not miss the fact that an analysis in terms of *order* throws a new light on old problems, and so the scientific benefit of the use of such a term is shown. But this is not all; the use of the term *order* has brought us to the point where we can see far-reaching practical applications of the knowledge we already possess, and of which we have not so far made any systematic use.

We know that the activity of the nervous system is facilitated by repetition, and we can learn useful habits as easily as harmful. In the special case of *s.r* also we can train ourselves either way, though one may have useful survival value; the other being harmful, with no survival value. The problem is again one of *order*, and, among others, a problem of extension and intension, as has already been mentioned several times.

Section D. Order and the problems of extension and intension

The problems of extension and intension are not new, but have been treated as yet only casually by 'philosophers', 'logicians', and mathematicians, and it has not been suspected what profound, far-reaching, and important structural psychological, semantic components they represent.

At this point, to avoid confusion, a warning is necessary. The problems with which we are dealing have never been analysed from the point of view of this work; namely, from that of structure. So, naturally, all that has been accomplished in these fields is *over-simplified,* and leaves out vital characteristics. Discrepancies have arisen between the structure of the old verbiage and that of the new. Before it is possible to formulate the general theory of this work, it will be necessary to go ahead in spite of discrepancies, and then to formulate the general theory and show how these discrepancies had a perfectly *general* origin in the stratified—and, therefore, ordered—structure of human knowledge. The discrepancies were inherent and *unavoidable* in the old way, but are avoidable in the new. It is the main aim of the present theory to elucidate structural issues in connection with *s.r* and many problems of human and scientific conduct, mathematics and insanity included, and, in general, with all known problems of scientific method and theory of knowledge. But we ought not to be surprised if such a pioneering enquiry proves to need many corrections and elaborations in the future. Psychiatrists are the least likely to disregard the problems of structure and *s.r*, since their science is young and still flexible. Besides, the psychiatrists know a-great deal about 'human nature' and behaviour, though they are handicapped by insufficient knowledge of the exact sciences and the absence of $\overline{A}$, *non-el* semantics. The opposite, perhaps, would be true about mathematicians. They know a great deal about how to play with symbols. Their work is engrossing and exacting. But very few are capable of separating themselves enough from this play to contemplate the broader, more 'human', aspects of their own science, the interplay of symbols in language, their structure, and the bearing of structure on *s.r* and adaptation.

Some of these specialists might say that the author uses their terms in a sense different from that in which they use them, and that, consequently, from their point of view, this work is not strictly legitimate. However, when a mathematician lays down a definition, such as 1+1=2, this has nothing to do with the *application* we make of it when we say that one penny and one penny make two pennies. Neither can he object when we add one gallon (of water) to one gallon (of alcohol) and do

not obtain two gallons (of the alcohol-water mixture), but slightly less. This last is a profound experimental fact, intimately connected with the structure of 'matter' and, therefore, of the world around us. The mathematician has nothing to do with the fact that his *additive* definitions, important as they are, do not cover the facts of the world around us, which happens not to be additive in its more fundamental aspects.

Also, the mathematical definition, one and one make two, is *not* invalidated by such non-additive facts. The mathematician does not claim, but rather disclaims, content in its formulae. There is no mention of pennies or apples or gallons of alcohol, . It is simply a definite language of definitive structure for talking about anything which *can* be covered. If facts cannot be covered by given linguistic forms and methods, new forms, new structures, new methods are invented or created to cover the structure of facts in nature.

The mathematician created such a different language long ago. He now calls his additive language 'linear', and the corresponding equations are of 'first degree'. He calls his non-additive language 'non-linear' and the equations are of 'higher degrees'. These latter equations happen to be much more difficult than the former and of complex structure, so that very often they can be solved only by approximation to linear equations. Now, without anybody's fault, the world around us does not happen to be an additive affair in its more fundamental structural aspects. Perhaps the most important and beneficial results of the new physical theories is that they point out this structural fact, and take it into consideration. The reader should recall the example about the man-made green leaf and the non-man-made green leaf, which differ in structure, and he will understand how our additive tendencies are the result of our primitive state of development and of this projection of our anthropomorphic point of view on the world. We reversed the natural order and imposed on the world the structure of our verbal forms, instead of the *natural order* of patterning the structure of language after the structure of the world.

This digression was especially necessary before approaching the problem of 'extension' and 'intension'. These have never been analysed from the point of view of structure and order, and whatever is known about them is taken for granted. It is true that we hear now and then casual remarks that mathematicians had a predilection for extension and 'philosophers' for intension, but these true remarks are not further analysed.

