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June 5, 1995

The Operational Situation

Living beings are in situations where their state is part of the state of the situation and where they condition the transition of the situation from one state to another. Their significance differs depending on the situation considered. If one considers the action of one animal within a forest, its significance is minor. However, if one considers the immediate situation of the animal, its operations and actions have a greater relative significance. There is another way to consider situations. Instead of viewing the living being as simply within a situation, situations can be understood in terms of the operations of the organism. This is the operational situation. It is defined as the complex of factors which can be organized to perform an act and the context <u>for</u> the organism in which this occurs. The context also is constituted in terms of the organism's operations. The purpose of this paper is to outline the model of the operational situation. It is general enough to apply to the biological and human sciences, theories of consciousness and knowing, and automation. It is specific enough to provide a framework for an integrated understanding of life and mind, and to guide research in these areas.

I will present it by first explaining what a situation in general is. As an indication of its scientific value and to build on a simpler model of situations, I will lay out the fundamentals of the physicists' notion of phase space. This is one tool for handling multiple variables in a complex situation. We will see that as phase space permits the representation of the state of a complex system, so the model of an operational situation provides the context for specifying the state of living systems. As phase space provides a means for discovering other relations by simplifying the representation of the state of a complex system, so the secondary notion of operational situations permits the finest degree of abstraction within the full situation. A key difference between the notion of phase space and the operational situation is the constituting of the operational situation by operations. Thus, a definition of operations will be provided along with their relations to functions and acts. The value of the model of operational situations in integrating the investigation of the multi-variable situations of complex systems can then be indicated, especially in the interrelations of biology, psychology and philosophy.

Situations

What is a situation? Most generally, it is a particular place and time. In pre-Einsteinian physics this was relatively easy to consider. Time and space were considered absolute. That is, in some sense they were independent of the matter that was "in" them. The notion of being "in" space or time was appropriate since individual spaces and times could be imagined as "containers". They were constants in the sense that they were the same for all observers. However, in current theory space and time are variables related to the state of matter. Particular places and time are inseparable from the state of matter which constitutes the particular space and time. Thus, space and time is different for different observers. Two events simultaneous for one observer may not be so for another. Thus, one observers clock may not be synchronized with another's, though they may have been originally if they were once in the same place and times. Contemporary physics provides transformation equations to correlate the space and time in one situation with that in another.

For events on the scale of our daily lives, a four dimensional coordinate system can be used to represent space and time, three dimensions for space and one for time. However, in the physics of quantum mechanics, a ten dimensional system is used sometimes.

A powerful tool for representing the state of a situation on the physical level is phase space. A good popular account of phase space is found in James Gleick's Chaos.

> Any state of [a] system at a moment frozen in time [can be] represented as a point in phase space; all the information about its position or velocity was contained in the coordinates of that point. As the system changed in some way, the point would move to a new position in phase space. As the system changed continuously, the point would trace a trajectory.[1]
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> Every piece of a dynamic system that can move independently is another variable, another degree of freedom. Every degree of freedom requires another dimension in phase space, to make sure that a single point contains enough information to determine the state of the system uniquely....Lorenz's stripped down system of fluid convection was three dimensional, not because the fluid moved through three dimensions, but because it took three distinct numbers to nail down the state of the fluid at any instant.[2]

Phase space is a tool for modeling situations. Phase space makes it possible to represent a multi-variable situation with fewer variables, providing the opportunity to discover patterns that would be difficult to conceive on a more detailed level. This was a powerful aid in the discovery of strange attractors. It can provide information concerning the successive states of situations by representing the states as values of variables. If elements in the state are systematically related to one another, on the physical level they can be related mathematically and their current state can be represented by a value in phase space. If they are not related, then additional significant variables can be added. The values of the variables can be graphed, representing distributions of values for successive states.

Using phase space we can model the systematic and unsystematic elements in a situation.. Unless the situation being studied is a fully systematic system in a steady state, all situations have systematic and unsystematic elements. Using phase space, the unsystematic would be represented by a set of independent variables. The systematic could be represented either by a single variable whose values represent the relations of the systematic elements, or each element could be represented singly. In the latter case, the distribution would display a strong relationship between these values, which in turn would indicate a systematic relation among them..

