CHAPTER VII - DESIGN OF INQUIRING SYSTEMS

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1. Metrology

The last two Chapters represent a style of inquiry which its admirers would describe as soaring and to which its detractors would confer the B.S. degree. It is time for a shift in style to the more precise and explicit, although, as we shall see, it is impossible to keep the vague and implicit out of the inquiring system.

The discussion of the Hegelian inquiring system ended with Hegel's optimism, the promise that the movement from thesis-antithesis to synthesis is a soaring to greater heights, to self awareness, more completeness, betterment, progress. We now need to see if this optimism can be defended and defined.

Our resource will be E. A. Singer, Jr., and specifically his Experience and Reflection. Singer chose as his starting point metrology, a science which has been remarkably neglected by philosophers. Metrology is the science of measurement. Now philosophers have shown an interest in the formal language of measurement (transitivity, asymmetry, etc.), but language is only a part of the story. The really fascinating aspect of metrology from a philosophical point of view is the operational design of measurement, i.e., the steps that must be performed to produce measurements, and the justification that the produced readings accurately describe some aspect of reality.

2. Standards and Units

To design an inquiring system which measures, two initial decisions must be made: the unit and the standard. The unit appears to be

"arbitrary," while the standard is not. As in all systems design, however, the distinction between arbitrary and nonarbitrary is itself a nonarbitrary strategic decision.

Suppose we use two examples to aid us in trying to design a measuring system, one physical, the other social. I want to measure the width and depth of an alcove wherein to place my desk so that I can measure my annual net income for the IRS. I go in search of my measuring tape (which is not where it's supposed to be, of course!), and with it in hand I compare the boundaries of the alcove with the numbered marks on the tape, and using a bit of simple arithmetic, I write down some numbers on a slip of paper. I've chosen to read these to the nearest quarter inch. Not wishing to go through the bothersome business of returning the desk to the furniture store because I miscalculated, I try two or three times with different markers, or perhaps I ask my wife to measure as well. With the desk in place, I sit and consult various records of income and expenses, using the appropriate governmental forms, and finally arrive at a net income figure expressed to the nearest dollar.

From these two homely examples, the shape of the measuring system emerges. The set of components for the length system include at least these: a rule-generating system, which specifies the steps to be followed, a tape manufacturer, a visual system capable of following the specified rules and thereby making comparisons and transforming these into numbers, and a second visual system capable of checking the first. But what is most relevant about the example is the very strong assumption that the furniture store, which presumably measured the desk for me, has very much the same system, so that their numbers and mine must agree, at least within the quarter inch requirement. Indeed, the interesting point is that there exists a system of measuring lengths, available to anyone who

can acquire a ruler or tape, which is thoroughly reliable within, say, an eighth or sixteenth of an inch. What is the design of such a measuring system?

We can readily see that the basis of the design is a Lockean community. It is interesting to note that the creation of such a community is no simple social task. In the history of the USA, there was a time when an inch was not an inch or a pound a pound. It took considerable legislation, together with the formation of the Coast and Geodetic Survey and eventually the National Bureau of Standards, to bring about sufficient agreement among various sectors of the public. Even today, the numbers appearing on food packages do not necessarily represent a reliable agreement.

The key to the design of the Lockean community for measurement is the "standard." In the most general sense,[1] a standard consists of a set of operations which in principle will resolve any disagreements arising in the community. Imagine, for example, that I have purchased a five pound bag of sugar, but on weighing it at home I find it to be only four and a half pounds. I return to the store, where the manager weighs it on his scale at five pounds. In principle, assuming a sufficient quantity of patience, we could resolve our differences, say by going to the nearest drugstore where finer weighing machines are available. But why would we believe in this method of resolving the issue? Because we might both be confident that the druggist is honest, with no stake in our quarrel, and that he is constantly checking his balance against "standard" weights. These weights themselves have been carefully prepared to conform to

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[1] If I were a general semanticist, I'd have to admit that the word "standard" is used throughout in at least two senses, the more general one referring to the operational design of the system, the more specific to some property of an object, e.g., a platinum bar and its markings. I hope the ambiguity will not bother anyone except a semanticist, because the context should make it clear which meaning is being employed.