We usually forget that whenever a mathematician or a 'philosopher' produces a work, this involves his 'attitude', which represents an ex-

tremely complex psycho-logical *s.r* of the organism-as-a-whole. In most cases, these attitudes determine not only the character of our work, but also other reactions which make up our individual and social life. Historically, the mathematicians have a steady record of achievement, and 'philosophers' (excluding epistemologists) one of uselessness or failure. Has this record something to do with the extensional and intensional *attitudes* ? In fact, it has. It is easy to show that the extensional attitude is the *only one* which is in accordance with the *survival order and nervous structure,* and that the intensional attitude is the reversal of the natural order, and, therefore, must involve non-survival or pathological *s.r*.

One of the simplest ways of approaching the problems of 'extension' and 'intension' is perhaps to point its connection with definitions. A collection may be defined, so we are told, by enumeration its members, as, for instance, when we say that the collection contains Smith, Brown, Jones, . Or we may define our collection by giving a defining 'property'. We are told that the first type of definitions which enumerates individual members is to be called a definition by *extension,* the second, which gives a defining 'property', is to be called a definition by *intension*.

We can easily see that a 'definition by extension' uniquely characterizes the collection, $Smith_1$, $Brown_1$, $Jones_1$, . Any other collection, $Smith_2$, $Brown_2$, $Jones_2$. , would obviously be different from the first one, since the individuals differ. If we 'define' our collection by intension; that is, by ascribing some characteristic to each of the individuals, for instance, that they have no tails, many collections of individuals without tails might be selected. Since these collections would be composed of entirely different individuals, they would be entirely different, yet by 'intension', or defining characteristic, they all would be supposed to be one collection.

Similar contrast exists between relations in extension, and relations in intension. These relations have been defined more or less as follows: 'Intensional relations are relations of "concepts"; *extensional relations are relations of denoted facts'*. Or, 'relations of intension are those which are ascertainable *a priori;* a relation of extension is discoverable *only by inspection of the existent*'. Or, 'intension covers the relations which hold for all the possible individuals, while *extension holds only for the existent*'. 'A relation of intension is one which is only discoverable by logical analysis; a relation of extension is one which is only discoverable by the *enumeration of particulars*', .[4]

All that has just been said are perhaps standard definitions; but, for my purpose, they are profoundly unsatisfactory. Because we have

had no better understanding of this most important question of order, a great deal of confusion has occurred in human 'thought' and many of our disciplines have become twisted in undesirable directions. This, to a large degree, accounts for the obscurity which characterizes the problems we are dealing with in this book. But it should be emphasized that even in this very unsatisfactory form, 'intension' and 'extension', as they were *felt and applied* (s.*r*, largely disregarding the verbal formulations), have played an enormous role in the development of our forms of representation, and our 'civilization'. Unfortunately, without an ordinal analysis, it was impossible to evaluate properly the relative importance of these semantic attitudes, and to realize the serious importance of these problems for a theory of sanity and resulting consequences.

Here, again, the knowledge which psychiatry gives will help a great deal. We know, in the rough, quite a little about two semantic mechanisms which are called extroversion and introversion. In the rough, again, the extrovert projects all that is going on within himself upon the outside world, and believes that his personal projections have some kind of non-personal objective existence, and so-have 'the same' validity and value for other observers. As a result, quite naturally, the extrovert is due to receive a great many unpleasant shocks, for the other observer does not necessarily observe or 'perceive' in the external events the characteristics which the first observer 'finds'. He has often projected them from his 'inside', but they were entirely personal. The first observer, in his semantic conviction that his observations are the only, uniquely correct, observations, feels that the second observer is either blind in some way, or unfair to him. In acute cases, he develops a mania of persecution. He feels that everybody misunderstands him; nobody is fair to him; everybody is hostile to him; he will get even with them; in the name of 'justice', he will punish them, . A dangerous and quite often incalculable bitterness and hostility follow. Such types are usually troublesome, and, if the affective components are strong, then such types are dangerously ill and liable to produce bloodshed or make other attacks. The most pronounced types in this extreme direction are called paranoids and paranoiacs.

The introvert type is different. He is mostly concentrated on what is going on inside of his own skin. Almost all of what is going on outside of his skin, he interprets in personal terms and feelings. Whatever unpleasant happens, he is always guilty; always willing to take the blame, which is quite often just, for many psychological reasons upon which we cannot dwell here. This type, in its extreme development, quite often

finds a solution in suicide. The most extreme cases are called ‘dementia praecox’ or ‘schizophrenic’ types.

In everyday experience, it is seldom that such clear-cut types as just described can be observed. For the purpose of studying such extreme types, one has to do researches in asylums. Even there we find a great number of mixed cases. In daily life we find in practically everybody a *predominance* of one or the other of these types of *s.r,* but in some the two types appear to be inextricably mixed. Observations upon this problem among so-called ‘normal’ men is difficult, as they represent great complexities.

