

EXPERIMENT AND THEORY IN THE AROUSING OF THOUGHT

A. G. E. Blake - *Systematics*, Vol. 4 No. 3, December 1966

INTRODUCTION

This paper brings together an account of experimental work in the development of reasoning powers with a theoretical description of thinking derived from both abstract and psychological material. The general model of the mind which is adopted here is derived from the descriptions given in J. G. Bennett's *Dramatic Universe*, Vol. III. The "forms of thought" employed are derived from the discipline of Systematics.

My main concern has been to construct a description of thinking which is more realistic than those at hand. The most important parts of this description concern thought as an *operator* and thought as an *ordering activity*. In the course of the description, the term "mental image" may be found to be used inconsistently. However, attention to the context should render the meaning clear. The mental image is not an object to which we can ascribe a fixed role in our thinking.

SECTION I. AN EXPERIMENT IN THE DOMAIN OF CONCEPTUAL WORK

The following describes work done with a group of six students studying for a general B.Sc. degree at a Technical College.* Before the methods to be outlined below were employed, some eight sessions had been devoted to general discussions on "scientific method" and "scientific ideas". These had succeeded in establishing that there was no simple "method" in science and that there were problems always attendant on the "precise meaning" of a concept used in science. They had become aware that being able to provide the correct formulations did not necessitate any actual mental grasp of the operative concepts.

1 *Introduction to Mental Images*

Exercises were set on the visualization of concrete objects into the space of the room: the movement of a cube, changes in its colour; the entrance of a man into the room; a book, a page, a word, etc. Observations were discussed which enabled the director

* I am indebted to Mr. R. Kelly, Head of the Department of Liberal Studies at Kingston College of Technology for his co-operation in the project.

to assess the different mental types pictorial, verbal, abstract, etc.—of the students. The discussion also provided a ground for explanations concerning mental imagery on the following points:

- (a) The difference between this directed and difficult work of building up and maintaining a mental image, and day-dreaming.
- (b) How memory-elements are used to build up the pictures as ordinary thought uses previously acquired material and re-arranges it.
- (c) The effort of keeping together in one immediate presentation the detail of a concrete image is comparable to the effort of keeping the elements of a difficult mathematical problem together in one mental grasp.
- (d) How, in many professions, a capacity of great value is that which enables a complexity to be "seen" in one mental grasp.
- (e) That this "holding together in one image" is not only operative for pictorial representations, but for any kind of mental content.

In this way, the director of the group was able to introduce the guiding notion of mental pattern as that which is the "togetherness" of any mental content.*

On later occasions, quite different kinds of mental imagery were introduced in which actual pictorial content was deliberately excluded. These included attempts to mentally "see" mathematical elements such as fractions. Attempts to describe what was seen were important as a direct exercise in conceptual work.

2 Visualization Applied in a Domain of Scientific Concepts

The domain was that of quantum physics, especially with regard to the quantization of the transfer of energy in electron/radiation exchanges. Discussion on the nature of the quantum were confronted by efforts to visualize *concretely* the action involved. These visualized "fictions" enabled the group to see, by providing something with which to compare their ability to *talk* about the relevant concepts, that they had no clear grasp of the conceptual operators.[†] The following points can be made: —

- (a) The concepts taught in the ordinary description of quantum theory were in fact a set of verbal structures for which the mental models were very simple, but in aggregate, confused.
- (b) At the same time, it was possible to see that a deepening of mental grasp could be achieved.

* See Section II, 4.3.2.

† See Section II, 3.

(c) The effort to make concrete representation models, in the light of the verbal structures of a theory, creates a mental tension. It does not lead to naive realism. It affords exercise in conceptual interpretation and awakens the sense of the conceptual as contrasted with the perceptual or verbal.

(d) Use of a concrete image makes a challenge to the capacity to hold mental elements together. It also evokes the organizing intention* necessary to break free from fixed patterns. Thus, in trying to "picture" the electron, the director brought in elements of physical theory which could not be accommodated in terms of an image of a rigid and spatially well-defined structure. At the same time, he insisted that there could well be an "adequate" mental image.

(e) The crucial point that is being demonstrated is that conceptual operation is operation and that any image or pattern is a nexus of operation.

Further exercises were set in order to provide material with which the group could, by mental work^t, come to see how concrete images can be used for representation in conceptual depth. One of these was to visualize the sense of space extension that would result from the sensory organs being dispersed as in a gas, in contrast to their localization in a rigid body. This was used to illustrate different modes of conceiving spatial "separation" than that of naive Euclidean realism. By the use of such illustrative exercises, chosen by the director in the light of his grasp of the totality of the relevant conceptual structure of the domain of thought, the group were helped to see the usefulness of concrete images as instruments for grasping a conceptual *complexity*; and, further, that conceptual operators *do not work in isolation*.

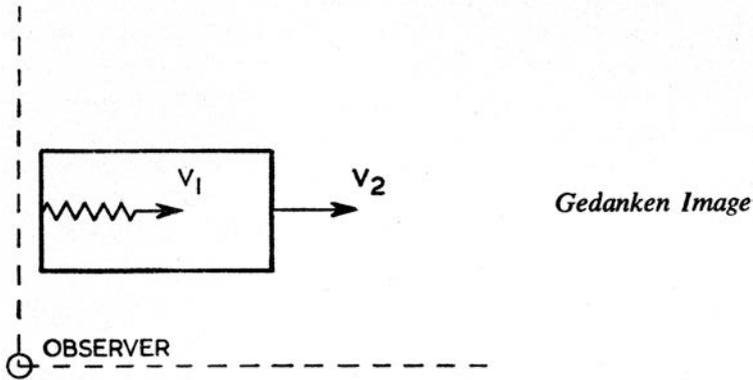
3 Application in Gedanken Experiment

The "gedanken" or "thought-experiment" chosen as an exercise was the enquiry made by Einstein into the velocity of light in a moving box. The group first pictured the phenomena in terms of the usual Galilean addition of velocities $W = V_1 + V_2$ and could see it in no other way. The director elucidated the basis of this belief—which is, in fact, not based on observation but conceptual conditioning. "Examples" were given (quite distinct from mental images proper) of the addition of velocities. The director referred to the gedanken image which was communally focussed by an

* See Section II, 6.1.

^t The term "mental work" is used here in a technical sense. See Section II, 4.3.4.

actual diagram on a blackboard and asked why the Galilean rule was "obvious" in terms of the image.



One member of the group suggested that the "space" "inside" the box and that "outside" it were different; "hence" the addition rule was obvious. This enabled the director to raise problems such as:

- (a) Is space existential in the sense of a quantifiable material: that is, the problematic of the ontological status of mensuration.
- (b) Distinction of "inner" and "outer" "space" would require a third proper "framework space" within which translations belonging to the two spaces could be given a common referent.
- (c) Distinction of inside and outside is in the first place a topological "property of space".
- (d) The linearity of the Galilean system requires, in fact, a certain homogeneity of spatial framework structure inside and outside the box. This homogeneity is destroyed in relativity theory by the "space-orthogonal" time-dimension which allows for "disjoint reference-frames".

These problems were raised by the director to help the group extend its conceptual grasp of the theme. Part of the complex to be grasped was the right seeing of *framework*: that is, not as an object, but as a *basis for abstraction*. Each of the problems presents a different aspect by calling up a different representation or image: the task is first to bring these into compresence and then to coalesce the situation as something intelligible.*

The theme was reflected back to general history with reference to the physical ether. A line of thought was opened up on whether the concept of "ether" could be dismissed purely as a mistaken

* The notion of intelligence as a coalescence of mental action is discussed in Section II, 6.

hypothesis, even granting absolute veracity to relativity theory. This line of thought emerged again in later work when the group had forgotten its first appearance.

So much was introduced explicitly or implicitly in this session that no one could expect the group to have retained much of it. Members of the group simply commented that they had been made to think in a different way about the subject. Some also reported that they felt stronger contact with the ideas of relativity. The last point is important as evidence of the effectiveness of this work with them, which is assessed in terms of the degree of mental order.

4 The Inception of Original Work through the use of Mental Images in Conceptual Operations

4.1 After this particular group of sessions, a new group began with a change of membership. In the course of these further sessions a working group crystallized out who were capable of following this line of work. The second series of sessions began again with discussions of scientific methodology. A side experiment was made in the *verbal realm of mentation** The director brought out many different views on the work of scientists and, as the session continued, helped the group to keep hold of the emerging complexity. Then one student was asked to put himself into a state of *believing that he really understood scientific method* and, from that, to describe it. It so happened that he responded very well— showing, incidentally, a good capacity for conceptual integration —and there actually emerged a useful and coherent picture of the complexity of scientific procedure. If this is done without there being any prior belief that the theme is understood—without starting from a viewpoint that is conditioned and tied to verbal forms—then the mental realm can operate to *produce order out of the complexity of data relevant to the theme*^t. The director guided the student in bringing into focus this view as expressing scientific method, not in terms of "theory", "experiment" and so on, but in terms of action. This was relevant to the guiding theme of the total experiment which aimed at conveying a sense of

* This is discussed in Section II, 4.2.2.

^t The conceptual operators are within the present moment that is extensionally defined by the content of the data at hand, but intensionally determined by the strength of will of the person in this region of mental existence. In ordinary verbal mentation, the conceptual operations help to govern the present moment of thought. The relationship between thought and time is crucial for understanding what is meant by "intentional thinking" in its pure sense, but goes outside the terms of reference of this paper. It is briefly discussed in Section II, 4.3.3 under the notion of the "duration of thoughts".

mental operations rather than of any particular set of actual "concepts". It also helped to establish the sense of all intellectual activity as a flux of operations—an important thing, since the common view is that it is a movement from one static "truth", to another. The experiment in verbal activity also demonstrated the "free" way in which description could be related to mental activity so that there is a dynamism of language and content by means of conceptual operation.* One important power to develop is the ability to respond verbally to "conceptual clues"—this opens the way to the direct linkage of description with grasp of structure that enables a person to think in terms of "categories" and "principles" and be free of spurious mental associations.