The ground of the unsystematic is the statistical independence of events from one another. Events are independent of one another to the extent that there are no relations between them. Individual events can have determinate causes, yet be unrelated to one another. Common examples include balls on a pool table and particles in a gas. You could trace the individual history of each ball or each gas particle, but there is no overall set of relations which account for the configuration of the moment. Instead we have a set of individual histories. Similarly, if we consider a population over time, there may be no overall set of relations which account for the frequency of events of a particular type. If there were, we would expect the frequency to be fixed. However, in unsystematic situations, or sets of situations, the actual frequencies diverge from the ideal statistical frequencies, and they do so unsystematically.[3]

The lack of system can be of two kinds. It may concern the particular event, and then it is an accident. Or it may concern the set of events. In the latter case the events exhibit statistical independence.

However, from another viewpoint, an unsystematic situation can appear systematic. This was true of the law relating the pressure and temperature of a gas to one another. With some room for errors in measurement, this appeared to be a fixed relation. However, with the introduction of statistical mechanics, this variation was traced to the unsystematic nature of the situation. The apparent systematic relation was discovered to be a phenomenological law only. But this did not make the situation completely unsystematic, for there are still unities and relations which form the population studied. Without them, there would be no statistics since there would be nothing to which to assign frequencies.

In summary, situations are systematic and unsystematic. They are aggregates of spatial-temporal unities and relations.[4] Insofar as there are relations and unities they are systematic. Insofar as there are unrelated aggregates they are unsystematic. Phase space provides a model within which to understand them which has some independence of the particular relations being studied. For example, phase space is compatible with both a classical and a kinetic theory of gases. However, it does not provide a non-mathematical treatment of situations.

Levels of Complexity

We must go beyond a mathematical model to understand biological situations. Biological systems are understood in terms of functions, operations and acts. However, to understand these, we first need a notion of levels of complexity.

The lack of system in a situation is the possibility for a higher integration, or the emergence of a new set of relations. Insofar as this new set of relations is an aggregate, the possibility exists for a higher level of organization. Since the possibility is recurrent, complex beings exhibit multiple levels of organization. [5]

For example, cells are organized in organs or systems and these, in turn, are interrelated with other systems in a living thing. The behaviors of animals within a species can be organized in terms of behavioral systems. In turn, these systems can be organized in terms of the group or a society.

Considered schematically, on the lowest level of organization, A,B, C, and D are related to perform function F1. E, F, and G perform F2. H, I, and J perform F3. The repetitive performance of F1, F2 and F3 constitute O. In this example there are three levels of organization. If we consider a set of organizations of O's, then it is easy to see that higher levels are possible through the iteration of our scheme.

The specialization of systems to perform functions which are in turn organized permits the modularization of functions. Modularization not only occurs on the same level, but exists between levels. Modularization permits generalization of function since elements can be combined in "innovative" ways to function. Rather than having higher levels of organization tightly linked to lower level organizations, in many cases the higher level need only be linked to the function or to the results of the lower level organization. To a certain extent, any organization which performs the function or which yields the result will do. This is the basis for equifinality and equipotentiality. In equifinality we find the same purpose being achieved by multiple means. For example, in the above schema it makes no difference in the occurrence of O if F1 is achieved through A, B, C and D or through X, Y and Z. The important thing is that F1 occurs. Within certain limits, then, in many structures the higher level of organization is indifferent to the manner in which the lower level achieves its function.

Just as higher level organizations can exist given a variety of lower level structures, so can lower level structures be parts of more than one kind of higher level organization. Corresponding to equifinality is equipotentiality. For example, the human hand can be used for a variety of tasks, and in human action the same means can be used for multiple ends. In organisms the function of a particular system can be integrated into more than one higher level of organization.