It has been already mentioned that the well-balanced man, a man who has survival value, should be a well-balanced mixture of both tendencies; namely, an extroverted-introvert, or, if we wish, an introverted-extrovert. As yet, these problems, no matter how important they may be, are beyond our educational methods, and only in acute cases are they taken care of by physicians, and then mostly in asylums. It is important to have simple means to deal with these semantic problems in elementary education as a *preventive* method, or as a branch of semantic hygiene.

Even this brief analysis shows how tremendously powerful the affective factors are which may be behind the unbalanced semantic attitudes. The reader should not miss the fact that in both types, when well developed, there is material for an extreme amount of self-imposed suffering. Then the nervous energy produced by the organism is absorbed in fighting phantoms, instead of being directed toward useful ends, such as regulating the normal activities of the organism, or fighting internal enemies, whereas, there should also be some energy left for activities and interests useful socially or for the survival of the race.

While the majority of individuals present different degrees of prevalence of one mechanism over the other, yet fairly clear-cut cases are to be found. The extreme complexity of the structure of the nervous system of man justifies the enormous number of degrees recognized. So large, indeed, is this number of possibilities, that we have little difficulty in understanding that the individuality of every one is unique.

Extroverted and introverted individuals are usually born such; at least, they usually have a predisposition to be the one or the other. To what extent these tendencies can be aggravated or improved by education is not yet solved, and, indeed, has never been much bothered about. To consider our activities merely as results of inborn tendencies is too narrow a view. The human nervous system is not finished at birth, and it continues its development for some time after the birth of the child. So it is much more influenced by environmental conditions, the verbal

included, than is the nervous system of an animal. The make-up of the individual is thus some function of different variables, among which the hereditary inclinations and the environmental conditions appear in a relation, at present, not fully known. The individual *feels and acts* according to his complex make-up, including *acquired s.r*, no matter what factors have played a role in its moulding, and, as a rule, he is little influenced by the way he rationalizes his activities. From this point of view, we may consider that the extensional make-ups and intensional characters are bound to show themselves later on in life, no matter how the subject may have rationalized them, if his *s.r* have not been modified.

It seems evident that the extroverted and introverted tendencies have some connection with extensional and intensional types of reaction; but, of course, they are not identical. They influence the individual in the selection of a profession, and in the preference for some special trend of activity. Thus, mathematicians, generally, have an inclination toward extension, 'philosophers' toward intension. Now, it is interesting to note that mathematicians have a record of continuous constructive progress, and at each epoch have produced the highest kind of language known. Also, the most important achievements in the fields which traditionally belonged to 'philosophers' have actually been produced by mathematicians. The 'philosophers', in the main, have a record of failure.

The reason for this difference, which is too remarkable to be a mere coincidence, may be found by application of the term 'order' in our analysis. *The extensional method is the only method which is in accordance with the structure of our nervous system as established by survival.* Reversed intensional methods disorganize this normal mode of activity of the nervous system, and so lead toward nervous and 'mental' illnesses.

As explained before, the structure of our nervous system was established with 'senses' first, and 'mind' next. In neurological terms, the nervous impulses should be received first in the lower centres and pass on through the sub-cortical layers to the cortex, be influenced there and be transformed in the cortex by the effect of past experiences. In this transformed state they should then proceed to different destinations, as predetermined by the structure established by survival values. We know, and let us remember this, that the reversed order in semantic manifestation—namely, the *projection into 'senses' of memory traces* or doctrinal impulses—is against the survival structure, and hallucinations, delusions, illusions, and confusion of orders of abstractions are to be considered pathological. In a 'normal' human nervous system with *survival* value, the nervous impulses should not be lost in the sub-cortical

layers. In such a case, the activity of our human nervous system would correspond to the activity of the less-developed nervous systems of animals which have no cortex at all. It must be remembered, also, that the sub-cortical layers which have a cortex, as in man, are quite different from corresponding layers of those animals which have never developed a cortex. It is impossible to avoid the conclusion that survival values are *sharply* characterized by *adequacy*, and that animals without cortex have nervous systems adequate for their needs under their special conditions; otherwise, they would not have survived. This applies, also, to those animals who have a cortex. Their activities for survival depend on this cortex; and when the cortex is removed, their activities become inadequate. Their sub-cortical layers alone are not adequate to insure survival. For survival, such animals must use not only their lower centres and their sub-cortical layers, but also their cortices.