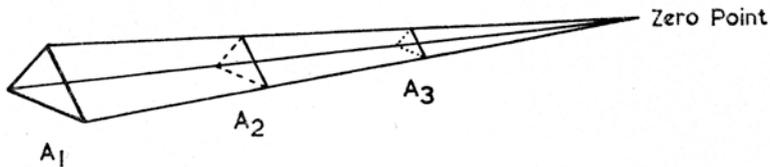
The next stage proper of the exploratory experiment began with the director suggesting a return to a conceptual problem raised in the previous group of sessions. At this time, the director had no mental picture about what could develop from it, and it was chosen simply from a sense of its potentiality to show up fundamental conceptual problems in physics. It was left to one of the group to express the problematic situation. It was one of the "applications of mental images" which was attempted before work on the Einsteinian *gedanken-experiment*—at that time, with little success. It consisted simply of contrasting the perceptual image of a solid body such as a blackboard with a concrete image of its molecular and atomic structure based on what the group knew of physical theory. The point being that the structures of the two representations are incompatible when referred to the "same entity". The issue was simplified by not bringing up the problem of the phenomenological description of the perceived object— which would lead directly into conceptual changes in the notion of "material body".

In this group of sessions, the problem took root and the group began to work on how to represent the two structures within one coherent conceptual complex. The work began with basic ideas and representations on the concept of atomism. Taking the Greek notion of division, the group were asked to picture indefinite division and report on the "result". Both views—the infinitesimal and the finite limit—emerged. These were used to show how the purely mathematical idea of a series and its limit, with its allowances of series which either exclude or includes the limit, arose from the same kind of mental operations. The possibilities were

* This is discussed in Section III, 4.

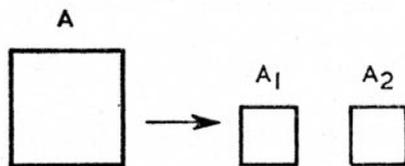
further explored to give four views:

- (a) The division has no end (this deliberately excluded knowledge of atomic structure).
- (b) It terminates in definite entities (this was adopted from the knowledge mentioned above).
- (c) In division, shape and other "material properties" lose their meaning.
- (d) One can visualize a continuous process of "taking the smaller and smaller", quite unlike division, which raises problems of dimensionability.



The discussion revolved around these views for two or three sessions, during which time, the group became familiar with poking at and describing these mental patterns and seeing their proximity to what are ordinarily called "opinions" or "beliefs": that is, what is considered to be "given as such", hence "obvious".*

4.2 The next phase of the work concentrated on seeing how "division into the small" and "addition of the small to give the large" were related. At this point, the director had led the group to adopt a minimal working language for referring to the conceptual pictures. Simple pictures of division were used with convenient labelling, thus:



* The method being described can hence be called a "training in phenomenological method". See Appendix 4.

The director also began periodically to prepare a written account of the discussion using a rough and changing symbolic language which was given to the group for private study. In doing this writing, the director was not making a report but conducting conceptual research himself; so that hardly explored problems were articulated and a structure given to what had emerged. The group did not accept it as a report, but used it as an extra source for their own work. Members of the group did not have the mental grasp of the director who was able to see a unifying pattern in the conceptual work that was done which they could not attain. The changes introduced into verbal activity were important in providing the basis for instruments of new conceptual operations. Conceptual operations cannot easily be sustained without verbal reference, but habitual verbal forms carry a conditioning of the mental life that must be avoided.

The intention was to find an effective representation of the complexity of material bodies—while retaining notions of an underlying atomic structure. Attention was drawn to the operational nature of the linkages between macroscopic and microscopic entities. Their co-existence must be analyzed to the point where one really grasps that this co-existence cannot be the same kind of thing as the compresence of two material bodies to each other. The transition from macro to micro-entities cannot be properly represented as a spatial translation. Therefore, the group adopted the general notion of "operation". Not only is there an analytic operation in the conceptual process of "moving" from macro to micro entity, but this has a relation to the operations which have to be done in practice (such as vapourizing solid iron in order to make a spectrograph).

In the first phase of the analysis, the group had to become aware that there were no *a priori* concepts of the structure of atoms-with-regard-to-macro-bodies. The "atoms" in any particular system are characterized by their place in the structure of the system. They cannot be treated as independently discovered entities. Whatever they are—in modern terms, whether units of crystalline structure, protein chains, molecules, atoms, photons, etc.—they exist in a substantial context and are only separable from the context by certain very special operations. These operations are both practical and conceptual. One attains to a connection with a micro-entity by complex experimental procedures. Conceptually, one grasps the structure of a micro-entity by a carefully constructed system of abstractions.

In order to take account of this non-spatial co-existence of

micro and macro-entities and how they are distinguished operationally, the group adopted a concept of a "two-phase universe". This was represented as a structure of two co-existent worlds, that of "atoms" and that of "objects". In addition, there were represented a complex of "constructional operations" and "operations for isolating smaller totalities", which were taken to be the operative connections between the two worlds.

In his account of this phase of the work, the director explained that it was based on clearly representing what is actually being thought, and recognizing the sources for the representations which arise. It is with regard to the last point especially that the careful use of a deliberately adopted language is important. The director also carefully had the group recall the original representation from which all the later complexity stemmed. Naturally, the group had not strongly grasped the full content of the conceptual fields they had entered. But they had acquired some ability in bearing with a greater conceptual complexity and recognizing the meaning of conceptual "transformations". This was later shown by ideas which they themselves later produced.

The notion of the "discontinuity" between the two phases was brought into focus. One of the important concepts to emerge here was that the structural unit differed from phase to phase—or, as the group began to say, from "world to world". This was supported by consideration of the physical properties of crystals considered in various sizes. The word "pattern" was introduced to refer to the holistic properties of each world. The word "action" was used to refer to transitions between worlds.

4.3 In the next phase, the divorce between the conceptual work of the director and that of the group widened, because the mental process naturally led forth into the setting up of theoretical frameworks which raised many problems of consistency and which branched in many directions. This, the group could only dimly see. The crucial factor, however, was that conceptual work was being to a certain degree *originated* by the group using the methodology in which they were guided by the director. It should also be pointed out that the director was using only the arguments raised by the work of the group.

A distinction was made between operations of "division"— which simply concern size—and operations of "decomposition"— which concern changes in the structure of entities involved. This distinction can be viewed as a simple discrimination between more or less abstract concepts. It can also be viewed as a representational distinction between considerations of spatial extent and

considerations of non-spatial structure. By using this simple distinction, it was possible to form the concept of a "molecule". A molecule was defined as the limit of division operation in the macro-world that is equivalent to a totality of the micro-world.

Further operations on this "molecule" would have to be those of decomposition. If the equivalence requirement is suspended, we then, have a "region of uncertainty" in which operations of both division and decomposition can take place. This is obviously what is needed in considering molecular chains—or even chemical combinations, for that matter.

Some further points emerged. Firstly, that the distinction between micro-entities—which is the basis of counting them—depends both on the macro-entity "within which" they subsist and on the operation whereby they are derived from that entity. Secondly, that the co-existence in the same place—to coin a neologism, the *homotopousia**—of the macro and micro-entities requires a different dimension to those of time and space. From this, came an indication that the "operations" we were dealing with could not be represented in space and time either. This notion carried forward to discussion on the significance of events.

We should point out the postulate of dimensions other than those of space and time is derived from a combination of two conceptual elements. The first is the recognition that *homotopousia* cannot be represented in terms of spatial configuration, proximities and separations; nor sequences, durations and so on. The second involves the relevancy that such spatio-temporal concepts are founded on a conceptual substratum of "things" and "motions of things"—in other words, the world of material bodies.

The director paid special attention to the problem of the right use of abstraction. There were three main kinds of elements:

- (a) Primitive representations: a *macro-entity* was considered as something given and conceptually neutral, and together with it, *extensionality*. Such elements were deliberately taken as known and invariable in conceptual operations.
- (b) Primitive postulates: such were *homotopousia* and *operation*. At the beginning these had minimal content.
- (c) Relevances: such elements as "similar to", "of a different kind to", "taken together with, means", had to be used.

With these three kinds of element, associative content was reduced to a minimum. The reduction of content made it possible to see more clearly the role of abstraction.

* From three Greek words *homo*, same; *topos*, place; *ousia*, subsistence.

(a) Use of primitive elements makes it more easy to grasp the role of an *impulse of relevance*. The combinations of concepts often used reflected an operative attribute of thought.

(b) The reduction of content enables there to be a *confrontation with complexity*. If the attention is attracted by habitual representations of hypothetical constructs—such as "fields", "waves", etc. —then it is not possible to see how these are originated and they become substitutes for mental action. Abstraction can be used to free the attention, so that the complexity of phenomena can be apprehended—and with this, the limitations of the power to represent such complexity. Such a confrontation is foreign to habitual thinking, but is the beginning of mental work.*

4.4 After the group had become immersed in this way of thinking, it became possible to attempt some new explorations. These concerned the problem of the "irreducible element" which remained after all possible modes of reduction. The problem concerned the "smallest possible" totality. Totality was defined thus:

- (a) There is a whole defined by characteristics of the whole.
- (b) There is an irreducible structure of the whole, without which it cannot be.

The first attempt at this gave a polar system:



In order for **○** to be what it is it must be part of the system \longleftrightarrow . It cannot exist as such in isolation.

The question was raised whether this was ultimate: what would be the characteristics of a system which was one-fold instead of two-fold! This was set as a pure conceptual exercise. The following results were obtained:

- (a) It could not be located. If it were located, then it would stand out against something, it would be separate from something. This would reintroduce polarity.
- (b) It could not be like an electric or magnetic field—for this defines gradients and polarities also.
- (c) Hence we have the notion of an *homogeneous field*—which is universal, is everywhere.
- (d) The transition barrier beyond it would be between what does not exist at all to bare existence.

This exercise was relevant to the earlier work done on the problem of space in relativistic physics.

*It should be added here, that it is only by such experiments that the real value of the work of certain philosophers can be grasped. There is a "science of philosophical disciplines" to be made clear that would be of inestimable value in efforts to go beyond the mechanisms of thinking induced by the usual processes of learning.

It was interesting to discover historical examples of scientists who had followed similar paths of conceptual work, such as Berzelius.*

The concept of polarity was referred to quantum physics, such as the ideas expressed by Bohm in his "Quantum Physics"!

4.5 In the final phase, the group themselves began to explicitly innovate. This was in the field of the concepts of space, time and pattern, to which they added a fourth, the concept of "event". The group considered the relation between macroscopic and microscopic processes, which involve quite different kinds of change. In doing this work, they became very free in their use of concepts—but not in a disordered fashion. Thus, in considering the case of a super-saturated solution, it was possible to regard the steady, super-saturated state as "non-temporal", *only becoming temporal at the moment of crystallization*. This case was also useful in bringing back into play the use of concrete visualization, since hypotheses were invited on the course of events at the moment of crystallization.