Functions, Operations, and Acts

Operators are organizations that transform themselves or other organizations or some other relata. There are two types of operations, reversible and irreversible. Reversible operations display symmetry in the sense that the initial state of the operator and the situations can be reattained. Irreversible operations are asymmetrical. The initial state is irrevocably transformed. The former are usually operative at a particular level of development, while the latter often lead to development.

Since operators are organizations, they can be hierarchically related. The notions of equipotentiality and equifinality above are two general forms of relations between higher and lower level operations.

Mathematical operations, like multiplication, transform their terms creating a product. By motor operations we can change our position or the configuration of our situation. By cognitive operations we can relate memories to one another and to key features in the present, or we can transform a mere proposition or proposal from possibly to actually true through a judgment.

Much of evolution has been the emergence of operations which have a bearing on the acts of organisms. Acts are operations performed by the highest level operator in a complex unity. This gives acts in organisms their comprehensive quality. In ourselves this is the free, conscious operator we identify most readily with attention and decision. Lower level operations are organized in terms of the act. Given the independence of levels of organization from one another, this means that the actor does not have control over the full range of operations conditioning the act.

For example, in a therapy session, a patient may be moving his leg up and down in a nervous mannerism. If this is pointed out to him he will be surprised. As far as he was concerned, it was not an act he chose to perform. On the other hand, this same operation can be an act if it is chosen.

Acts, then, are distinct from another class of operations, expressions. Like the nervous mannerism, expressions can be chosen. Most often, though, they are not chosen for themselves, but are subsidiary to some end. When we speak, the flow of words emerges as a whole as the expression of what we mean. When the normal person expresses pain, pleasure or surprise, it is the unusual instance where that expression is chosen. There is a range of cross-cultural facial expressions and postures which evoke cross-cultural complementary behavior in people. The joyful smile, angry faces, threatening scowls are meaningful to all. However, in our daily life, like actors, we can elevate expression from mere operations to acts. We may choose our words carefully, or reinforce our message with a particular look. We can be aware of our body language and change it to match that of those with which we are interacting.

The role that operations play within higher levels of organization is their function. While operations are organized transformations, there are another set of biological functions which are more "passive". Examples are the function of the color of an organism as camouflage, the function of a single biochemical within a larger organization, or the function of the developed shape of the femur in standing or running. Thus, all operations are functions, but not all functions are operations. Likewise, all acts are operations, but not all operations are acts.

This notion of function is normative only in the sense that the function is part of a biological organization's operation. Either "X functions" within the operation or it does not. The question of teleology would be resolved in a discussion of the emergence of functions in evolution and the organization of goal directed operations.

Not all aspects of an organism may be functional. They may not be related within a higher level operational organization and, therefore, have no further "use". The appendix is a commonly used example.

The unsystematic is also evident within complex systems. There are operational organizations which are not related to one another. They may be open to future integration. In some combinations they also could become dysfunctional, hampering the organism's abilities to act. This is sometimes the case with computer programs when conditions are set by one part of the program that another part cannot accommodate, causing the program to fail. The situation can be recurrent among programs within computer systems, causing the system to fail.

The Operational Situation

The operational situation is understood in terms of the organism. Most generally, it is the complex of factors which can be organized to perform an act and the context for the organism in which this occurs. The context can include elements which are not part of the organism, but to which the organism is related. Thus, the context is constituted by a set of relations in the organism or has a correlative set of relata in the organism. Examples of the former are sub-situations within a biological system, or a merely psychical reality. This notion will be discussed in more detail below. An example of the latter is the processing of the visual system.

The organism is related to every aspect of the operational situation. Thus, if there is not a correlative relata in the organism for an element, that element is not part of the situation for the organism. For example, the current price of beef may influence when cattle go to market, but the activities of the commodities markets are not part of their operational situation.

The situation is complex. Acts occur within contexts which are constituted by operations. In turn, these operations occur on multiple levels of organization and within their own context. However, to avoid an infinite regress of contexts, let me point out that operations form networks of relations, so that the contexts can be mutually self-constituting. In this vein, the ultimate context of any operation is the organization of the organism as a whole. The notion of the operational situation implies that, to a significant extent, the organism constitutes its own context.