Among animals, as all evidence shows, the enormous majority have, without human interference, nervous systems working usually in the 'normal' way; that is, according to the survival structure. 'Insanity' and kindred nervous disturbances are known only among ourselves (however, see Part VI). Apparently, the cortex, through its enormous internal complexity, which provides many more pathways, and through its complex interconnections, which offer many more possibilities, with a greater number of degrees of 'inhibition', of excitability, of delayed action, of activation. , introduces not only a much greater flexibility of reaction, but, through this flexibility, a possibility for abuse, for reversal of manifestations, and so for a deterioration of the survival activity of the nervous system as-a-whole. The sub-cortical layers and other parts of the brain of man are different from the corresponding parts of the animal brain, which has a less-developed cortex. The nervous system works as-a-whole, and the anatomical homology of the parts of different nervous systems is a very inadequate, perhaps even a misguiding, foundation for inferring *a priori* the *functioning* of these systems, which ultimately depend not only on the macroscopic but also on the microscopic and sub-microscopic structures. For instance, we can cut off the head of some insects, and they go along quite happily and do not seem to mind the operation much. But we could not repeat this with higher animals. The behaviour is changed. A decorticated pigeon behaves differently from a decorticated rat, though neither of them seems affected greatly by the operation. A decorticated dog or ape is affected much more. Man is entirely changed. None of the higher types is able to survive long if decorticated.

There is on record the medical history, reported by Edinger and Fischer, of a boy who was born entirely without cerebral cortex. There

were apparently no other important defects. This child never showed any development of sensory or motor power, or of ‘intelligence’, or signs of hunger or thirst. During the first year of his life, he was continually in a state of profound stupor, without any movements and from the second year on, until his death (at three years and nine months), was continually crying.[5]

Although many animals, for instance fishes, have no differentiated cortex, yet their nervous system is perfectly *adequate* for their lives and conditions. But in a more complex nervous system, the relative functions of different parts of the brain undergo fundamental transformation. In the most complex nervous system, as found in man, the older parts of the brain are much more under the control of the cerebral cortex than in any of the animals, as is shown in the example above. The absence of the human cortex involves a much more profound disturbance of the activities of the other parts of the brain. Since the cortex has a profound influence upon the other parts of the brain, the insufficient use of the cortex must reflect detrimentally upon the functioning of the other parts of the brain. The enormous complexity of the structure of the human brain and the corresponding complexity of its functioning accounts not only for all human achievements, but also for all human difficulties. It also explains why, in spite of the fact that our anatomy differs but little from that of some higher animals, veterinary science is more simple than human medicine.

Because of the structure of the nervous system, we see how the completion of one stage of the process which originated by an external stimulus (A) and has itself become a nervously elaborated *end-product* (B), may, in its turn, become the stimulus for a still further nervously elaborated *new end-product* (C), and so on. When association or relation neurons enter, the number of possibilities is enormously increased.

It must be emphasized that A, B, C. , are, fundamentally, entirely *different.* For instance, the external event A may be a falling stone, which is an entirely different affair from the pain we have when this stone falls on our foot. It thus becomes clearer what is meant by a statement that the ‘senses’ abstract in their own appropriate way, determined by survival value, the external events; give these abstractions their special colouring (a blow on the eye gives us the feeling of *light*); discharge these transformed stimuli to further centres, in which they become again abstracted, coloured, transformed, . The end-product of this second abstracting is again an entirely different affair from the first abstraction.

Obviously, for survival value, this extremely complex nervous system should work in complete co-ordination. Processes should pass the

entire cycle. If not, there must be something wrong with the system. The activities of the organism are then regressive, of lower order, a condition known as ‘mental’ illness. The gross anatomical divisions of the nervous system should not be relied upon too much as an index of function. Perhaps these anatomical speculations are even harmful for understanding, because they falsify the facts, emphasize the macroscopic similarities unduly and disregard subtle yet fundamentally important microscopic and sub-microscopic structures and differences, which are perfectly manifest in the functioning, but which are difficult to observe directly on their level.

The term ‘abstracting’ is a multiordinal term, and hence has different meanings, depending on the order of abstractions. It is a functional term and, to indicate the differences in meanings, it is necessary to indicate the different orders. It is structurally a *non-el* term, built upon the extensional mathematical pattern x', x'', x'''. , or x_1, x_2, x_3, . . . x_n, or x_k (k=1, 2, 3, . . . n). This allows us to give the term ‘abstracting of different orders’ a perfectly *unique* meaning in a given problem and yet to keep in a fluid state its most important *functional implications.* Something similar happens when the mathematician discusses his x_n. No one can miss the fact that he deals with a variable which can take n values; so this symbol has a quite definite descriptive structural and semantic value. So has the ‘abstracting of different orders’.

It is desirable to introduce consciously and deliberately *terms* of a *structure* similar to the *structure* of human knowledge, of our nervous system, and of the world, involving appropriate *s.r.* Multiordinal terms are uniquely appropriate, since they take their ∞-valued structure from the structure of events (1933) and do not reflect their older, one-valued, false to fact character on the events. (Note the order.)