national "standards." But here we seem to be on the verge of an infinite regress. Suppose, to continue the example, that the druggist decides in my favor, but the grocer, who is a man of principle even though an incredibly bad entrepreneur, wishes to check the druggist. Together we go to the National Bureau of Standards, which weighs the bag in its carefully controlled laboratory and reports a reading of 4.5238 lbs. Where does the grocer go now if he's still convinced he's right? He could, of course, go to an international body, but eventually the process must stop. Thus the Lockean community is designed so that its members agree, say, that the National Bureau is the ultimate check on any disagreements. Does this mean that the Bureau sets arbitrary units and operations? Of course not. It is the responsibility of the Bureau to assure itself that there is a sound theoretical base for certifying that a given method of measuring is, or is not, acceptable wherever it is applied, and under whatever conditions. This is why the "unit" of length, for example, is not arbitrary at all. One aspect of the Bureau's measure of performance is the simplicity or cost of maintaining the system, together with the degree of refinement of measurement the system produces. The shift of the standard of length from a platinum bar immersed in a liquid to the wave length of yellow cadmium was based on these considerations.

Here again, the emphasis in the literature on the formal aspects of measurement has led to some linguistic confusions. Formally, it is true that any unit of length can be chosen and shown to be proportional to any other unit. But it does not follow that the unit of length is "arbitrary" in the measurement system, any more than the dollar is arbitrary, if "arbitrary" means that alternative choices are equally valuable from a design point of view.

3. A Measure of Performance of the Measuring System

We can begin to see how a measure of performance, and hence of progress, might now be defined. Assume that there is a positive value of measuring length to a group of people, G. This group includes housewives, carpenters, plumbers, manufacturers, scientists, surveyors, etc. We might then say that the measure of performance of a measuring system, M, is the degree to which M can design G into a Lockean community, i.e., the degree to which differences about length among G's members can be resolved by M.

But the lessons of the last few Chapters show us that creating a Lockean community does not necessarily imply that knowledge will thereby result. Why should we suppose that the community of measurers is describing reality? A number of responses can be made to this question, as we shall see. At a very simple level, one could adopt a pragmatic position, as did John Dewey, and say that the measuring system measures reality if the use of its data "works out satisfactorily." Thus the measurement of the length of my desk accurately portrays reality if the desk fits.

It is to be noted that this account has a very peculiar twist: the measuring system is based on relatively precise rules and theories, while its defense is based on the very imprecise concept of "works out." The weakness of the philosophy is apparent enough. Most USA automobile drivers might have agreed that the internal combustion engine has "worked out satisfactorily" until they learned of its contribution to air pollution. But if one tries to go beyond Dewey to measure the real utility of length measurements, then there is another peculiar twist, for now the reality of all measurements depends on the "fundamental" measurement of utility, i.e., on a measurement process which, according to the criterion given

above, has a very low measure of performance. To return to the illustration, I sit at my well measured desk to measure my (real) income during the past year. To be sure, there are rules to be followed and observations to be made; furthermore, there will be a disinterested observer, an auditor of the IRS, to check my observations and obedience to the rules. But there is no Lockean community, because except in the simplest cases, few would claim that the final number "measures" income. If "income" means real value received over a period of time, then it is safe to say that no one knows how to measure income even approximately. Thus the proposed base for a satisfactory measure of length, namely, the real value of the length measuring system, is itself in a dubious state of development.

And yet, despite the fact that we cannot even approximately state the worth of our global system of measuring length, it seems absurd to say that there is a serious question about our ability to measure length. Hence, some other criterion is needed to convince us that the Lockean community of length measurers is describing reality rather than illusion. And the criterion seems to be ready at hand once we accept the wisdom of examining the history of a system in considering its design. Two hundred years ago the Lockean community could agree on a length measured within one-thousandth of an inch. Today, the accuracy can be within 100-millionth of an inch. In and of itself this result is not impressive, of course, because refinement alone is hardly the hallmark of reality; today's realists scorn the scholastic ability to estimate the population of angels within one or two angelic heads. But it is worth noting how refinement does carry its own conviction provided agreements of certain kinds are possible.

4. Readings and Replications

To return to the bag of sugar, if the grocer and I disagree on the

first decimal point (e.g., 4.9 vs. 4.5), then the druggist may settle the matter for us because his scales agree consistently to the third decimal point. In general, when two measuring systems disagree in the nth decimal point, their disagreement may be resolved by a third measuring system accurate to the (n + 1)st or higher level. Of course, this principle does not hold unless we have agreement in the community about certain aspects of the three systems. Our design task is to try to understand these aspects.