Additionally, there can be multiple unrelated processes occurring simultaneously. Organisms are not fully systematic. Thus, the operational situation is both systematic and unsystematic, as is any concrete situation. In the discussion of vision, we will see that this lack of structure provides the possibility for diversity of functions in constituting and operating within the situation.

While the operational situation is for the organism, it is not merely for the organism as conscious, but for the organism as a whole. On the level of consciousness, a situation exists for consciousness, or, in phenomenological terms, consciousness is "consciousness of...". However, conscious operations are supported by unconscious or non-intentional operations such as the workings of individual nerve cells and neural networks in memory, or the increase in the flow of blood to areas we exercise in actualizing our decisions. On a higher level we have the embodiment of our psychic development which is retained and operative though not fully conscious.

As one would expect, operational situations differ from species to species and, to a lesser degree, by individuals within a species. It also differs by level of development and within developmental stages. Naturally, it differs too by external circumstance, and, in higher animals, by the particular stages within the individual's motivational cycles.

The operational situation is temporal. Operations can incorporate past functioning and be anticipatory. Thus, the situation can embody a range of possibilities to which the organism is attuned. Motivational cycles are an example.

As recurrent sets of operations motivational cycles tend towards their realization in acts. The recurrence of cycles can lead to development of a complex network of flexible operations. The basic cycles are motivated by drives. These usually operate through one's lifetime of for a developmental period. Drives have biological conditions, though they usually are satisfied within the higher levels of organization of behavioral systems. Thus, in higher animals, the history of complexes includes psychic history as well as explanations on the biochemical level.

In persons drives can become values. Conversely, values can become motivators through linkage with feelings. The basic cycles, then, can be subsumed within a meaningful existence.

Though a motivational cycle achieves its apex in acts, it does not terminate in acts. The acts result in changes to the subsidiary elements supporting action. The complex of operations either assimilates them to itself, or accommodates itself to them. This changes the conditions for the next actualization of the cycle. For example long term memories form during dreaming which can become operational in later cycles. The motivational cycle, then, can have an unconscious component which conditions its realization and which is self transforming after the acts are complete.

In higher animals, then, behavioral systems incorporating motivational cycles contribute to constituting the operational situation for an animal in the focusing of interest and acts in the realization of motivations. The acts can range from flight from enemies to hunting for food and nurturing behavior. In humans motivations become linked to meanings and values and can be actualized in responsible action.

Evolution and Operational Situations

The 'units' of evolution have been conceived variously as individuals, species or populations. Though this may be the case, it is also true that operational situations evolve. An environmental niche can be considered as a set of operational situations. As evolution proceeds, environmental niches are taken over by more highly developed organisms. With more operations available, the niche, and the types of operational situations that compose it, evolves. There is also evolutionary pressure within the operational situation, since evolution changes not only organisms, but to what they are related. To a significant extent, it is the ability of organisms to respond to the challenges within the operational situation which drives evolution. Examples are the emergence of intentionality and intelligence.

As intentional, operations are conscious of elements correlative to the conscious operation. Consciousness is 'consciousness of'. If what we are conscious of is other than consciousness, but is a content of consciousness, then conscious operations make present what they are not by organizing themselves in terms of what they are not.

We can understand how this can occur by understanding the emergence of operational memory. In general, memory is based in the recurrent performance of operations, a fundamental characteristic of life. Memory is operational when it is instrumental to performing acts. It is more general than cognitive memory since it does not embody claims about reality. It is the memory of operations performed, which is used to guide future tasks of the same type. For example, in learning to speak we remember our past sounds and those of others and use them to modify our speech. In subsequent speaking, these memories become operative. There is evidence that the development of all the senses in mammals occurs by the formation of operational memories. In turn, these are correlated to neural development. This also occurs in skills.