Now we are ready to reformulate the problem of extension and intension in terms of *order.*

If the natural survival order is lower abstractions first and higher next, then extension starts with absolute individuals, and conforms to the proper survival order. Extension recognizes the uniqueness, with corresponding one-value, of the individual by giving each individual a unique name, and so makes confusion impossible, Training in *s.r* of sanity becomes a possibility, and order becomes paramount. Extension and order cannot be divided. When we speak about ‘order’, we imply extension, and, when we speak about extension, order is implied. That modern mathematics and mathematical ‘logic’ has so much to do with order, as to make this term fundamental, is a necessary consequence of the extensional method which starts with unique individuals, labels them

by unique names and only then generalizes or passes to ∞-valued higher order abstractions like ‘numbers’, . The direction of the process of abstraction is here in the survival order, from lower abstractions to higher. It hardly needs to be emphasized that, to the best of our knowledge in 1933, it is the only possible way to follow the natural order and to evade reading into a fundamentally one-valued external event, our older undif*ferentiated* ∞-valued fancies (which happens if the process is reversed in order) involving powerful factors in our *s.r*.

Intension means structurally the reversal of the survival order, since it starts with undifferentiated ∞-valued higher abstractions and distorts or disregards the essential one-values of the individuals and reads into them as *uniquely* important undifferentiated ∞-valued characteristics.

Historically, mathematicians have had a predilection and, because of the character of their ‘element’ (numbers) and their technique, a structural necessity, for the use of extensional methods. It does not need much imagination to see why they have produced results of utmost (although relative) importance and validity at each date.

‘Philosophers’ and reasoners of that class have had a predilection for intension, and this also explains why, in spite of tremendously acute verbal exercises, they have not produced anything of lasting value, for they were carried away by the structure of the language they used. This predilection being already based on the reversal of the survival order, it was bound to lead in the less-resistant individuals to nervous and ‘mental’ defects.

The issues, as presented here, are very clear-cut, and, in fact, too clear-cut, as we have disregarded for the present the *cyclic* order of the nervous process. This last fact first abolishes the sharp distinction between ‘pure’ extension and ‘pure’ intension, each process never being ‘pure’, but always ‘impure’, one influencing the other. ‘Pure’ intension and ‘pure’ extension are delusional, to be found only in ‘mentally’ ill, with no survival value. This explains why we have to use the terms of *preference* and *order*. Without these terms I would not have been able to carry through this analysis at all. This reversal of order in *s.r* implies. different distribution, diffusion, intensity of nerve currents in the sub-microscopic field, and so involves important, different semantic components of non-survival value. It is most desirable to learn to control the activities on the sub-microscopic level by means of training on the macroscopic level, if means to do this can be devised.

The writer is not at all convinced that, acting as we do under the spell of intensional and ignorant ‘philosophers’, the existing systems and educational methods are not largely following the reversal of the sur-

vival order of our nervous processes. It seems unnecessary to point out that a structural and semantic enquiry on this particular question might be important and beneficial. It seems, without much doubt, that human institutions and activities should be in accord with 'human nature', if we are to expect them to survive without crushing us, and a scientific enquiry in this 'human nature' would be not only desirable but exceedingly important.

The reader, with the help of another person, should perform a very simple experiment. Let the assistant select secretly a dozen newspaper headlines of letters of equal size. Let the reader then sit in a chair without altering his distance from the assistant and let the assistant show him one of these headlines. If he is able to read the headline, it should be rejected, and a new one selected by the assistant and put a foot or more farther away. If this one is read correctly, it should be rejected, and a third one placed still farther away. By such trials we can finally find a distance which is slightly greater than the maximum range of clear visibility for the reader, so that, although the headline is only slightly beyond the distance at which one could read it, yet it would be illegible. Let the reader then try as hard as possible to read headlines which are just beyond his visual range. When he is convinced that he cannot read the headline, let the assistant *tell* him the content of it. Then the sitter can usually *see* with his *eyes* the letters, when he *knows* what is supposed to be there. The question arises, what part in the 'seeing' is due to 'senses', and what to 'mind' ? The answer is, that, structurally, the 'seeing' is the result of a cyclic *interdependent* process, which can be *split only verbally.* The independent elements are fictitious and, structurally, have little or nothing to do with actual facts. The human nervous system represents, structurally, a mutually interdependent cyclic chain, where each partial function is in the functional chain, together with enforcing and 'inhibiting', and other mechanisms.

Up to this stage, we have used the term 'cyclic order', but, in reality, the order is *recurrent,* though of a character better described by the 'spiral theory', as explained in my *Manhood of Humanity* on p. 233. In the 'spiral theory', we find the foundation for this peculiar stratification in levels and orders, which is necessitated by the structure and function of the human nervous system. It should be noticed that the equations of the circle and spiral are non-linear, non-plus equations.