Of some interest is the fact that two members of the group, who had little regard for each other's intelligence, came independently to the same concept of the "event" as each other. This had been made possible by previously establishing common symbolic forms in which the concept could be located.

The arising of the notion of "event" is of some interest for our understanding of the nature of thinking. As we shall note in Section II, 4.3.2, it is not possible to represent actions per se in the mind. One has to find conceptual compensations for this deficiency. Nevertheless, all our empirical data for thinking derives from actions and it is on account of our habitual tendency to abstract static configurations that we find ourselves involved in endless conceptual contradictions. Attention to actions shows that what is missed in our ordinary mental grasp are *structures*. Actions cannot be represented in terms of linkages between static configurations. (Consider, for example, the contradictions which arose in the nineteenth century concerning the "propagation of light through ether".) Actions are properly understood in terms of structures which do not involve such abstractions as "atoms and motions", "particles and fields", etc To come to this, one needs to gain more freedom in front of habitual representations which are

* Sec Appendix 2.

1 Sec Appendix 3.

fixed in the patterns of one's thinking: their limitations can only be overcome by mental work. It was to this end that the experiment was conducted and it was encouraging to observe that the students were able to become free of the usual reifications which are dominant in the teaching of science, if not in science itself. Their independent discovery of the importance of the notion of "event" was, as near as could be hoped for, confirmation of the soundness of the methods and theory involved.

SECTION II. A THEORY OF THOUGHT

1 Thought as diverse

Thinking cannot be characterized as a single homogenous activity. It is connected with most regions of experience, including perception, not only with "ideas", "problem-solving" and "abstraction". This means that it is a complexity, including diverse elements, and cannot be reduced to a fixed mechanism. Thought raises, and attempts to answer, questions of meaning such as how we can know what is true. It also enters into the nature of human identity. There is probably a diversity of thinking between different people as there is a diversity within a person's thought.

2. Duals of Thought

As a duality, thought can be apprehended in three main ways:

2.1 The duality of the visible and the invisible. In perception, for example, there are "implicit structures of interpretation"—or "schemata"—which belong to thought but which are not experienced as such. On the other hand, intensive intellectual work is hard to account for without the acknowledgement of "trans-conscious operations" which cannot be seen as such, but which deeply influence the course and value of the work.

2.2 The duality of the voluntary and the involuntary. In thinking only a very restricted "part" of the process is voluntarily directed. To a large degree, thinking "goes on" and is involuntary, whether this is a matter of idle associations or of intellectual constructiveness. In all instances of thinking, the voluntary side is accompanied by an involuntary side.

2.3 The duality of the universal and the particular. Every idea or form of thought, though it may be applied to a restricted segment of experience, carries with it universal implications. These are the basis of analogical reasoning, but also of the "connectivity of thought"—that is, its appeal to a unity of structure in the complexity of experience.

3 Thought as an Operator

Thought is an operator. In this sense, it is something more than the changing content of the mind. It is not simply a passive awareness of something since there is always an intending or a looking-towards something which is not in the immediate presentation. Thus, in "planning the day ahead" there is a looking to the requirements of the coming day though all the data used for calculation lie at hand in the immediate present. Thinking without an impulse independent of the phenomenal is inconceivable. Thought as an operator is not an object for the awareness, nor can it be described in terms of "thinking-subject" and a "thought object". In relation to what is the untransformed content, what is "to be thought about"—whether this be a personal experience, a grasp of phenomena, a cluster of mental images, the description of something involving a problem, or whatever—thought "looks elsewhere" and one can be aware of this. But of the operator as a whole, one cannot be aware.

Something is done in thinking, but what enables this to be done is neither the phenomena nor the intent, but an independent impulse concerned with *relevancy**. What makes things relevant to one another can be a mechanical pattern of associations in the brain. It can also be an intuitive grasp of the structure of the world of human experience. The impulse of relevance by itself can do nothing, for only in conjunction with the phenomenal and the intent can there be an act of meaning. Relevancy is implicit in the conviction of necessity in a logical argument. We can say that in the thought-operator there is a will-dynamism in which the affirmation of intent is reconciled with the receptivity of phenomena.

Relevance is a factor that has no content of its own and neither is it an intent. It is neutral with regard to knowledge and desires. Therefore, a person thinking is *not aware* of relevancy as such—it can only be *understood*.

If one examines a logical argument one may feel a dissatisfaction with its adequacy. This is due to an operator which

* The notion of relevancy here introduced has much in common with that of reason as ratio as discussed by the Scholastics. And as Simone Weil has insisted, for Plato the contemplation of ratios as they arise in geometrical structures was the primary intellectual discipline. In her brilliant essay on "The Pythagorean Doctrine" (*Intimations of Christianity*) she relates the notion of geometrical equality (equality of certain ratios) to the problematic of the will in thought.

involves relevancy as the initiating factor. From this sense, there can come the intent of something more fundamental to be brought out, which assumes the role of an impulse of affirmation. The means by which the critique arises and which then enables thought to "go forward"—that is, to operate—is the will to connect and disconnect and balance indefinite multiplicity with bare unity.

For the affirming impulse, we have chosen the descriptive title abstractive intent. By "abstraction" it is not intended to convey the sense simply of "taking out" elements from a content: abstraction is a creative act since the elements belonging to it do not exist as such in the given content. The abstractive intent is authoritative in character and that is why one tends to speak of thought as "inherently free". In every thought operation there is a decision which is the engagement of the intent and relevancy together. Usually, however, thought is so conditioned that the abstractive element cannot rise out of the habitual intentions— which means that it is not possible to think in a different way.

With regard to awareness, the phenomenal, extensional and changing is object-like, but the abstract intent is revealed in the awareness itself. In thought-operation, one knows the phenomena and is conscious of the intent. There are many possibilities here depending on the type of knowledge and level of consciousness. These belong, however, to the description of the different realms of mentation or thought-activity.* One is not aware of relevancy as knowledge or consciousness. This is because, of the three impulses, it is most closely linked to the will. Again, there are many possibilities since the will to connect and disconnect—as we have described relevancy—can be quite mechanical as in the use of words, or it can be creative as in making experience intelligible in a quite new way that will carry conviction to others—and there are many other possible modes.

Without the phenomenal and the intent, relevancy carries no meaning. Meaning arises only with the operator as a whole and is a co-working of the three independent impulses. The degree of harmony in this co-working that is attained is a measure of the understanding. Understanding applies to all kinds of knowledge and all levels of consciousness. Much confusion in philosophy has

*The word "mentation" is used here in its precise sense as "mental action". With the onset of physiological explanations of thinking in the second half of the nineteenth century, it was used more in the sense of cerebration. Our use of the term is intended to convey the sense of the whole gamut of thinking activity, including purposefulness and awareness.

resulted from the failure to take into account that the operator of thought is the coalescence of three independent elements and cannot be described in terms of what one is aware alone. Further, the will-character of thought-operators has been neglected, whereas the fundamental property of the will is the capacity to form, and enter into, relations. The point here is that a coalescence of elements is substantially different from their compresence: it has an order and a structure in which the mutual relevance of the elements modifies their separate character. This is why there can be different kinds of operator, in this case, the different modes of thought.

The will-character of the phenomenal requires explanation. It is most clearly apparent in mental work when the images in the mind set up a resistance to the affirming intent. The sense of being unable to put the situation together is primarily a sense of the conservative character of the phenomena "in the mind". Without this, one would not be able to reach the point at which something "does not make sense". The "resistance" of the phenomenal is part of the conditions necessary to the operator. Thought depends on the arising of a confrontation with something which is unintelligible. Here, we can add that the abstractive intent seeks to make phenomena conform to "its own image".

With the third impulse, we are most severely taxed by the limitations of our Indo-European languages. Their main defect for our purpose is the subject-predicate logic inherent in the form of verbs. An impulse is not an operator in itself and operators are logically prior to operations. Therefore with verbs we are two stages removed from what we want to pin down. The form of agent and manifested action is also misleading since in an impulse there is no such separation.

The sentence "I think" has no meaning unless it is placed in a context of relevance and the content is specified. It can best be looked upon as a *class-concept for the totality of acts of thought*. It is very far therefore from being a statement of fact.

4 Mentation or the Activity of Thought

By "mentation" is meant the whole activity of thinking and this includes both "subliminal cerebration" and "supra-conscious insight" as well as the thinking of which one can be aware. This means that mentation involves more than one level of experience. Our description of mentation will be divided into two parts. The first deals with the notion of *three realms of thinking* to be

associated, but not identified, with different levels. The second deals with the structure of mentation as an *ordering activity*.

4.1 Three Realms of Mentation

The first of these realms is that of operations of thought of which we are not directly aware. The second with those operations which necessarily involve out attention. The third with those which are beyond the scope of our mental grasp.

4.1.1 Verbal

This includes "forms of perception" as well of "description". These forms, and their associations, constitute the habitual modes of thinking which we take for granted. There is a degenerate triad (that is, where the three terms are not properly independent of each other) of perception, language and association.* Verbal forms condition how one thinks and even how one observes phenomena and interprets external situations in general. Excluding language, this realm of thinking is dominated by the accidental association of strong impressions. The realm as a whole is to be characterized by a lack of separation between the person and the operations of his thought. It follows that "verbal thinking" is never objectified save in the forms of language used in general and that it corresponds to "opinion". Nevertheless, it is the basic field of action in which the workings of intentional and supra-intentional thinking is manifested. Without the forms of mathematics, for example, we would not be able to think about certain features of our experience at all.

4.1.2 Mental

This includes all that one can call "mental images" and the element of direction and judgement which leads to the notion "I think". It is in this realm that one can talk of "ideas"—which are the means of making experience intelligible to oneself. One of the most important characteristics is the degree of freedom which allows a question to be formed in the mind: this is the positing of an intelligibility which is not in the "present mental state". Mental activity both discovers and makes its own "objects". It has a general principle of reason and a particular one in the judgment of the person. It can to some degree take account of what is not part of its present mental content: there are always "transcendental" considerations—such as levels of abstraction, the unity behind appearances, the best solution to a problem, etc.—though

* Cf. C. E. Osgood, *Method and Theory in Experimental Psychology*, pp. 643-5. He gives a report on the verbal basis of associations between different modes of perception, especially visual and auditory.

these are not homogenous. The limit of the mental realm is in the person's capacity to grasp the action of his own thinking.*

4.1.3 Intellectual

The term is chosen to indicate that this realm has no "mental" content and does not provide a "personal experience". It is beyond the sphere of the attention since it is not subject to the directives which operate in a person actively thinking. It is characterized by a direct access to the structure of the world, including our experience. Therefore, it is that which enables a person to understand what he is doing in thinking and also that which is the source of creative steps. Since it cannot be characterized in terms of mental images and judgments it is not "thinking" as one experiences it. It is described as a direct grasp of structure, because structure is both universal and particular, abstract and concrete. If, in the mental realm, the agent of thinking, the operations of thought and the subject of consideration are distinct—in the intellectual, all can be expressed in terms of operations. In its lowest manifestation, the intellectual is called "intuition". It is also the transcendental element of reason and the power behind creative synthesis.