Living systems act within unsystematic operational situations. This means that external occurrences are realized in accord with probabilities. The recurrences can be more or less similar. In dealing with recurrent events it is an effective strategy to retain successful past functioning. As noted, this is the foundation for memory. However, since it is to be operative, memory also is anticipatory. It is an organization of the organism in terms of what it is not, the recurrent external events in the operational situation. It embodies the general structure found in intentional operations.

With a memory-anticipation structure, innovative activity must emerge to make adjustments in the present situation between the operational situation as anticipated and as actual. This provides evolutionary pressure for the emergence of intelligence. This adjustment may be the emergence of different capacities, but ultimately, what ever capacities there are, they need to be tuned to the situation. This is done by combining them in different ways, timing action and so on.

Cognitive systems exploited this evolutionary gradient in moving from the extroversion of the object in sensitivity, to knowledge of the unimaginable via the organization of symbols which refer to what they are not. If we accept that we know what actually is, then there has been a correlative evolution of intelligence from regulating systems which operate 'analogically' in terms of the body, to knowledge of real things and events, or knowledge by identity, with a corresponding self transcendence. Symbolic processing is the perfect mediator for such transcendence.

The notion of 'analogical' processing helps us to understand operations mediated by the body. For example, in building a nest certain movements of the bird are related to different placements of materials within the nest. By organizing the movements, the nest becomes organized in a particular way. By changing the possibilities for organizing the movements, different kinds of nests become possible. Thus, internal regulations can yield external regularities. In operational memory the converse can occur. External events can yield internal transformations which become analogous to the external events. In addition, the whole process can be internalized, as in the avoidance of anxiety arising in conjunction with a particular memory.

Returning to intelligence, since there are multiple elements, it is most effective if there is a central operator which has access to them. With more than one central operator, the organism could be immobilized often through conflict concerning which actions to choose. As it is, we have internal conflicts between "subsystems" or operational centers, but they usually can be resolved or overridden to permit immediate action. This central operator has emerged as the irreducible (for us), free, attentive core of consciousness.

Minds vary, then, depending on the operations they have available and the operations they perform. The state of a mind, as well as the state of the operational situation, would be the particular configuration of its operations and their relata. Since that configuration is both anticipatory and unsystematic it needs to be understood in terms of probabilities for action as well as in terms of its present acts.

These are instances of the general pressure within the operational situation for the emergence of ever more complex and refined anticipatory operations. In turn these require greater complementary compensatory skills to adjust to the actual situation. As this situation becomes iterative pressure emerges for ever more complex and varied operations. One can get a sense, then, of how evolution can be "self-driving" in the emergence of greater complexity if the locus of evolutionary pressure is in operational situations.

A Secondary Notion

Much of development and existence within developmental stages is the performance of operations on operations. As the example of the emergence of intentionality indicates, for one set of operations, the set of operations it regulates are part of its operational situation in a manner similar to that of external things and events. The internal environment can be part of the operational situation, not simply as operator, but as operand. This situation is iterative on each level of complexity. Many biological regulatory functions work this way. Operators in the cell regulate internal functions as well as relations to external elements. The immune system regulates itself to some extent as well as operating on other elements.

This indicates that there is a secondary notion of the operational situation. If we consider operations only and not acts, then we can consider the internal situation only. We also could consider operations in their relations to the external aspect of the situation. An example would be the tearing of the eye on a windy day. Though it can be considered in itself, its real significance is found in the full situation. This could affect the vision of a tennis player, for example, causing him to mis-hit the ball. Or it could clear dust from the eye of a contact lens wearer lessening their irritation and permitting them to see better.

A more complex example is the structure of the eye itself. The rods and cones of the retina fire differently for different occurrences. Some, for example, fire only for vertical movement, while others fire for lateral. The rods and cones provide a mosaic of operators which can be related to an indeterminable number of visual fields. The same is true of the possible motions of the digits on the hand. For example, the movement of one finger traces a curve, which, mathematically, has an infinity of points. Likewise with the other digits. Conceivably, then, there is an infinity of possible combinations of positions. In actuality, however, the combinations are bounded operationally. We do not try all possible combinations, nor do we have a propensity to do so. In general, we combine movements in terms of acts we perform, where the movements, as operations, contribute to the act.