The above relation underlies a fundamental mechanism, known in psychiatry as 'sublimation', in which, and by which, quite primitive impulses, without losing their intensity and fundamental character, quite often- are transformed from very primitive levels, which frequently

represent vicious and anti-social effects, into desirable characteristics, socially useful. Thus, a sadistic impulse may be sublimated into the socially useful vocation of the butcher, or, still further, into the skill and devotion to the service of their fellowmen, shown by many surgeons. We see that this mechanism is of tremendous importance, and responsible for what we call ‘culture’ and many other values. Our educational methods should understand this mechanism and apply this knowledge in the semantic training of youth. It is important to realize that this mechanism appears as the only semantic mechanism of correction which is in accord with the structure of the human nervous system, and so it seems workable. Various metaphysical preachings usually start by disorganizing the proper survival working of the human nervous system, and then we wonder that they fail, and that we cannot change ‘human nature’. To deal with ‘human nature’, which is not something static and absolute, we need to approach it with more structural understanding and less prejudice. Then, and then only, can we eventually look for better semantic results.

The writer does not want the reader to conclude that, because in mathematics we have followed the survival order through extension, the mathematicians must, by necessity, be the sanest of the sane. Quite often this is not true, since many complexities exist which will be taken under analysis later.

Section E. Concluding remarks on order.

One thing remains fundamental; namely, that the problems of order and extension are of paramount structural importance for sanity and our lives. They should be worked out and applied to the semantic training of the young in elementary education, . This would certainly produce a new generation saner than we are, and one which would, perhaps, lead lives less troubled than our own, and so, perhaps, of better survival value.

To appreciate fully the immensity of the task of a more detailed analysis of the problems of ‘extension’ and ‘intension’, the reader is advised to read the *Survey of Symbolic Logic,* by Professor C. I. Lewis, University of California Press, 1918, in which Chapter V is devoted to an important attempt at a formulation of strict implication of *both* extensional and intensional character, which is the *only* organism-as-a-whole, *non-el* possibility. Lewis’s theory of ‘strict implication’ introduces the notions of *impossible* propositions and so throws considerable light on the problem of non-sense, a light which is very seriously needed.

In concluding, it must be mentioned that a theory of *sanity*, because of the survival value of *order*, cannot *start* with the older, undifferentiated similarities, which are a product of *higher* abstractions, and thus of later origin, but *must* start with *differences* as fundamental, and so preserve the structure and order of the survival trend as applied in this work.

Animals do not possess such a highly differentiated nervous system as human beings. The difference between their higher and lower abstractions is thus not so fundamental, as we shall see later on. With them the question of *order* is less important, as they cannot alter it. Animals have the benefit of better co-ordination, since in them the above-described structural difficulties do not arise. They have normally no 'insane'. But, also, for the same reason, animals are not able to start every generation where the older left off. In other words, animals are not time-binders.

The structural complexity and differentiation of the nervous system in man is responsible, as is well known, not only for all our achievements and control over the world around us, but also for practically all our human, mostly semantic difficulties, many 'mental' ills included. The analysis in terms of *order* on the macroscopic level (semantic manifestations) reveals a profound connection with sub-microscopic processes of distribution. , of nervous energy. When the mechanism which controls these processes is properly understood, then they can be controlled and educated by special semantic training. In other words, theoretical, doctrinal, higher abstractions may have a stabilizing and regulating *physiological* effect on the function of our nervous system.

The reader may be interested to know that 'order' is very important in animal life. An analysis of nest-building and the rearing of young among birds shows that each step of the cycle is necessary before the next step is taken. If the cycle is broken, they usually cannot adjust themselves to the new state of affairs, but must start from the beginning.[6] This is a situation similar to our own when we cannot recall a line in a poem, but have to start from the beginning of the piece in order to recapture it. Pavlov was able, by the change of four-dimensional order of stimuli, to induce profound nervous disturbances in the nervous systems of his dogs, .

It appears, also, that in mild cases of aphasia, which is a neurological disturbance of linguistic processes, with word-blindness, word-deafness. , the notion of 'order' and 'relations' is often the first to be disturbed. In some cases, lower order abstractions are carried out successfully, but calculation, algebra, and other higher order abstractions, which require

ordered chains, become impossible. The aphasic seems to have a general incapacity for grasping *relations*, realizing *ordered series*, or grasping their succession.[7]

We see that the problems of *order* are somehow uniquely important; and so the investigation of the psycho-logics of mathematics, which is based on *order*, might give us means of at least partial control of different undesirable human semantic afflictions.

But, after all, we should not be surprised that it is so. The structure of nervous systems consists of *ordered* chains produced by the impact of external and internal stimuli in a four-dimensional space-time manifold, which have a spatial and also a temporal *order*. The introduction of the finite velocity of nerve currents, which, although known, was, as a rule, disregarded by all of us, introduces automatically our *ordering* in 'space' and 'time' and, therefore, in space-time. That is why the old anatomical three-dimensional analogies are vicious and false to facts when generalized. For better or worse, we happen to live in a four-dimensional world, where 'space' and 'time' cannot be divided. Whoever does this splitting must introduce fictitious, non-survival entities and influences into his system, which is moulded by this actual world and unable to adjust itself to fictions.