The key design feature of the length measuring system is the ability to "replicate," i.e., to go through the same set of operations several times. Suppose, following Singer, that we call an output of one set of operations a "reading." Then the design specification seems to say that the readings should be in "sufficient" agreement. It is reasonable to argue that if they are not in agreement, then the system is not reliably describing reality. The converse, of course, is not so obvious: if the replicated readings agree, we cannot infer that the system is working properly. To make this point clear, imagine one of the following four conditions: (1) the object measured remains the same in length over the period of time in which the replications occur, as does the measuring rod; (2) the object fluctuates in length, while the measuring rod does not; (3) the object remains the same, while the rod fluctuates; (4) both fluctuate. Suppose, also, that the operational rules of the design system are the simplest: compare the markings on the rod with the limits of the object and, using arithmetic, report as a reading the differences. In the first case we could assume that the readings would sufficiently agree if the observers were careful. In the second and third, we would expect trouble, because the replications would not produce agreements. But in the fourth case, we might find agreement again, e.g., if the object and

the rod were made out of the same temperature sensitive material in an environment where the temperature is fluctuating. It is important to notice that the four conditions are the framework of observation of another system, the Hegelian over-observer. Our question of how the system should behave in each of the four conditions is thus Hegelian in kind: how can the over-observer be created?

Apparently the simplest cases are the second and third, where the measuring system is clearly out of phase with reality. One would expect that a "competent" observer would produce "inconsistent" readings when he made "independent" observations. The descriptors "competent," "inconsistent," and "independent" are judgments of the over-observer, who judges whether the operational steps have been carried out correctly, and whether the observer's previous responses are influencing his present observations. As system designers, we might be tempted to say that two or more readings are inconsistent if they are not exactly alike. But this would be a tactical error of design, the error of naive empiricism which tries to base all inquiry on agreement. To be sure, provided the observer is really competent and is really making independent observations, then conditions 2 and 3 cannot hold if the readings are all alike <u>within the level of refinement of the readings</u>. But an inquiring system faced with an endless set of identical readings would never be able to determine whether condition 1 or 4 holds, or whether 2 and 3 hold at a more refined level of observation. The situation is a very familiar one in all experimentation which permits replication of observation. The experimenter wishes to test a hypothesis, and finds that his readings are in agreement with his theory within a specified level of refinement. No amount of additional testing with the same results would ever enable him to decide whether another hypothesis, also compatible with the data, is false, or

whether his own would fail at a higher level of refinement.

5. Partitioning (Refinement)

To Singer the tactical lesson seemed clear: whenever all readings are identical, then the inquiring system must shift to a higher level of refinement. It should be emphasized at this point that any such tactical decision of the inquiring system, like all tactical and strategic decisions of any system, involves an ontological commitment. In the present case, the inquiring system commits itself to the idea that every meaningful descriptor of natural objects can be "partitioned." We say that a descriptor P is partitioned into descriptors P_1, P_2, ..., P_n if the following hold:

(1) If "X is P_i" ($i = 1, 2, \ldots, n$) is judged to be true by the inquiring system, then so is "X is P"; and

(2) If "X is P" is judged true, then either "X is P_1" or "X is P_2" or ..., or "X is P_n" is judged true; and

(3) "X is P_i and X is P_j" ($i \neq j$) is never judged true; and

(4) $n \geq 2$.

One interpretation of these stipulations merely says that a partitioning is an exhaustive and inclusive division of a set into at least two parts, but this is a special case of more general conditions. The inquiring system may use set theory as a basis of its judgments, but it need not do so. Often in the history of science the judgment has been based on a Lockean community agreement (e.g., in physics that there are exactly two kinds of particles, or in chemistry that there are n elements, or in biology m species, etc.).

The ontological assumption of partitioning is often expressed in terms of "quantification," because the number system provides a very convenient way of satisfying the four stipulations. Indeed, the essence

of the "qualitative" is captured by the ontological assumption that nature can be reduced to a set of descriptors which cannot be partitioned. As we have seen, this assumption poses awkward, but not necessarily insurmountable, problems for the inquiring system. This is a point which we shall examine in the latter part of the book when we speculate about the problems of inquiring systems. Although quantification permits a very elegant way for the system to explore alternative explanations of natural events, it may also exclude a whole aspect of nature, e.g., the unique individual who cannot be pursued down the endless pathways of partitioning.

Singerian inquiring systems, then, are quantitative in the sense specified above, so that the rule to partition whenever complete agreement of readings occurs is assumed to be a meaningful rule in all cases (although it may be extremely difficult to implement). The rule is applied until the system reaches a level of refinement of its readings where not all readings agree.