4.2 Mentation as Ordering Activity

The description of thought as an operator suggests that thought has a "will of its own". This is consistent with psychological findings which seem to indicate that there is no stable invariant agent in the totality of the average person, that is, no single will, but a multitude, which are grouped according to the various regions of experience, of which thinking is one. However, to speak of different "regions of experience" is to indicate something further. The operator has no localization and no ascribable duration; these are involved when there is an ordering activity. We can view the activity of thinking as an operational equilibrium of order. It cannot be detached from the empirical flux which enters thinking as what we might call the "forms of appearances" and which establishes the surface of mentation. On the one hand mentation tries to make sense of the forms of appearances by making connections between them. On the other hand, mentation concerns

* We have referred to "person" here as that which plays the role of direction in mentation. We do not wish to conjure up any spurious associations of person-hood, since direction is a source of activity, an Aristotelian "cause"—and this is not a being. Thus the use of the word "person" is a provisional one which will be superseded in the next section to follow.

itself with seeing appearances in different forms. The first is the experimental side of mentation and the second the rational

In some mental operation the "forms of appearances" become mental patterns, to a greater or lesser degree distinguished from actual appearances by their lack of empirical detail and their generality. These patterns connect and disconnect with each other in the course of experimentation. These govern the way in which one is "thinking about something". Thus, in reading some passage, there is an interplay of mental patterns arising in response to the words, which establishes a "working hypothesis of meaning". The characteristic of effective experimentation is adequacy.

There are dangers of fixation in this. Once a certain degree of adequacy has been attained, there is a temptation to repeat modes of connection without making adjustments for new problems. Then experimentation becomes akin to the repetition of routine standardized "experiments" which schoolboys have to do.

The two defects open to experimentation are stagnation and confusion. Thus we speak of the "conditioned mind" and the "confused mind" as cases where ordering activity is weak or non-existent.

In mentation, one sometimes sees that earlier mentation has been conditioned and that there must be other ways of looking at the problem. Or one may recognize that mentation is capable of generating its own kind of order which then becomes an element within the flux of thinking. It is this that seeks to originate a new form of seeing appearances. The rational element has to find an application. The rational element is the origination of order in mentation independent of the empirical flux; it is not a conviction about the forms of appearances, but about the way in which thought should work. It has the role of directing mental work since it is a generative principle of order and not an operative one. In the absence of mental work, the generative principle is collapsed into the operative, which means that there can be no originality. To be able to "think for oneself" means to be able to bring order into the content of the mind from within.

The rational and experimental interplay constitutes the "horizon of mentation"; it is the mental field which determines the level of attention.

Attention is a property of the will—not as an operator but as a principle of ordering. We must take account of the widely recognized character of will influences that they arise prior to their manifestations in awareness. What we call "understanding" shows itself in the ability to bring order into the mind. This requires a

combination of will and consciousness, for (he will has to be effective and this involves clarity of perception. The direction of mentation is not wholly understanding, which implies both that there are ineffectual operations and also that there is some disengagement of volition from the mental field altogether.

This suggests that the ordering activity of mentation must also involve an element which is able to "know" what is effectual and constructive even though this not in the understanding. It constitutes a source of reference for the will and can be called ordination. In traditional metaphysics, this element was referred to as the Intellect and it was understood that it was transcendental to ordinary awareness and, in terms of ordering, prior to volition. If we say that the mental field is a domain of rational teleology then we can say that there is an ordination which transcends the limits of attention.

A source transcendental to the level of attention is required if we are to explain how it is that there are "spontaneous" changes in the mental field whose origin is quite invisible and which show evidence of an ordering influence beyond the capacity of the understanding.

It is unfortunate that philosophy has always tended to equate this transcendental element with abstraction. Certainly, we cannot attribute to it the highly differentiated content of the mental field; but if this is excluded, we are not left with bare abstractions, but with a *structure of operations* unattached to place or time. The notion of the a priori is unfortunate in combining the notion of the rational and the ordinal; the word is even more badly used when the a priori is objectified as something to be known. In our scheme, the a priori is an appropriate characteristic of the ordinal, as the *a posteriori* if of the empirical. Then the understanding is their "common field" which is naturally divided into the rational and the experimental.* The a priori is not then, something to be *found*, but something to gain *operative contact* with.

4.2.1 We will set out the scheme of mentation as we have derived it:

1. Mentation is an *ordering activity*.
2. The *horizon of mentation* is the limit of the mental field.
 - 2.1. It corresponds to a certain *level of attention*.
 - 2.2. As a being-structure, it constitutes the *mental image*.
 - 2.3. It is the operational domain of the *understanding*.
3. Mentation is grounded on an *empirical flux*.

* Or "theory and practice" as the Sufis say.

3.1. This is the basis of the *spatio-temporal differentiations* apparent in thinking.

3.2. As the "forms of appearances" it is the raw material of thought, the *a posteriori*,

4. The horizon of mentation is illuminated by an *ordinal* source.

4.1. This is the *intellectual intuition* which is not limited to and by the level of attention.

4.2. It is the a priori element which can *inform* the mental field.

5. The mental field is constituted out of a *patterning of content* and a *forming of attention*.

6. There is an *experimental* element which makes connections between patterns.

6.1. It involves *linkages* between mental patterns and aggregations of empirical forms.

6.2. It is *limited* in the degree of complexity that can be held together in one representation.

6.3. Its character is *observational*.

7. There is a *rational* element which introduces a direction to mentation.

7.1. It permits acts of mental *freedom*.

7.2. It has the role of positing forms of the rational. This positing arises within the activity itself. It is an *attitude* and gives rise to certain forms of *attention*.

7.3. Its character is *hypothetical*.

4.2.2 It is difficult to describe mentation in terms of these four elements—empirical, experimental, rational and ordinal—without representing them as being-structures in their own right. Nevertheless, we cannot say what they are, but only how they come into operation in the ordering activity. It is not necessary to suppose that the four elements belong to four definite levels of being. The being-level of the totality is best described phenomenologically in terms of the level of attention obtaining in the mental field, the mental field is the region of mental work. If one is capable of saying "I am thinking", then in some degree, there is an ordering of the present moment of thought; consequently, the roles of the four sources of order must be filled in some way. This can be parodied by the following illustration: a reluctant schoolboy is ordered to do a problem (rational); he looks round at his neighbours' work (empirical) and copies from

one he suspects to be reliable (experimental); to make sure, he looks at the answer in the teacher's book (ordinal) while he is out of the room.

This does not exclude the possibility of there being an ideal mode of this tetrad corresponding to the construction of man.

Such a view has been entertained with the discrimination of three realms of thinking verbal, mental and intellectual -and experimented with in the concluding account of mentation in terms of the mental image. A more detailed analysis of the character of the four sources of mentation can be made by the framework of the four determining conditions of space, time, eternity and hyperaxis. This now follows.

4.3 A description of the Four Sources in terms of Linkages between the Four Determining Conditions of Space, Time, Eternity and Hyperaxis.

The postulate is that there is a universal order which subsumes under it two kinds of determination, transitive and intransitive. These in their turn subsume two kinds of condition, separative and connective, to give four in all.*

	<i>transitive</i>	<i>intransitive</i>
<i>connective</i>	eternity	hyperaxis
<i>separative</i>	space	time

These four determining conditions do not constitute a description of ordering activity because there has been no discrimination of higher and lower order. This is introduced by taking the conditions in pairs and considering these pairs relative to each other. The pair eternity-hyperaxis describes, relative to the pair space-time, a higher degree of freedom. By introducing a relativity of freedom we are concerned with *being*. The pairs eternity-space and hyperaxis-time then represent the span of possible operations. Each of the four pairs constitutes a source of change when they are considered as substantially linked. In physics, the linkage of eternity and space manifests as the force-field, i.e. the source of accelerations; the linkage of hyperaxis and time manifests as the quantization of action, i.e. the source of spin. Thus we may use these four pairs of the determining conditions to define in abstract terms the character of each of the four sources of the tetrad.

* The broad definition of the conditions runs as follows: "Space: Rules setting behaviour against the background of existence; that is, the outer relationships of wholes. Time: Rules setting existence against the background of behaviour; that is, the inner aspect of function. Eternity: Rules having reference to existence and particularly to different levels of existence that we find in our experience. Hence these are largely concerned with consciousness. Hyperaxis: Rules from which both behaviour and existence can be abstracted—that is, those that determine the manifestations of will possible in a given situation". (J. G. Bennett, *Dramatic Universe*. Vol. I, p. 152.)

- (1) Space-time: the Empirical Source.
- (2) Eternity-space: The Experimental Source,
- (3) Hyparxis-time: the Rational Source.
- (4) Eternity-hyparxis: the Ordinal Source.

We shall relate these four linked pairs of determining-conditions to the ordering activity of mentation.

4.3.1 Space-time: The Empirical Source of Mentation.

The most immediate characteristic of space-time is motion. Most of our basic notions of the world are developed out of the accommodation of our own bodily motions to impressions of the world around us. The forms of appearances are conditioned by our knowledge of the motions of material bodies. From these we derive the sense of the mutual exclusion of things, succession and extension. The main "form of appearances" is that of the solid material body or *thing*—that is why we tend to put space as the dominating condition.* Even though disciplined attention to our actual perceptions can reveal impositions on the phenomena by extraneous concepts—particularly those induced by words in the course of our conditioning into certain forms of communication with others—there remains an irreducible ground to our mentation which provides the raw forms for thinking and to which all concepts and images have in some way to be "compared". This ground is the world of space-time which is given and without which mentation would be totally different from what it is for us. In this respect, we can remark that the construction of our own bodies and our existence on a solid, the earth, amongst other quasi-rigid bodies is a prime condition for our thought. Beings with bodies of gas existing in a state of absorption in a liquid would think on quite a different foundation. As we are grounded on material objects, such beings would be grounded on vortices. It should be added that awareness can never "reach down" to this ground, because in doing so, it would lose itself. The empirical source is the prime conditioning of our thought, of which we can never be conscious, but yet can understand. That is why the rational element can grasp the nature of this source, but not the experimental, which must "take it for granted".