It seems obvious that all these problems of 'adjustment' and 'non-adjustment', 'fictitious' or 'actual' worlds. , are strictly connected with our *s.r* toward these problems, and so ultimately with some structural knowledge about them. But *attitudes* involve lower order abstractions, 'emotions', affective components, and other potent semantic factors which we have usually disregarded when dealing with science and with scientific problems and method. For adjustment, and, therefore, for *sanity*, we must take into account the neglected aspects of science, of mathematics, and of scientific method; namely, their semantic aspects. In this way we shall abandon that other prevalent structural fiction referred to at the beginning of the present chapter; namely, that science and mathematics have an *isolated* existence.

The above considerations of order lead to a formulation of a fundamental principle (a principle underlying the whole of the non-aristotelian system); namely, that organisms which represent *processes* must develop in a cert*ain natural survival four-dimensional order*, and that the *reversal* of that order must lead *to pathological* (non-survival) developments. Observations disclose that, in all human difficulties, 'mental' ills included, a *reversal of the natural order* can be found as a matter of fact, once we decide to consider order as fundamental. Any identification of inherently different levels, or confusion of orders of abstractions, leads auto-

matically to the reversal of natural order. As a method of preventive education and psychotherapy, whenever we succeed in reversing the reversed order or restoring the natural survival order, serious beneficial results are to be expected. These theoretical conclusions have been fully justified by experience and the work of Doctor Philip S. Graven in psychotherapy. It should be noticed that different primitive 'magic of words', or modern 'hypostatizations', 'reifications', 'misplaced concreteness', 'objectifications'. , and all semantic disturbances represent nothing else but a confusion of orders of abstractions, or identifications in value of essentially different orders of abstractions.

The above considerations are entirely general, but, because of their novelty, they have not, as yet, been applied in the *non-aristotelian* simple and workable form to psychiatry or education. In a very instructive paper on *The Language of Schizophrenia*,[8] Doctor William A. White applies some of these notions. Because of the method of approach, I will quote from this paper. It should be understood that this paper deals, also, with other issues, and the quotations do not do justice to the author, because I quote only those passages which are of particular interest here, omitting the literature given by Doctor White. The italics and one footnote are mine.

'It requires but a moment's serious consideration to realize that the subject of schizophrenic language must be immense if for no other reason than that it involves an understanding of the whole subject of language of which it is but a part. The extent and depth of the subject of language may be further appreciated from the fact that the single feature of its neuronic background as it is brought to attention in aphasia constitutes one of the most complex problems in the whole field of neurology and one with respect to which we are still hopelessly ignorant, especially when the enormous amount of work that has been done in this field is considered. . . .

. . . . . .

'There have been a few other recent contributions to the subject of schizophrenic thought and speech which, as they run more in line with my own thinking on the subject I will refer to more fully. These studies *equate the processes of thinking of schizophrenic persons with those of primitive peoples and of children.*

. . . . . .

'. . . In the archaic thinking of a prelogical kind, found among primitive savage races, the vividness of the images is greater than among more highly developed races, and the effect produced in the observer is projected and believed to be an inherent attitude of the object, which thus acquires a "demonic" character. All things which arouse a similar emotion are thought of as being actually the same. In dementia praecox there is a similar loss of objectivity, hallucinations and reality are imperfectly distinguished, and every happening has a meaning and effect on the observer; the idea of an action produces the action directly, instead of offering a possibility of action, and this is interpreted as a compulsion from without. Paralogical thinking is a stage beyond this, identification of objects is based on similarities, differences being neglected. . . . This form of thought is common in dementia praecox.

. . . . . .

'. . . While for the normal person the chief criterion of the world of real objects is their independence of him, whereas imaginary things depend for their

existence on him, the general characteristic of the schizophrenic patient's experience is that his mental and imaginary experiences have a substantial and concrete nature when the normal person would see only symbols and analogies. His thoughts have magic power and can produce real results; they have for him a substance and he can manipulate them physically....

. . . . . .

'Many other childish manifestations resemble those of schizophrenic persons: children's jokes, tricks, and plays in words have a similar autistic character, with no apparent meaning in relation to actualities, and this changes at puberty. Children, like the patients, love to make up a sort of neoplastic language of their own having meanings known only to themselves or their immediate circle. Perseveration and stereotypy in speech and actions are often observed in children. Their musical performances show the same mechanical rendering, and the same preference for simple melodies and rhythms as are found in schizophrenic patients....

. . . . . .

'Just in the same way we must be careful *not to equate* the regressive psychotic and the primitive *too literally*. That there are close analogies in their respective ways of thinking there is no doubt and that the recognition of these analogies has been of the utmost importance in enabling us to understand schizophrenic thinking must be acknowledged but perhaps, to be on the safe side, the matter should rest there for the present at least.