Now if the readings disagree at some level, e.g., in the third decimal place, how should the inquiring system decide which of the four cases specified on page 9 actually holds? The question is one of the "analysis of variation," i.e., of deciding whether a variation or disagreement is significant or not. All Singerian inquiring systems face this problem, whether the inquiry is about lengths, or about the planning of urban housing; or computing income taxes. In the case of length measurements, the system may take advantage of the immense technology of statistical "analysis of variance," which is a special case of the analysis of variation, based on a theory of randomness of natural events. In areas like housing and income taxes, the technology becomes one of politics and law. We see a new dimension in the Lockean community, which

in effect creates disagreements in order to attain a higher level of agreement.

But has the partitioning rule gained us anything? Here again the answer to this strategic question depends on a whole system judgment. In its simplest form, the assumption says that if two contrary hypotheses are both consistent with a set of adjusted readings at a specified level of refinement, then there exists some higher level where one (or both) will fail to be consistent. But this simple form is rather deceptive, since it does not take into account the tremendous resilience of general hypotheses about the natural world, nor the strong relationship between hypotheses and readings. Indeed, when the inquiring system decides that a hypothesis is not consistent with a set of readings, it may adopt one of the following policies: (a) revise the hypothesis by adding new variables, or changing the functional form of the hypothesis, (b) revise the procedure of adjusting the readings (including discarding one or more of them as being incorrectly obtained), or (c) tolerate the inconsistency until more evidence is available. Hence the role that partitioning plays is to bring the inquiring system to a stage where it must decide between these alternatives, the more sophisticated assumption being that refinement of readings will eventually produce this stage.

6. Kant's Problem: Design the Process of Revision

We can now appreciate the most subtle and difficult design problem of Singerian inquiring systems, which, in honor of its originator, might be called Kant's problem. It is the problem of revision of the a priori (Kant) or Weltanschauung (Hegel) or natural image (Singer): when and how to revise. The design problem depends on the response to the teleological question, why revise, which in turn depends on the purpose and measure of performance of the system.

Actually, Kant's design problem goes back to the Leibnizian and Lockean inquirers as well. Leibnizian inquirers permit a kind of competition among world views, or fact nets, so that the design of when and how to revise becomes a consideration of the relative weight of each competitor. In Lockean systems, the design idea is to create a community of reasonable men, whose agreements become the basis of when and how, and even why. The community seems to work best when it does not make explicit the grounds of its agreements. But Kant and Hegel try to make the inquirer self-conscious. Kant argues that the community shares a common a priori mode of shaping and interpreting sensory responses (time, space, causality, etc.). Implicit in Kant's argument is the question whether the shape imposed on the data is appropriate. Once we pass beyond Kant's own reply (there is only one way to shape the data), we are in the land of the strategy of design with no clear guideposts. Hegel's design suggestion is just the opposite of Locke's: whenever the community builds up a strong agreement in a Weltanschauung, then create the counter-Weltanschauung. What Hegel leaves unanswered is the question whether such a procedure of disagreement gets us anywhere.

With Singer, the design problem becomes much more explicit than with any of his contemporaries. Most philosophers of science of Singer's time were devoting their energies to a "logical reconstruction" of science, using the new and very powerful tool of symbolic logic. In the language of this essay, they were trying to determine how science has been designed. They were wise enough to see that science is <u>not</u> what scientists do, because scientists, being human, are often foolish and perverse even when they are "doing science." Rather, the logical reconstructionists believed that they could cull the essence of the scientific method by sorting out the inconsistencies and confusions through logical analysis. Thus they

believed that there has been a basic design of science, and that the design structure can be excavated by removing all the rubble. The success of the logician in revealing the design structure of mathematics probably gave considerable reinforcement to their conviction. But the logical analysis of mathematics at best revealed only the design features of proof, and not of discovery, i.e., revealed how problems ought to be solved, given the conditions, rather than what problems ought to be solved. In systems language, the logicians learned something about the tactics of mathematics, but comparatively little about its strategy. In the area of empirical science, the venture was successful at the tactical level if one could assume a warranted data base, i.e., a set of atomic assertions about the natural world which are unassailable. Since it is almost always strategically unsound ever to design an inquirer which commits itself strongly to accepting a data base, the tactics of logical reconstructionism have very limited application. The strategic error of logical reconstructionism, for Singer, lies in its attempt to reconstruct the inquiring system by the use of only one discipline of inquiry, logic. Singer, on the other hand, saw the necessity of using the whole scope of inquiry to aid in the design task. As we shall see in the remainder of this essay, the definition of "whole scope of inquiry" is itself a difficult and elusive problem, but it is almost certain that the whole scope is not limited to any one discipline, or, indeed, to all the disciplines as they are recognized today.