4.3.2 Eternity-Space: The Experimental Source of Mentation

Eternity is characterized in terms of potentiality, pattern and the conservation of entropy. It is always richer than what is actualized: thus it represents the awareness behind the sensations

* Kant put space and time as the outer and inner forms of "intuition". His "intuition" corresponds very well to our "empirical source of mentation".

in perception. As pattern, it is capable of engaging the attention which has no way of access to the purely spatio-temporal linkages. The conservative properties manifest in the coherence of spatial configurations within the mental held. The rôle of space in mental imagery should not be neglected. It is by spatial modes of representation that we mentally picture a set of concepts, a group of objects, or the pattern of an event. That is why it is almost impossible to visualize an "instant of change" since time is not an inherent factor in the experimental source. Roughly speaking, we can say that the experimental source of mentation is characterized as a *configuring of content according to a pattern*. The patterning may be viewed both as "internal" and so "in the mind" and imposed on its content; and also as "arising from" the content to reveal itself in the awareness. Both are in some way true, but neglect the hyparchic influence which comes from the rational source. However, in this source considered independently, the two views have to be accepted as valid; in experimental terms, they have no reconciliation. The first view describes the configuring as an *organization of content by the awareness*. The second describes the acausal or synchronous* patterns which *emerge from groupings of content in the awareness*. Again, both perspectives can be verified by attention to one's own experience. In the first we have the conceptual set of the mind and in the second the permissive attention of the mind.

The conjunction of eternity and space in general gives rise to "force-fields" involving gradients of potential energy. These properties are observable in complex visualizations when one experiences the *conservative forces* at work in mental representation. Thus, one can flip between two conceptual perspectives but not have both. Nevertheless the two are mutually necessary and therefore organized. The organization, since it involves restraints, sets up conditions for experimentation, in the sense of seeking out connections *within limits*.

4.3.3 *Hyparxis-time: The Rational Source of Mentation*

The basic character of hyparxis is *recurrence*. In combining it with time, we have suggested the notion that here is an element concerned with *asserting the uniqueness of a duration*—but which nevertheless can never completely overcome its involvement in indifferent successions of time. The concept of the uniqueness of a duration requires some explanation. The experimental source

* A term first used by C. G. Jung to describe patterns of events having an acausal significance. The theory of synchronous laws has been developed by J. G. Bennett in *The Dramatic Universe*, Vol. II, Chapter 26.

has in itself no duration. This is not to suppose that there is no succession set against the forces of conservation—the instability of mental patterns is an obvious phenomenon—but that duration is not the concern of the experimental factor. To speak metaphorically, there is a "dreaming present state" in the linkage of eternity and space. That is why one cannot associate direction with this source. The direction of mentation is intimately bound up with the establishment of a duration which is both now and more than now (a phenomenological characterization of the unique duration). The linkage of hyparxis and time issues as a cycle and here we can draw attention to the significance of the duration of thoughts.* We can be bent on the pursuit of a single theme for a limited time only. There follows instants of distraction, association, dreaming, which give way to the "same pursuit again". Here we find both a cyclicity of mentation and the phenomena of recurrence—the same again. The "mental pursuit" offers up an image of what is meant by "direction" in mentation. It is the hyparchic condition that enables this to be originated internally—that is, not as a response to external influences, but as a free act of will. It is also this condition which enables a confrontation to be made with the empirical source—to which the experimental can only respond.

4.3.4 Eternity-hyparxis: The Ordinal Source of Mentation

Removal of the conditions of space and time characterizes a linkage free of the limitations of succession and separation. The intention which we associated with the rational source has no application here for it can only arise in a world of actualization—that is, in the context of temporality. Kant recognized that beyond the reach of purposes, in the sphere of the spirit or *Geist*, there is a transcendental *irrational source* which reason must pre-suppose in its efforts to understand Nature

The form of the linkage suggests a priori certain conclusions. The hyparchic condition is the way in which eternal structures can be projected into time. We can suppose, therefore, that the ordinal source has the capacity to influence the goals of the rational source. It is indeed the case that the major creative steps in science have involved the setting of quite new and unsuspected objectives for enquiry. There is also the sense in a work of enquiry of being informed concerning the direction to take. It is a characteristic of the rational that it hovers between confidence in its own ability to direct mentation and uncertainty concerning why any particular

* Cf. P. D. Ouspensky, *The Fourth Way*, pp. 234 and 345. 226

direction should be taken. This uncertainty is grasped by the understanding as a certain arbitrariness in the impulses of the will, which can only be overcome by a "higher wisdom".

The condition of eternity has the property of immediate communication between different levels. The "patterning of patterns" manifests as a spontaneous image in the awareness which shows something new. There is an "attunement" attainable whereby once the ordinary course of mentation has been stilled, the inner communication between the ordinal and experimental can establish a new configuration of content. The "stilling of the mind" is achieved by fatigue or by a careful balance of the attention. It is also dependent on the development of a particular organization or "sensitivity" which is the instrument of attunement. If this is developed, or even momentarily operative, there can be a "vertical linkage", with the experimental as intermediary, between the empirical and the ordinal. Then, response to the empirical source can take the form of "revelation" and we have the situation of the chance association which explodes into a deep insight.

These descriptions concern the interplay between the ordinal and the experimental and rational sources. From them, we can return to a consideration of the ordinal linkage itself. It will be useful to posit three domains relevant to mentation. The first is the domain of *motions*. The second is that of *communications* and third that of *creations*. These correspond to the three levels of the tetrad, where the axis experimental-rational is considered to belong to the intermediate level. To use a concrete image: in sexual intercourse there is a level of bodily activity, a level of experiencing and a level of creative activity; on the level of experiencing, the man and woman hope for a communication that can only be real if there is a contact with the creative element.

Mentation cannot lift itself up by its own operations. If there is to be a transformation of thinking then help is needed from a source free of the disturbing influences of space and time. This is the realm of creations, that is, of operations which are uncommitted to any particular place or time. The linkage of the condition of pattern with that of recurrence establishes what, in the context of mentation, we can call *principles*—that is, unique forms of the understanding. These transcend the dichotomy of one and many which cannot be escaped in the mental horizon of the rational and the experimental. But they are not mere eternal verities,

because they are operative *through hyparxis* and *only in the linkage of the two conditions do they have content*.

One point should be made clear in these descriptions of the four sources according to the determining conditions: we should not regard the separate elements each as a form of thinking in its own right. Mentation involves the confluence of the four elements in a structure it is not their aggregation. In the last section of the paper we shall briefly utilize an exercise which demands the visualization of four objects which have four conceptual linkages between them. The difficulty of success in this venture is an effective demonstration of our inability to conceive the tetrad in a direct form. That is why connecting arguments have to be introduced to supplement our mental inadequacy. We have used the four determining conditions not only out of a priori considerations, but to help our mental grasp of the systemic structure involved. There is no subsistence without the total manifold of the four conditions. However, since these are conditions of limitation, the relative independence of the four pairs we have described introduces a structure of freedom in which the notion of ordering activity can find a meaning. Mentation is the operational matrix out of which a unique entity of thought can be born. It is also that in which we have to work in order to maintain a mental life.

5 *The Idea in Thought*

Ordinarily, "thoughts" lack stability. In mental work there are not only fluctuations of mental content beyond control; but removal of the ground of thinking, its verbal or perceptual support, internal or external, tends to destroy the coherence of the activity. "Thoughts" have a limited "intrinsic coherence". If there is a strong connection of the mental and the intellectual, then a strong "idea" can be formed. A thought with some degree of intrinsic coherence has an "inner structure" ranging from verbal to intellectual meaning. Such a thought is not an "object of thought". It is a means of "interpretation", an act, as well as a fusion of diverse mental content. There is a dimension of con-cretion which has to do with the intrinsic strength of thinking. This is the "mental grasp" concentrated in an "idea".

6 *The Form of Thought Events*

The description of thought-events in terms of a triad can be

projected into the nine like dimensions alone* There are the following considerations.

6.1 *Organizing Intention—Eternity—Affirmation*

Eternity is characterized by the co-existence of multiple states of the same entity and gives rise to force-fields and potential gradients when projected into space-extended situations. The compresence of multiple states is the condition for different levels of abstraction and the means for establishing an entelechy^t of thought.

6.2 *Disorganizing Flux—Time—Receptivity*

Time is characterized by the disturbance of established forms and the influx of disorder. In thought this is reflected as the instability of any mental configuration "left to itself". Concentration on the eternity aspect alone loses the person in a pure "mental state" without content. The conjunction of intention and flux is the necessary condition for active thinking.

6.3 *Emergent Cyclicity—Hyparxis—Reconciliation*

Hyparxis as the form of action reconciles eternity and time by the property of recurrence. Between the unchanging state and the changing content, there is a cycle of operation which has to do with what is made intelligible. The recurrence of ways of relating intention and flux constitutes the development of concepts. Intelligibility is a recurrent property of experience which in the domain of thinking operates as ideation.

The three space-like dimensions concern the extensional properties of the thought content:

6.4 *Perspective—Accelerational—Affirming*

There is a "mental field" which configures the content into aspects. These aspects reflect fluctuations of interest: only part of the content is of immediate interest.

6.5 *Association—Translational—Denying*

The conservative properties which govern the continuous pathways of associations.

* These considerations of dimensions are based on the six-fold categorization of framework as developed by J. G. Bennett in *The Dramatic Universe*. There are taken to be three time-like or inner conditions and three space-like or outer conditions. Framework is viewed as the totality of rules which determine possibilities of existence.

^t An Aristotelian term reintroduced by Driesch and Lloyd Morgan in the sense of the formative power of the organism.

6.6 *Image—Rotational—Reconciling*

Association and perspective are stabilized by the rotational properties of the representational image: something which can be "turned around in the mind".

These six conditions enable a full account of mental action to be made in phenomenological terms. Of great importance for the study of mental images is the category of "rotational space". There are gradations of visualization exercises which draw attention to rotational properties (such as mentally tying a knot). Further, this scheme enables one to "locate" mental images in the concrete context of associations, interest and so on. In this paper, the use of mental images is considered to begin with the exercise of voluntary attention to mental content and has a limit as the vehicle of a clear act of intention.