. . . . . .

'Another point should be made at this time, after what has been said of the loss of the boundaries of the ego its indefiniteness, etc. These expressions are apt to be equated, if we do not think carefully, with such concepts as disintegration and dementia. We must not lose sight of the magic of words and not be led astray by the old meanings when we are striving for new ones but are forced to use the words in current use.... Now regression to a childish or primitive level of this sort, which is what occurs in those conditions in which the ego is said to lose its clearness of definition, does *not imply disintegration* in the sense of disorder *but regression* to a different kind of order or, as my friend Korzybski would say, to a lower order of abstraction.

This is important for a *princip*le is embodied in the nature of this change....

. . . . . .

'This *principle*, namely, that the schizophrenic thought processes and language are of a *lower order of abstraction*, accounts, in part at least, for another phenomenon. If by a process of regression the mechanisms of thinking tend to ever more primitive levels then we should expect them ultimately to arrive at a concrete perceptional level, and when this occurs hallucinations, which have long been regarded as evidence of the schizophrenic splitting, come into the picture. While I believe that there must be other factors to account for the hallucinations they are at least to be expected as the natural outcome of regression—as are the forms of thought already referred to. . . .

'It comes about, therefore that we cannot understand the language of the schizophrenic patient without the aid of these principles, because the language of a lower level of psychologic development, or a lower order of abstraction, must remain unintelligible to those who think in the terms of higher levels. The whole problem of the understanding of the psychoses, from this point of view, might be well considered as the problem of the translation of the language of the psychoses.

. . . . . .

'Summary and Conclusions

'1. A complete understanding of the language of schizophrenia would imply an understanding of language in general of which schizophrenic language is only a part. This would further imply an understanding of thought in general of which language is largely an expression. Because of its extent this program is quite impossible, but certain principles need to be clearly in mind in order to avoid taking over, in any attempt to understand the language of schizophrenia, certain misconceptions in both of these territories which are still rife, not having been as yet fully replaced by the newer ways of thinking about the matters involved....

. . . . . .

‘2. There is one psychiatric assumption I have made and which is fundamental to my approach to the problem of the language of schizophrenia. It is that schizophrenia is a regression psychosis. This is of the greatest importance for, if it is true, we should expect to find in the thinking and in the language of schizophrenic patients characteristics of earlier stages of development, earlier genetic levels.

‘3. The development or evolution of thought and speech, the assumption of genetic levels, implies that there must be a *law in accordance with which this development proceeds.* This law is that thought and language in their development change from feeling, concreteness and perception in the direction of reasoning, differentiation and abstraction.

‘4. The law of schizophrenic thought and language must be the *reverse of the law for their development*, on the assumption that schizophrenia is a regression psychosis.

‘5. *This reversal of the law of development implies results that are very different from those implied in the old terms “disintegration” and “dementia.”*

‘6. This *reversal* can be briefly and simply indicated. The language of schizophrenia is of a lower order of abstraction than normal adult language.

. . . . . .

‘7. The thinking and the speech of schizophrenia while of a *lower order of abstraction* nevertheless make use of words which we are accustomed to use to express a higher order. This *discrepancy* is one reason why such language is so hard for us to understand. Another reason for our difficulty in understanding the schizophrenic patient is that while some of his symbols are of a lower order of abstraction by no means all of them are so that there is a *strange mixture* which further confuses our understanding. Still another difficulty is due to the magic of words.* We are still far from free of this influence and are therefore forced to think that when there is a word there must be a thing corresponding to it and also forced to think of the wording as necessarily meaning what it usually has meant in our experience.

‘8. *The reversal of the law of development* in schizophrenia also accounts, in part at least, for hallucinations which have long been regarded as signs of the schizophrenic splitting. Regression must lead ultimately to concrete, perceptional configurations and all that that implies.

. . . . . .

‘12. For the understanding of the language of schizophrenia, therefore, the whole dynamic situation needs to be comprehended. The main obstacle to this understanding has been, in the past, the magic of words.* . . .’

Identification, or the confusion of orders of abstractions, in. an *aristotelian* or *infantile* system, plays a much more pernicious role than the present official psychiatry recognizes. *Any* identification, at *any* level, or of *any* orders, represents a non-survival *s.r* which leads invariably to the reversal of the natural survival order, and becomes the foundation for *general* improper evaluation, and, therefore, *general* lack of adjustment, no matter whether the maladjustment is subtle as in daily life, or whether it is aggravated as in cases of schizophrenia. A *non-aristotelian system*, by a complete elimination of ‘identity’ and identification, supplies simple yet effective means for the elimination by preventive education of this general source of maladjustment. Book II is entirely devoted to this subject.

* [‘Magic of words’ represents only a minor yet very complex manifestation of *aristotelian s.r* of identification and, naturally, exhibits, also, the reversed natural order in evaluation.—A. K.]