To pursue the underlying ideas of Singer's design, we should explore at greater length his design idea of "adjusting" readings by returning to the four simple relationships between the measuring rod and the object measured. Suppose the measuring system adopts a natural image in accordance with the first type of assumption, namely, that the measuring rod and the

object-to-be-measured remain invariant. But suppose, also, that the readings are judged to be significantly different. At this point, the measuring system is faced with a strategic problem, as we have noted. Suppose it chooses to change the image to option (2), that the rod remains invariant but the object changes. In doing so, the measuring system must create an image which stipulates how the object changes with time or some other measurable variable. The situation is a common one in industrial quality control; to test a lot of bullets, for example, one takes a sample, fires them through a "standard" barrel, and takes readings of the velocity. However, the object being measured (bullet velocity at the end of the barrel) changes over time, or, more precisely, with the number of bullets tested; the decline in velocity can be taken as linear by the measuring system. Once the coefficients of linearity are estimated, the measuring system is in a position to estimate, for each reading, what velocity would have been obtained had that reading occurred on the first trial, when the barrel was brand new. Thus the measuring system is able to take the ith reading and "adjust" it back to the first reading. In other words, the measuring system has been able to adjust condition (2) (changing object) to condition (1) (invariant object) by adjusting the imagery.

At this point, those who hold precision and certainty as high values of the inquiring system may feel that the whole foundation has slipped. Once the measuring system engages in the game of adjusting imagery, and hence data, to "save" its view of the world, all fundamental control seems to be lost: there is no ultimate court of appeals. One has only to recall the very flexible and subtle strategies open to the Ptolemaic geocentric theory to see how far this game can be extended.

But such a reaction arises out of the kind of parsimony that no

longer is suitable as a criterion for the design of inquiring systems. The parsimony arises out of a desire for authority or authorization in design. The word "authority" derives from the concept of leadership, a component of the system to which one can turn when in doubt. It is similar to the concept of control, which implies that a component can observe and correct the behavior of the system. But Singerian inquiring systems have no such component. Put otherwise, authority and control are pervasive throughout the system and have no location; the system is controlled, but no component is the controller. The idea has already been mentioned several times, under the labels "tactics" and "strategies"; a tactical decision assumes an authority, while a strategic decision does not. Thus a Singerian inquiring system must bring in the whole breadth of inquiry in its attempt to authorize and control its procedures.

7. Revision Opportunities: The "Sweeping In" Process

Singer describes one such process, which he labels a "sweeping in" operation. In the example cited above, where the object changes, the measurer can "sweep in" variables and their laws which enable him to adjust his readings. One sees that it would be very helpful if the inquiring system had a catalogue of opportunities in this regard, and that the traditional problem of the classification of the sciences might provide some clues. Singer's method follows a traditional one of starting with logic and noting the dimensions added by each science in turn. Thus arithmetic adds number and numerical laws; geometry adds point, line, plane, etc., and the laws of space; kinematics adds time and pure kinematical laws; mechanics adds mass and mechanical laws; physics adds groups and fields and statistical laws ("randomness"); biology adds function, organism and purpose and teleological laws; psychology adds mind and psychic laws; sociology adds groups of minds and group laws;

ethics adds ultimate purpose and moral laws.

The sweeping in process consists of bringing concepts and variables of this catalogue into the model to overcome inconsistencies of the readings. Thus, in the examples cited above, temperature and barrel wear, both physical variables, were incorporated into the measuring system's image of nature. In the nineteenth century, Bessel was able to account for discrepancies by sweeping in the reaction-time of observers, a psychological variable. We see again that Singer's design idea is one more way of building Leibnizian fact nets, and that one may view the history of the design of inquiring systems as the elaboration of the basic design features of the Leibnizian inquirer.

The construction of this catalogue of opportunities is a very difficult design task, as can be seen in the literature dealing with the topic. Some logicians dispute the contention that arithmetic "adds" anything new; relativists argue whether kinematics is separable from geometry; in quantum mechanics, statistical laws are taken to be basic (so that mechanics and physics are not separable in the catalogue); molecular biology struggles with the problem of teleological and deterministic laws for biology, while computer sciences cheerfully use teleology (e.g., in problem solving) to describe the behavior of machines. Of course, a great deal of the dispute depends on what one means by "adding" a new dimension. Here Singer himself seems to be confused, because sometimes he regards the new dimension, e.g., number, to be a primitive (not definable, say, by the concepts of logic), while sometimes he regards it to be definable (e.g., he defines purpose and life in terms of physical concepts).