The experimental work was very much concerned with the connection between the verbal and the mental realms, and between the mental and the intellectual realms, as they show themselves in the working of mental imagery. The direct connection between the verbal and the intellectual realms is, however, of primary significance: this posits the existence of an intellection that is prior to ideation. In this connection, thought does not require mental imagery and the mental realm has the role of holding to a clear intentionality without content (an excellent example is creative work in pure mathematics). However, an account of the total structure of intelligence is beyond the scope of this paper. In this theory of thinking, intelligence is considered as the coalescence of all forms of mental action. It is therefore a substantial condition of the person; indeed, one can go so far as to identify the person with his intelligence. This avoids the confusion of setting the person apart from the actions of "his" mind. Each thought-event is a microcosm of the person or an atom of intelligence. It is probable that the structure of coalescence differs in its detail from person to person. This hypothesis will be investigated in a later paper.

SECTION III. THE CONTENT OF MENTAL IMAGES

1 *The Subliminal Image*

Language, among its other uses in human life, provides the most commonly available vehicle of abstractive intent. The use of words involves a semantic dimension which is both extensional and intensional: there is both a reference to "things" and to "qualities of things". This would suggest that the realm of verbal thinking

involves some kind of "implicit idea*" about the nature of things, for the phenomena available in the awareness lack the form and the simplicity which is the concern of abstraction. However, to speak here of "ideas" is misleading. The situation can be more truly described in terms of a mediation between phenomena and the abstractions of language by means of habitual associative patterns. Such patterns are acquired by imitation and consolidated by repetition.

In the case of mechanical thought operators, there is no reflection or mental work. When students study a scientific topic, the main requirement that they have to meet is to be able to connect terms of specialized vocabulary with a very limited set of idealized situations. The regulative patterns are built up by absorption of examples of how to proceed; at no time is there any mental work to see why one should proceed in this manner. Instances of variant motion are immediately translated into Newtonian terminology, but why this should be done is left unquestioned. The operator as a whole is conceptual; but there can be no work with concepts until there has been an "objecti-fication" of the mechanical concept.

Thinking by repetition does not mean that there is nothing present of the mental realm, but that there is no operative contact with it. Nevertheless, in place of this contact, there is an imagery in correspondence to the verbal concept. This is how the mental realm "compensates" for its own disengagement. The imagery is not only representational, but embodies an attitude of mind. Thus one can say that students believe in such things as "forces" and "fields" as if they were physical entities. The mechanical operators in the verbal realm do not themselves reify the technical terms being used. Reification is due to a kind of hypnotism that reduces mentation to an ineffectual imagining. Belief in theoretical entities is usually accompanied by an inability to actually think about them—it is not known how to do this.

Observation shows that the representational images are not clear objects of the awareness—indeed, they may not be noticed at all. There has to be a certain focussing of attention before they can be grasped and examined as a way of representing phenomena.

The crucial transition to mental activation is made with the recognition that there are alternative procedures in making a thought operation: this opens the field of the experimental and rational interplay. Work which leads to and involves the use of a "best" method—of solving a problem, say—must involve some

capacity to experiment with alternative methods and also the power to grasp the rational form of what is thought about.

Interpretation involves a commitment to the inherent intelligibility of things that can be revealed by abstraction and sustained attention. The use of models is constituted out of an experimental flux which involves the view that things only make sense *if something is done to them*. For most students, the interplay between rational interpretation and experimentation with conceptual models is something extra-curricular.

2. Order and Mental Images

The "mental image" is constituted out of the whole field of interplay of the rational and experimental sources. From the ordinal and empirical factors comes the determination of its degree of order. It is not an entity, but a way of thinking that involves both discovery and invention. Habitually, we treat the mental image as an object and identify it with the concrete images in the mind which are akin to perceptions. This completely fails to explain how mental images can be used to make perceptions intelligible.

It is now generally acknowledged that perception must involve some synchronous linkage between different levels of organization: there is no evidence of a process which leads from sensory impulses to an awareness of objects. This suggests that in operations of thought there is some interplay between different levels of organization and different modes of linkage. In a mental operation there is a patterning of the content of awareness and a form of the attention that cannot be treated as equivalent to a known object and the state of the knower. The form and pattern constitute the mental image: this is the being-aspect of a mental operation. The effectiveness of the operation is shown in the unity of the image, which is not a pre-existing state, but something to be won by mental work. Out of the conflux of different factors in the mind, order emerges through the activity of making sense of things.

The empirical flux is *transformed* into the image which has an experimental function and is endowed with a form of attention or a mode of interpretation in terms of principles: there is an interplay of *translation* between the image as content of the mind and image as form of thinking. The ordinal source which is characterized by an intellectual grasp of structures, enters the mind to find *expression* in the mental image *as it is being developed towards unity*. It would be a mistake to assume that there can be a fixed mental pattern in this activity—there is, rather, a *living order* in the mind.

3 Rational Experimentation in the Verbal Realm

The rational is all that comes from (the independence of the mind from its content; that is, it concerns the basic ways in which one is able to think about experience. If we take the empirical flux as verbal, then there is a descriptive operation in which things are made intelligible by the way in which they are described. Such description is not only a portrayal of the exchanges between features of various models (experimental) but also a discipline of the attention which is the basis of the rational element as a source of ordering. It is difficult to convey the sense of the field of action in which one is "simultaneously" engaged in the construction and comparison of models and also in the generation of the principles upon which these are assessed and also described. Holding to the demand of describing the models is one of the most useful ways in which one can come to the recognition of the influx from the rational source. One sees after some exercise in this that the demand entails the description of how one is thinking and that this how is something more than the acceptance or rejection of this or that model.

Clearly, the rational source is connected with what is ordinarily called "reflection" where any particular model or pattern of appearances can be held apart from the commitment of one's attention, thereby enabling that attention to acquire a structure which is obscured when there is no mental work. But it is more than a withdrawal from the scene of mental change— it is an essential factor in how order is to be brought about. In description, this is seen in the discrimination of different meanings of a word. For example, "mass" in the mass energy relationship is usually assumed to be "the same" as "mass" in Newtonian physics; but their rational identity is as distinct recurrences of a single item of intelligibility, for each of them requires its own group of representational constructs which can be connected only by a transformation of the way in which one looks at the problem.* In reading, the rational element has to be awakened if the theme is to be understood, for the words can only stimulate the formation of models. Effectual discussion in a group requires a common understanding of a discipline of attention which is exercised both individually and co-operatively. In the experiment described, this

* Reference should be made to Section II, 6. Put in the terminology of that section, one could say that the two aspects of "mass" come under the same organizing intention through transformations connecting images and perspectives with the emergent cyclicality.

was established by building up a common field of rational experimentation.

4 *Words and Mental Representations*

There is an important sub-structure of the tetrad of mentation which operates in the connection of words with visualization. In this context, words have three independent dimensions.

(a) As *signs*, which constitute names of classes, sentences, instructions and so on. The best analogy we have is that of the encoded information, stored and flowing, in a computer prior to their entrance into operative changes.

(b) As *stimulators* of a mental content. Thus the word "orange" can conjure up a picture of an orange. The mental content represents what the words refer to.

(c) As *elements of meaning* where it is understood how to use words.

We shall consider an example taken from an essay by Christopher Alexander.¹ The task is to visualize as a group four objects: an orange, a water-melon, a football and a tennis ball. The grouping has to show all the conceptual connections between the four items. Each of them is a member of two classes of which there are four in all: "large", "small", "fruit" and "ball". Thus, an orange is "small-fruit" and a football "large-ball". In the first dimension of words we have the names "orange", "tennis ball", "large", "fruit" and so on which are codes for selecting pictures and grouping items of mental content.

There may also arise "verbal instructions" on how to proceed in constructing the representation. In the second dimension of words, the representation shows itself to be limited. One can set up a matrix from the four classes and put the four objects into one of the four spaces but one then loses the content of the terms "orange", etc. One can then attend to visualizing the four objects arranged in a square, but with loss in the content of the classification.

Class	<i>small</i>	<i>large</i>
<i>fruit</i>	orange	water-melon
<i>ball</i>	tennis-ball	football

The distinction of large and small can be attended to, but what is left consists of grey featureless shapes, and the attention

¹ *A City is not a Tree*, reprinted in *Design*, February 1 966. This essay contains some very valuable material on the way in which thought is habituated to cope with complexity.

has lost the distinction of fruit and ball. The loss in both these cases is compensated for by an apprehension that is a composite of words in their first dimension and words in their third. This is usually described in three ways, corresponding to the three dimensions, as "verbal", "conceptual" and "qualitative" respectively.

Such exercises help us to grasp the meaning of conceptual. This is very important in the domains explored in the experimental work described at the beginning of this paper. What we call the conceptual is a working compromise between the understanding and the limitations of our powers of mental representation. Mental grasp of the group can be extended by effortful attention, but there is a clearly recognizable element that is concerned with the best way of achieving the result. Words are used as instructions and the attention is formed. In the mental representation there arise certain responses to the instructions and there, a process of construction and analysis is under direction. Thus it is possible to see that the verbal element of thought has a positive role as a means of giving instructions to the responsive level of the mind.

It should be added that exercises in which verbal instructions are excluded have their own value in forcing the directive of the mind from its attachment to habitual representations. But the above example does indicate how it is no mystery that one is able to effectively describe a mental content. "Instructions" and "descriptions" are the same kind of element in thinking.

5. Use of Mental Patterns

The way into the activity of using mental images to activate mental work presents many difficulties for one unused to such an approach, but these self-same difficulties provide necessary experiences for gaining a new understanding of the nature of thinking.

5.1 Different types of people have different types of imagery: some see by way of pictures, others "abstractly", some in a way akin to kinaesthetic patterns, some in colours even.* It requires some time before it can be recognized that what is mentally significant is not that which is apparent and of a kind with perception, but what is not apparent, which is the pattern or mental form expressed by the model. The material of the model can be derived from any empirical source.

* C. E. Osgood *Method and Theory in Experimental Psychology*, pp. 640-6. His notion of image as a perceptual replica is a spurious limitation imposed by fin* concepts of behavioural psychology.