In short, the visual field is constituted by a population of neurons. The population will handle whatever is there within the range of their capacity. As a population, it is an aggregate. Its lack of organization is what makes the visual field possible. The openness of the system allows it to handle a range of visual experience. It also allows it to be in relation to the non-systematic situation. As we all know, the visual system in the eye is supplemented by other processing, memories, anticipations and so on. But there is a statistical residue here also. This permits the higher levels of organization to have a similar flexibility in handling the unsystematic. Now, one may disagree with this simple analysis of the visual system. The point, however, is not to discuss what vision is, but to understand the secondary notion of the operational situation. We have illustrated that notion by discussing the operations of the retina and their general relations to unsystematic external events and to the higher integration of their outputs by the higher visual and psychological centers.

Theories and Models

A theory is a set of explanations. An explanation is a set of terms and relations which answer "Why?" "What?" and "How?" questions. To understand why something happened is to understand what happened or how it happened. If we focus on the key set of general terms and relations we can create a model. Models include key sets of expressions, images and symbols which correspond to the key relations. As a set of general terms, relations and examples, models can be varied as required to grasp particular instances.

What is a complete explanation? A complete explanation of a level of organization would tell what it is and why it is what it is. The latter would include the part of its history pertinent to its becoming what it is and an account of the present relations which maintain its current state. The account of its history would recede to the point where the conditions for its emergence became present. For example, life emerged because the conditions X, Y and Z were present. To ask why the conditions were present is to ask for an explanation of them. Though it does have a bearing on the explanation of life, its bearing is subsidiary to the bearing it has on the explanation of the conditions themselves. The fact that we need to ask another question about another set of organizations is indicative of this.

If the level of organization is organized within a higher level, the explanation would include an account of those parts of the higher level which organize it.

It may seem that we need to explain the whole organism to explain part of it. There is some truth to this, since the organism is a unity. But since it also is not fully systematic, the unity is partially de facto. The notion of animals having a "republic of instincts" and the corresponding inability to outline an integrated theory of one motivation underlying all of a person's acts are indicative of this.

The model of the operational situation overcomes this problem by distinguishing the primary and secondary notions. The primary notion would include all operations and their correlates which have a bearing on an organism's acts at a particular place and time. The secondary focuses on some subset of operations and their correspondingly reduced range.

The Heuristic Value of the Model

The operational situation is caused partially by operations and partially by external events. However, the range of external circumstances which are relevant is determined by the capability of the operations to relate to them. Operations, then, play the primary role in constituting the situation. For example, just as physical space and time are determined within particular states of matter, so organic and psychological space and time are constituted by operations with some reference to physical space and time.

When operations regulate other operations, the primacy of operations is unambiguous. When operations transform "external" circumstances, transforming the situation, their influence can be matched by "external" transformations to which the organism must adapt. However, as noted above, the range of events which are significant is determined by the operational range of the organism.

The key to defining the operational situation, then, is to define the operations. In science this takes two general directions. The first is to focus on operations within a complex unity, such as understanding the operations of white blood cells in fighting infections by gathering data in vivo. The second is to create the experimental situation to isolate operations by simplifying the "external" circumstances.

In either case, the results need to be integrated within the understanding of the broader situation to overcome possible deficiencies caused by abstracting. This is clearest in the second case. Discovering the operations a rat uses to navigate a maze does not give the full range of these operations within the animal's lifecycle. To do so would require observing their use in the "natural" habitat.

One heuristic precept then, is to discover operations. A second is to acknowledge the unsystematic. To do so is to recognize that not all operations are related, nor are all the external circumstances. They need to be understood statistically.

A third is to acknowledge the relations between levels of organization. Higher and lower levels are explained to some extent in terms of each other. The notion of operations on all levels permits a multi-level explanation within a single model. For example, it is possible for emotional expression to be unconscious, conscious but not at the focus of attention, and integrated self-knowingly into our acts. Each, with respect to the emotional operators, is a different situation. But it is possible for all three to be operating at the same time with respect to different emotions at different stages of expression, constituting our emotional state. We could explain the levels of expression within the state from the level of the operations of neural transmitters through the expression in acts.