Nor is it clear what the progression of the sciences means from a design point of view.* One might say that the inquiring system should

explore as low as possible in the progression before going to a science at a "later" stage. But such a strategy would be foolish. For example, it is well known that one reason why inconsistent readings are obtained between laboratories following the same measurement procedures is the different training of the observers. It would be foolish to explore physical variables to account for the inconsistency when this more or less obvious socio-psychological variable is available. Furthermore, there is no sound reason why the inquiring system should "start" with logic. To be sure, all inquiry uses logic, but then, as we have seen, all inquiry uses every branch of inquiry. Logic itself can be regarded as a derivation of social communication, i.e., as a branch of sociology.

Sometimes the catalogue of inquiring system concepts is likened to a lattice framework of interconnected concepts, but this analogy only weakly portrays the depths of the problem. The complexity of the interconceptual design is better illustrated in that episode in physics when wave and particle imagery were recognized as legitimate dual Weltanschauungen. To be fanciful, the catalogue program calls for interpreting chemistry as a teleological science (so that, for example, the fragmentation of the sample in Chapter 0 is an attempt to minimize some variable of the system); or calls for interpreting physical particles as living things; or calls for conceiving all scientific laws as moral laws; and so on. All of the recent hue and cry for "interdisciplinary research" by foundations and other supporters of science might be regarded as a response to the collective unconscious realization that human knowledge does not come in pieces: to understand an aspect of nature is to see it through "all" the ways of imagery.

8. The Strategy of Agreement Revisited

We can begin to sense the endless process of the Singerian inquiring

system. This feature of its design can be emphasized if we examine further the strategy of agreement. We have already seen one departure from the terminating strategy of the Lockean inquirer, when all the readings are alike. The argument was that an increasing number of like readings did not increase the system's confidence in an hypothesis, because there exist counter-hypotheses which are also in agreement with the readings. This argument extends to the case where the readings differ, but the differences are judged to be satisfactory. At such a stage, the strategic question is whether or not the system should seek a counter-hypothesis. The spirit of the Hegelian inquiring system on which Singer built his theory of inquiry says that when all is going well, and data and hypothesis are mutually compatible, then is the time to rock the boat, upset the apple cart, encourage revolution and dissent. Professors with well established theories should encourage their students to attack them with equally plausible counter-theories. This is the only pathway to reality: whenever we are confident that we have grasped reality, then begins the new adventure to reveal our illusion and put us back again in the black forest.

But the process is dialectical, which means that two opposing processes are at work in the inquiring system. One is the process of defending the status quo, the existing "paradigm" of inquiry, with its established methods, data and theory. The other is the process of attacking the status quo, proposing radical but forceful paradigms, questioning the quality of the status quo.

Singer in the quotation at the end of Chapter 0 called the "real" an "ideal," and we can see why. The idealist is a restless fellow who sees evil in complacency; he regards the realist as a hypocrite at times, because his realism is unrealistic. The realist, on the other hand,

accuses the idealist of being impractical, because his insistence on destroying the value of the present way of life precludes positive action. The Singerian inquiring system does not seek to resolve the philosophical dispute, but, on the contrary, seeks to intensify it.[2]

9. The Teleology of Inquiry

Singer made the theme of endless process a central one in his philosophy; his name for the restlessness he has in mind is "contentment."[3] What appear to be opposites, the restless and the contented, become the opposite sides of the same idea, when we realize that "contentment" comes from the Latin "continere," to "hold together." The contented life is the complete life, made up of all those aspects of a life that make it meaningful. But to be restful is to establish oneself in only one sector of a life, and to ignore the rest. So to be "contented" is to be restless.

But "restless" does not really capture the essence of Singer's idea, because it too often connotes pointless, whereas the Singerian inquiring system is above all teleological, a grand teleology with an ethical base. If we use the scheme on page 00, the following characteristics emerge:

1. The inquiring system has the purpose of creating knowledge, which means creating the capability of choosing the right means for one's desired ends.

2. The measure of performance is to be defined as the "level" of scientific and educational excellence of all society, a measure yet to be

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[2]I tried to portray the drama of the dispute in Chapter 14 of Challenge to Reason, New York: McGraw-Hill Book Co., 1968.

[3]See his On the Contented Life, New York: Henry Holt & Company, 1936.

developed.[4]

3. The client is mankind, i.e., all human teleological beings.

4. The components have been the disciplines, but the design of inquiry along esoteric, disciplinary lines is probably wrong, as we have seen, if the purpose is "exoteric" knowledge, i.e., knowledge that goes outward to be useful for all men in all societies.