Consider Newton's "Absolute time flows uniformly on every-where". Any concrete representation of this shows that flow must be extended; that is, that duration is primary. Hence that "everywhere" here means not only in space but in relative time as well. This in its turn raises problems of the meaning of simultaneity: is there a "simultaneity" of flow of time between past and future? This leads to the problematic of the distinctiveness of temporality and spatiality. All these questions, which are very relevant to an understanding of Newtonian and Relativistic physics, arise from the effort to make an image of a "flow of time".* The direction of the effort, the structure of interpretation and the form of the image at hand are a triad in constant dynamism (this in its turn throws light on the "flow of time"). The actual image need not be pictorial: elements of the infinitesimal calculus could have served as well, or any representation of a continuous transition orthogonal to spatial distributions. The relevancy of the image could not be pre-set because it has to be grasped in the course of the activity.

5.2 The second difficulty revolves around the description of mental images. The description of perceptions as perceptions and the description of models as models both require a special discipline because they suppose some inwardly generated standpoint. In ordinary discussion it is assumed that the way of representing phenomena, that is, the kind of models used, is something held in common. To make a transition towards the description of models as models it is necessary first to show that there are no models held in common and that conceptual descriptions are therefore always ambiguous and lead to contradictions. In order to have conceptual clarity, one must see the model being employed and also the way in which it is being used—this also involves the recognition of its limitations as a mode of explanation. However, it is the case that many students do not even realize that models are being used and they have first to come to that.

Work with mental images begins with the becoming aware of the mental patterns which order speech behaviour and which represent "assumptions". A movement can then be made from a discussion which "hangs in the void"—having no firm base in the grasp of a model—to an explicit description of representations which show how a concept is being grasped. Making the model

* Other images could have been used. The point is the method of demonstrative critique of theoretical statements by use of examples such as is used in Wittgensteinian analysis.

clear also enables one to see something of (the unordered nature of the mental field. This awareness is also the basis for awakening an insight into the complex dimensions of the mental image. For example, there is a qualitative differentiation in interpretation which constitutes a " hierarchy of principles." Philosophy abounds with attempts to bring to an explicit formulation, applying in general, such a hierarchy. But the differentiations involved cannot be expressed purely linguistically because they become operative only in mental work.

The descriptions and explanations that are given exhibit a certain degree of structure, quite complex in itself. The mental activity which produces these must be even more highly structured. It is an added difficulty to attempt to grasp mental operations; yet, in doing so, needless verbal disputes can be avoided once problems have been translated into a question of what is mentally "seen".

Once a mental pattern has become objectified as a model it becomes possible to enquire into its origins and hence see it as an experimental construction. It is then clearly just a representation of some aspect of the total theme. One can raise the questions: "On what grounds do I accept this view of the matter?" "What can this representation tell me about what I am interested in?" "How does this influence my habitual interpretation of the subject?" By means of these questions, the mental pattern becomes the *starting point for an investigation* and not the fixed opinion which it is when unrecognized.

6. Transition from Description of Model to Conceptual Operation

At first, one has to "guess" what the image "is". That is, in the first instance, it is difficult to see just what is "intended" and what is "accidental", what is "meaningful" or "useful", and it is also difficult to recognize what is "there" at all, since this recognition has to be coupled with a description and there is "present" that which cannot be described in phenomenal orientated language. Beyond this, is the problem of just what is "conceptually significant" in the model. The model is always restricted and hence always incomplete: the rational element seeks to find a completion which can never be fully realized. However, because of its very incompleteness, there can be mental work. This involves an intelligent connection with "invisible" elements including the intellectual grasp of structure that bypasses all mental patterns.

The mental image, as it stands, is representative of the "conditioned opinion", but it is also the means of attaining a new judgment. If there is no awareness of mental patterns, then

there can be only opinion and mental blockage. Thus people often find it difficult to "see" how it is even "possible" that the Galilean addition of velocities should not apply in relativistic situations. Until the mental basis of assumptions are brought into awareness, it is not possible to activate the necessary experimental and rational interplay and gain an advance in conceptual structure. The recognized pattern is a means of conceptual operation. In this case, there is an operational depth to the mental image. For example, it can support the connection between Newton's Laws of Motion and the constitution of Newtonian Space-Time continuum. This connection is not a simple concept and requires a step of integration, involving a deeper level of comprehension which is concerned with the meaning of dimensionality in general.

7. The Structuring of the Mental Image

The "extensional awareness" of mental activity within the activity itself is always "disjoint", that is, lacking in self-completeness and this entails that there is an unperceived structure. Thus, a mental image which is carrying the import of a grasp of conceptual operations passes into unity of thought only through a form of judgment. Here, the word "judgment" does not merely mean a commitment of thought as to the truth or falsity of a "proposition" (which is its usual meaning) but a structured commitment of the mind which constitutes an act of interpretation that takes into account the modality of truth involved, or the "manner" in which the image shows forth a conceptual meaning. Further, one can speak of an "origination of thought" in that, in principle, a complex of mental activity moves towards unity only by means of something transcendental. Behind the mental work of clarifying conceptual operations, which has an empirical basis in verbal activity, there is the whole problem of the "direction of the mind", its finality, which presupposes a trans-mental ordination. Attention is formed by the rational element but also attracted by experimentation towards certain patterns of thinking. This means that it is never possible to fully grasp what is going on in mentation and, consequently, that ordering in the mind is not a totally rational affair.

The depth and coherence of a given mental image is dependent on the degree of intellectual integration operative for the person seeking to understand what is in his mind. It cannot be said that the mental pattern is simply "there" to be judged, not that it is constructed purely from some belief or intellectual attitude. Change in mental imagery is very complex. Not only are there changes due to functional fluctuations of the mind which

lead to instability and associative (verbal-like) interactions; there are also changes which are representative of rational experimentation, and further, there are changes which are a matter of the emergence of unity.

Active conceptual thought requires an organic coherence of patterns in the mind and this is enabled by intellectual activity which provides integration. It is the connectivity, or co-operation, of the intellectual with the verbal which constitutes this integration of mental activity. This must be viewed in the perspective of the whole field of mental life. It is rare for there to be a definite conceptual step in one recognizable "experience": the elements of the piece of mental work are dispersed amongst other kinds of mental occasion. Nevertheless, there is an organizing influence superordinate to awareness which enables these pieces to come together in an accomplishment of thought. So people are accustomed to allow a problem to remain "at the back of the mind"—that is, not engaged in the current flow of mental occasions—where it takes shape and an answer begins to "show itself". The clear difference between people is in their capacity to concentrate this action into a definite piece of mental work, even though the directive and effortful activities of mental work do not bring about intellectual order, but only make it possible of realization. Further, this concentration allows the person to come to some understanding of his own thinking, in which an important part is his understanding of *how to make the most effective mental efforts*. This latter is the key to the intellectual organization of thought, which is distinct from rational experimentation.

In the structural integration of concepts, intellectual ordination is brought to bear within the mental field established by the interplay of the construction of models and the rational concern with completeness. Then the mental image is an intermediary between the verbal and the intellectual realms. The same field of action involves both the reconstruction and development of the mental pattern as a clear representation and as a means of grasping the significance of concepts within a total intellectual ordination.

We have said that the mental image is going towards unity. It is not an entity, but a being-structure which is both synchronous and operational. Its synchronous character is in its emergence towards identity by the joint influence of organization of the intellectual and disorganization of the verbal. Its operational

character consists in its being the field of construction and trans-formation in which there is a rational teleology.

The emergence of order and unity is not describable in terms of a succession of objects of the awareness—succession is how one views the flux of experimentation—it is a continuing activity that has its own time. The "mental image" is a blend of what is thought about, concepts of the thing thought, the purpose of thinking in this way about it, and the meaning of the whole interplay as a vehicle for the intellectual source.

The invisible organization of the mental image is due to an operative contact with an "apprehension of structure" that has no content analogous to perceptual experience. Extensions into the invisible realm enable the mind to be ordered intellectually. The intellectual ordination is not an awareness of patterns, nor a judgement upon them, but an immediate communication with how the world of our experience is ordered.

As the mental image is an intermediary between the intellectual and verbal realms, the activity can be viewed as a co-working of two actions; analysis of the mental field and search for, or going towards, a "deeper insight". Analysis works towards the differentiation of the mental field into elements of different characters so as to establish, for example, a clear awareness of an hierarchy of conceptual operators; or of the rational weight of different interpretations—or, at least, of the distinction between verbal and conceptual elements. The search or opening is concerned with allowing the integrative intellectual power to change the structure of attention. Judgment is suspended concerning the content of the mental field and experimentation is disregarded.

8 *Mentation and perception—thought transformations*

The structuring powers of the intellectual are not confined to abstractions: the intellectual does not enter as a "super-abstraction" and the mental patterns used in conceptual operation are used as a means towards concreteness. Conceptual power is not only the operativeness of the ability to see connections. There is the equal importance of concreteness which safeguards thought against falling into abstract forms by bringing about a confrontation with complexity. Without concrete complexity, the structural integration of the intellectual has no content with which to make an individuation of thought, or *idea*.

An additional kind of work is often useful, namely: the construction of images of concrete situations which are based on a combination of composed perceptions and conceptual models.

An exercise set to the experimental group was to visualize the "molecular life" of a super-saturated solution in the duration of the crystallization process. This was intended to bring about a coalescence of the hypothetical (rational), experimental and empirical sources.

If we exclude the notion that making progress in thinking means a movement towards abstraction, then we still have to take account of the necessity of a disengagement from the ordinary process of thought and a refinement of the content of attention if there is to be a "transformation through thought".*

A key to mental transformation is the *reconstruction of perception*. Another is *mastery over conceptual operations*. A third is the *ability to form strong mental images*. Thinking remains anchored in the concrete and the complex but becomes able, by communication with higher orders of intelligence than that coalesced in the person, to participate in a process whereby the world is made more intelligible.

A definite step in thinking is characterized by a coalescence of diverse factors. There is the coalescence of external perceptions with awareness of internal operations and there is a coalescence of verbal elements with mental ones. The first of these is the substantial basis of scientific method, but is integral to any intelligent apprehension of experience. As to the second, experience in trying to construct a new kind of model to explain a domain of phenomena is usually demonstrative of our inability to do this in any direct sense—if there were a direct path, then it could become automatized. It would appear that what we have called the "mental image" can only become effective in one's thinking—that is, overcome its usual incoherence and incompleteness—by a coalescing transformation which cannot be attributed to operations within the mental field. It is dependent upon operations which involve the intellectual realm of mentation.