The same is true of knowing. If philosophy considers a higher level of generality than other fields, and if the generality is of operations, then it would have a biological component in the neural support for knowing, a psychological component in the cognitive operations, and a philosophical component in the focus of those operations on philosophical issues. The emergence of a philosophical model, then, would be a transformation of our state of mind with operational implications radiating throughout the levels of organization, with the simultaneous transforming of our psychology in its basic orientations and the neural substrate supporting it. The understanding of the model of operational situations, transforms our own situation and provides a context for understanding the transformation.

The model has metaphysical implications if we consider the set of relations of cognitive operations to reality. Kantian, phenomenological or critical realist positions, though theoretically unreconcilable, can be conceived within a single view to the extent that they are models of the cognitive operational situation, outlining which elements are relevant and which are not, where the relevance is conditioned by the cognitive operations.

It has implications also for theories of sports or skills where the relevant "external" factors are selected in terms of the acts to be achieved. What is "external" for a highly proficient player is different from the average player. The space of a tennis court is higher, wider and longer for a professional tennis player since they can play more of the "outer" court. Time differs also since events occur at different speeds than for the average player. In addition, different situations are created due to the skills of the players, situations at which the average player can only marvel and exclaim "How can they do that?".

The example of the tennis players is one of mutually conditioning operational situations. These occur in behavioral systems such as those conditioning attachment behavior in mother and child. The fact that operational situations evolve is seen in the evolution of behavioral systems[6] and the corresponding evolution of culture in animals.[7]

Conclusion

The ability to specify operations, their range, and their current relations within a situation circumscribed by them presupposes a model for understanding life analogous to the physicists' use of phase space. We saw that the model of an operational situation provides the context for specifying the state of living systems just as phase space permits the representation of the state of a complex system. Phase space also provides a means for discovering other relations by simplifying the representation of the state of a complex system. The secondary notion of operational situations provides an analogous simplification by permitting the finest degree of abstraction within the full situation. It also provides the context for integrating the results within the larger, real situation.

It should prove especially fruitful in integrating biology, psychology and intentionality analysis in providing a model of mind. The integration of biology and psychology is a scientific task. Insofar as it has a bearing on resolving philosophical questions, intentionality analysis is a philosophical task. Otherwise it is psychology. The integration of the two is a scientific and a philosophical task. The model of the operational situation provides a common terminology and a conceptual framework where different levels of complexity can have different qualities or different manifestations. We saw the latter in the expression of feelings. The former may be the case with the mind where different neural networks perform different functions and where a threshold level of a type of neural activity is probably a condition for alertness. Finally, it provides a model for different disciplines investigating a common, complex living being. For example, neurology, psychology and philosophy all regard conscious acts, but they do so within different contexts. These contexts are understood through the secondary notion of the operational situation. Their seamless integration and their dysfunction are understood in terms of the full situation. It is the role of the philosopher to indicate the outlines of the integrations of scientific and philosophical results. By doing so I hope I have provided a model that will prove heuristically fruitful.

Footnotes

1. James Gleick, Chaos, (New York: Viking, 1988) p. 49-50.

2. Gleick, Chaos, p. 135.

3. Bernard Lonergan, Insight: A Study of Human Understanding, (London: Longmans, Green, 1957), p. 62.

4. Lonergan, Insight: A Study of Human Understanding, p. 172.

5. Lonergan, Insight: A Study of Human Understanding, p. 438. Provides a much more sophisticated account of these relations.

6. John Bowlby, Attachment (New York: Basic Books, 1969) pp. 74-84. Provides excellent account of behavioral systems.

7. John T. Bonner, The Evolution of Culture in Animals (Princeton, N.J.: Princeton University Press, 1989). Provides numerous examples of the evolution of behavioral systems.