5. The environment of the inquiring system is a very critical aspect of the design. Singer's theory of value is essentially "enabling." That is, ethical values are based on an assessment of man's capability of attaining what he wants, and not an assessment of the goals as such. Thus the ethical system apparently passes no judgment on the quality of a man's life. But this appearance is deceptive, because one man may want to deprive another of his life or liberty. Hence the environment which the inquiring system critically needs is a cooperative environment, where A wants that goal which will aid B in attaining his goals. One sees how fuzzy the boundaries of the inquiring system become, because inquiry is evidently needed to create cooperation and cooperation to create inquiry. This is why the design of a Singerian inquiring system eventually becomes the design of the whole social system.

6. The decision makers are everyone--in the ideal. But at any stage, there will be the leaders and the followers. For Singer, the most important decision makers are the heroes, those inspired by the heroic mood to depart from the safe lands of the status quo. More needs to be said about these men and their moods when we assess the inquiring system

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[4]Singer used to speculate on the suitability of using the standard deviation of a physical constant (e.g., the velocity of light in vacuo) as a surrogate measure. But this speculation was made in an era where physical science was held in high regard, and it was not naive to expect that the findings of the scientists would be published and aid all men in the pursuit of their goals.

vis-a-vis the concept of progress.

7-8. The designers are everyone--in the ideal. Progress can be measured in terms of the degree to which the client, decision maker, and designer are the same. This stipulation may seem odd in one regard, at least. If the client is all mankind, then how can those who have died be served by the living system? Worse still, since the ideal is never attained, the system must inevitably fail to serve all cients. But the thesis that once a man has died he can no longer be served is not a tautology, and indeed may be challenged by the counter Weltanschauung that all men are immortal in terms of being clients. It is not even necessary to postulate individual immortality. To worship one's ancestors may simply be the act of regarding their life intentions as sacred as our own and our progeny.

9. I have purposefully stressed the theme of betterment in the foregoing account, even to the point of a kind of simplistic optimism. It is doubtful whether Singer himself would have so strongly expressed his hopes for mankind. The counter-argument is most strongly reinforced when we ask for the nature of the inbuilt guarantor which gives sense to the optimism.

10. Science and Imperatives: The "Is" and the "Ought"

The fact that the Singerian inquiring system has no real terminating point on any issue brings out some interesting features of its language. The language of such an inquiring system needs to convey both what has been learned and what has not been learned. In a language like English the indicative mood of expression ("This apple is green") is reasonably capable of expressing what has been learned, but is very poorly designed to express the unlearned. Singer suggested, instead, that the language of the inquiring system requires a departure from the form "X is P" as

regards all three of its parts: subject, verb and predicate. To express the uncertainties of the finding, one needs to convey the idea that the subject in the inquiring system's finding may not be the real subject which a specific question about nature has raised. The predicate should somehow express the latitude of uncertainty about the descriptor, e.g., by conveying some range of possible values. Finally, the verb should convey the information that the finding is a judgment of a Lockean community, based on its self-imposed rules.

In place of "X is P," Singer therefore suggests something like "The object observed is to be taken as having property P plus or minus ε." The "is to be taken" is a self-imposed imperative of the community. Taken in the context of the whole Singerian theory of inquiry and progress, the imperative has the status of an ethical judgment. That is, the community judges that to accept its instruction is to bring about a suitable tactic or strategy in the grand teleological scheme. The acceptance may lead to social actions outside of inquiry, or to new kinds of inquiry, or whatever. Part of the community's judgment is concerned with the appropriateness of these actions from an ethical point of view. Hence, the linguistic puzzle which bothered some empiricists as to how the inquiring system can pass linguistically from "is" statements to "ought" statements is no puzzle at all in the Singerian inquirer: the inquiring system speaks exclusively in the "ought," the "is" being only a convenient façon de parler when one wants to block out uncertainty in the discourse. As a computer programmer would say, the whole design is instructions, including the "data base."

11. Progress or Process? The Heroic Mood

Singer's theory of progress is far more subtle than the theory of "linear progress" which was popular in the nineteenth century. To

understand it, one needs to adopt a dialectical point of view. On one side, call it the light side, is production-science-cooperation, the trilogy of nineteenth century optimism. The progress towards this trilogy is towards a world of enlightenment, where men have the means to live out their individual lives in their own unique ways, without having to disrupt the lives of others, or, more strongly, with the natural urge to help others to enrich their lives. But the lessons of history tell us that when production and science begin to dominate, then society becomes fragmented; only some men reap the benefits and do so by exploiting the environment and their fellow man.

"Oh," says the scientist, "then we must use our science to see how we can get men to cooperate more, to reduce population growth rates, air-water pollution, labor exploitation. The measure of progress must include cooperation, which cannot be separated from production-science. Refining our measures and producing more effective machines is not progress if thereby more conflict occurs. In other words, progress is not linear, but a very complicated non-linear relationship between the enabling forces of production, science, and cooperation."