The distinction between a compresence of mental elements and a coalescence is usually overlooked. The reason for this is clear. Once a coalescence has been achieved, the operative mental image becomes a factor "taken for granted" in mentation. Only at the moment of transformation is it possible to grasp that there is a substantial transformation involved. It is typical of ordinary

* A phrase I first used in reviewing *Creativity, its Recognition and Development*, edited by G. W. Taylor and F. Barron (*Systematics*, Vol. 2,1). There, I tried to show that what is called "creativity" should be considered in its *whole context* as one aspect of a complex transformation; not, as it is usually viewed, as the capacity to have "bright ideas".

mentation that it can grasp what is before and what after a transformation, but not the transformation itself. One of the main reasons for giving an account of certain experimental work at the beginning of this paper was to show evidence for the argument that attentive observation to the operations of thought is in reality an integral part of effective mentation.

Appendices

(1) *Composition of the Group*

This had been an exceptionally productive group. Part of the reason for this had been the earlier sessions in which the director had had much trouble with gaining co-operation. After passing through emotional barriers, the group assumed a good strength and the director had their confidence and respect while, at the same time, a large freedom of informal exchange with them.

Another factor was the excellent selection of types present. For example, there was a girl in the group who did nothing but listen. There were both "intuitives" and one "hard-working" man. Two members of the group had received very late academic training. One had been in a secondary modern school until the age of fifteen and had to catch up by attending special courses. Another had been badly treated in the school because the headmaster resented his taking science. He had failed his mathematics and had to study for a further year outside school. A third member of the group had been expelled from Cambridge because of his behaviour. Most of the group were heavy drinkers and promiscuous. All of these personal factors were very relevant to the work that was done. These students recognized that the working sessions were the only time during the week when they were called upon to think!

(2) *Berzelius*

"Inorganic compounds which are composed of three, four or several simple bodies are in effect only combinations between several binaries; for example, salts are combinations of oxides. The metallic sulphides, which are made of sulphur with two, three or several metals ought to be considered as composed of different sulphides. It is evident that in the same way the crystalline metallic alloys (which often contain several metals) can be considered as being made up of binary combinations.

"The properties of inorganic compounds depend upon the primitive electrical state (electric polarity) of those bodies and we presume that this state is the cause of their reciprocal action and their affinities. On the other hand, inorganic active compounds of the same elements show chemical properties so different that, looked at from the same point of

view, it is impossible to regard them as formed from the same elements". (*Journal de Physique*, 1811, 73, 262-264.)

(3) *Bohm's "Quantum Theory"**

"The change from bacterium to spore can probably be regarded as a rearrangement of the various parts of the bacteria and its environment (i.e., the atoms and molecules), brought about by the forms within these parts whereas the change of the electron cannot be described in this way. Instead, it is a fundamental change in what would classically be called the "intrinsic" nature of the electron, a change that is not further analyz-able in terms of hypothetical component parts of the electron and its environment. This is the meaning of the statement that at the quantum level of accuracy, the universe is an indivisible whole, which cannot correctly be regarded as made up of distinct parts", (p. 162.)

"We are led ... to a new point of view, based on the idea that the quanta connecting object and environment constitute irreducible links that belong, at all times, as much to one part as to the other. Since the behaviour of each part depends as much on these quanta as on its 'own' properties, it is clear that no part of the system can be thought of as separate.

"... in quantum theory . . . quanta do not constitute separate objects, but are only a way of talking about indivisible transitions of the objects already in existence", (p. 166.)

(4) *The Relevance of Phenomenological Method*

Phenomenological method involves the following disciplines, each of which are directly applicable to the method which has been described above:

(a) To describe just what is "given". In phenomenology, "thoughts" even "abstractions" are as equally given as perceptual appearances. One should not begin description from some pre-conceived theory of the "origins" or "causes" of phenomenon, but seek to clearly state just what is the "object of consciousness". In order to achieve this, certain other disciplinary methods are adopted.

(b) Phenomenology posits that the "phenomena" are "constituted" out of "intentionality". The actual object "seen" is what is seen in a particular way: one attends to particular "facets" of it, or is interested in it in a particular manner such as aesthetically, practically, professionally and so on. No separation is made between this "attending of facts and in a particular manner" and the "actual object in itself", since one never

* Prentice-Hall, 1951

has experience of (he object in itself. At the same time, the structure of intentionality can be "intuited". This is the necessary basis of phenomenological description.

(c) One should be prepared to subjugate phenomena to an epoche: this is a putting of the world into parenthesis". The "world" is phenomena "habitually intended" and the ability to suspend habitual intentionality is essential.

(d) Husserlian phenomenology posited a science of essences, that is, of irreducible structures of intentionality which are experienced as "ideas". Clarity of grasp of these ideas is essential to the "science of reason".

The practical application of phenomenological method demands real mental work. In the experiments described above, conditions were established for this to be possible. By working with mental images and being called upon to clearly describe mental patterns, the group was mentally confronted with a demand to follow the phenomenological method. This side of the work was never explicitly discussed with the group. They were acquiring experience in its practice, and this was always referred to the problematic of "mental grasp" and "clear concepts". It could be correctly said that the phenomenological method is itself illuminated by such work.

(5) Glossary of Terms used with special Meanings

Numbers in brackets after entry refer to numbers of sub-sections in Section II.

Associations: Non-directed linkages of items of knowledge (6.5).

Attention: Directional factor in awareness; associated with will. In mentation (q.v.) there is a form of attention associated with the rational source (q.v.). The level of attention is determined by the degree of separation between the pattern of mental content and the form of attention: the greater the separation, the higher the level.

Concept: Associated with abstraction. The conceptual operator constitutes the bridge of abstraction in thinking and is needed for the right use of words denoting classes and other reductions from the complexity of our experience. In mentation, concepts are the abstract modes of representation which compensate for deficiencies in concrete representation.

Cyclicity, emergent: Emergence of a recurrent mode of apprehension, constituting an "atom" of intelligibility (6.3).

Empirical Source: The ground source of mentation. It is constituted out of the "forms of appearances" such as they are impressed in the conditioning of our thought. It is associated with the linkage of space with time and in human thinking is dominated by quasi-rigid material bodies (4.3.1).

Experimental Source: What we are aware of in thinking. It is characterized by a patterning of thinking and its contribution to mentation is in its role of making connections in response to external impressions and internal patterns. It is constituted out of configurations of content and is therefore the basis of work with mental images (q.v.) (4.3.2).

Field, mental: The region of interplay between the experimental (q.v.) and rational (q.v.) sources of mentation. Neither subjective nor objective, but operational.

Flux, disorganizing: The instability of all mental content (6.2).

Horizon, mental: The plane of awareness determined by the level of attention (q.v.).

Idea: The prime entity of thought which is uniquely characterized as something intelligible in itself. It renders our connections with the external world accessible to operations of thought. It also serves to link mentation with universal principles of structure. In thought, it has a life of its own. In its intrinsic significance it is not an object of awareness. Thus, in mathematics, what one is aware of in doing mathematics are representations of mathematical ideas, not the ideas themselves (5).

Imagery: Term used to denote objectified mental content without reference to pattern.

Image, mental: The ordering of the mental realm; associated with a definite configuration of content. Cannot be understood without reference to the form of attention (q.v.) engaged in the ordering activity. It is also operational, existing in the field of interplay between the experimental and rational sources in mentation (q.v.).

Image, representational: Model established in the workings of intelligence (q.v.) (6.6).

Intellectual Realm: The realm of thinking which is transcendental to the level of attention (q.v.). It is characterized in terms of pure operations free of association with the conditions of space and time (4.1.3).

Intelligence: The coalescence of all forms of mental action. Intimately associated with the person (6).

Intent, abstractive: The general description of the affirming impulse in the triad of an operator of thought. Can be described as the desire to see the intelligible and is associated with awareness (3).

Intention, organizing: The formative power of intelligence (q.v.) which projects into awareness as the coherence of a complex of representations (6.1).

Mental Realm: The realm of thinking which is bounded by the limits of awareness and attention. It can be considered in three parts: a patterning of content, an horizon (q.v.) and a form of attention (q.v.). It is the field of mental work (q.v.) (4.1.2).

Mentation: The ordering activity of thought, associated with mental work (q.v.). It is described in terms of three levels, where the intermediate domain is defined by the level of attention (q.v.). The lowest level is considered as subliminal in its operation and the highest of the three as beyond what can be grasped by the attention. The main principle of mentation is the emergence of order in thought, or a movement towards unity of apprehension (4).

Operator, thought: The coalescence of an intent (q.v.) a specified content and a context of relevance (q.v.). Thought operators make meaningful connections. They can take many forms, depending on the context. There is a conceptual (q.v.) operator which is a right use of abstraction (3).

Ordinal Source: What is superordinate to the mental field (q.v.) and therefore responsible for creative influences. Since it is beyond the sway of the rational source (q.v.) it is the substantial source of the a priori. It is concerned with the completeness of mentation which lies beyond the level of attention (q.v.) and is

characterized by direct grasp of structures. Not abstract, it synthesizes the universal and the particular by its linkage of eternity and hyparxis (4.3.4).

Perspective: The alignment of attention (q.v.) with respect to the mental content (6.4).

Phenomenal: The general character of the receptive or denying impulse in the thought-operator. It has no meaning except in confrontation with the affirmation of an abstractive intent and in a context of relevance. It is characterized by limitation and associated with knowledge (3).

Rational Source: Characterized as the form of attention (q.v.) in the mental field (q.v.). It is responsible for the direction of mentation and establishes, through its hyparchic character, a present moment of thinking. It is recognized in the guise of judgment and through operations of reflection (4.3.3).

Relevancy: General description of the reconciling impulse in the thought-operator. It has no content of its own and is free from desire. In ordinary thinking, this is the element which is "taken for granted". Because we are habitually blind to this impulse, we are not able to think directly about structures (q.v.). Only understanding (q.v.) can grasp the role of relevancy (3).

Structures: These are ordinal forms of intelligibility which cannot be directly represented in the mind, but which are apprehended in the intellectual realm (q.v.). Structures are taken to be inherent in every situation, but can only be grasped by the mind in the context of complexity. One is able to grasp structures through understanding (q.v.).

Understanding: The mental grasp most intimately associated with the will. Understanding is not directly related to awareness and is therefore independent even of attention (q.v.).

Verbal Realm: The realm of thinking that does not require attention to meanings. It can be described as the realm of subliminal thinking, since it is composed of those mechanized modes of thought which do not require the formation of any pattern in awareness (4.1.1).

Work, mental: Required in order to bring mentation towards unity. Without mental work, the intellectual (q.v.) and verbal (q.v.) realms cannot become effectively connected.