This is all very well, but one cannot help noting who is speaking: the scientist. He wants to make science, i.e., the inquiring system, the leading edge of progress, because for him there can be no progress without understanding. Even if we grant him his premise that science has created more and more knowledge, why should we also grant him his other premise that the net benefit has been positive? Why not simply say that making knowledge is like any other form of life: it happens and it is neither good nor bad. You make knowledge, he makes love; you both simply live out an existence.

To Singer, such a charge to the scientific community is based, not

on so-called scientific evidence, but on a "mood," a complex of emotions which arise out of man's ancestry.

Had Singer written later, he could have used the wealth of material which Jung and his followers have collected to illustrate the force of the "collective unconscious" on the human psyche. Singer found his clue in but one albeit important aspect of this force, the heroic mood. Joseph Campbell has well described the structure of the mood in his Hero with a Thousand Faces.[5] The myths of the hero, he says, begin with some stable state of affairs, a comfortable house, beautiful wife and children, high respect, in short, plenty of production-science-cooperation. Then comes the impulse for the adventure or quest, sometimes in the form of a message from the gods, or other heroes, but in any event the hero has no choice but to go forth, to leave the comforts for a kind of cold darkness. Beasts and evil spirits keep challenging him in the dark forest. In our drama, the black forest and its challengers are the mood that progress does not exist, only a process at best, that the enterprise is no enterprise at all. For the hero in the midst of his journey has no assurance that anything will happen except his own death and that of his companions. At this stage, the idea of progress and fulfillment seem very foolish indeed. The stage need not be tragic or ominous, of course; it may be humorous, playful, silly, lovely. Then science and its great big serious program of knowledge, control of Nature, and the rest looks utterly ridiculous: fat science proclaiming it will save the world while it odoriferously defecates in public.[6]

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[5]New York: Meridian Books, 1956.

[6]For the contrast, see James Hillman, "Senex and Puer: An Aspect of the Historical and Psychological Present," Offprint from Eranos-Jahrbuch, XXXVI/1967, Zurich: Rhein-Verlag, 1968.

But then the hero--or some heroes at least--arrive at their goal, fight the ultimate battle and win. As in the case of the Buddha, the battle may be a spiritual one, or for our inquirer, an intellectual one. But this is not all; the hero must return, and there is usually much to tempt him to stay and not bring back the fruits of his labors, just as Newton hid many of his important discoveries in his study. For the journey back means leaving the heights of heroism for the mundane, boring, everyday existence. Furthermore, the trip back is usually another black forest and its challengers, but this time the other side of the forest is dullness.

It is very important to note that the hero's journey is not restricted to great men-to semi-gods. The hero is in every one of us, and it is impossible to say whether a Newton or Theseus is a greater hero than the individual who risks his security in the quest for self-knowledge. To be sure, the heroic mood is often suppressed by other emotions and thoughts; to free it in every man is an ideal, the ideal of a unified decision-maker, client and designer.

But what about the question: is there progress or merely process? Which is the same as the thematic question of this essay: does the inquiring system generate knowledge of reality or its own form of illusion?

The response is: it depends on where you are. If you are at home, in the status quo, there is a kind of quiet progress, an orderliness, cleanness, comfort, in which little discoveries here and there push back the decimal places and provide better ways of doing things. If you are on the road, then there is no progress, just change, which can be bright or dark, funny or sad, tragic or comic. The rules are gone, laws make no sense. If you are fighting the battle, or whatever the mission may be, you are risking your soul for something overwhelmingly important and

central. Progress is no longer diffuse, but here and now in your actions; revolution is one word for it. If you are on the way back, you may be disillusioned, angry, dead in spirit, or playful, or senile.

12. The Guarantor

Can we design the heroic mood? Jung, in his The Undiscovered Self, tells us about two views of the human psyche. In the one, man is counted and classified. The wonder is the diversity, but out of the diversity comes the need to lead, to pass regulations which tell us which classes of people can do what, regulations which become the State. The other world view is the unique individual and his relation to something more wondrous than himself. One might be tempted to say that design belongs only to the first view of the human being, but this would be much too hasty a judgment. The hero's quest, which is universal across mankind, is one example of a unique relationship of an individual to his God; it cannot be "designed" by any of the typical methods of design which we have discussed thus far. But design is very young, practically a baby. What would design have to be like for us to be able to design a unique individual's relationship to his God, or to design an heroic mood?

We have come by a long route back to the issues of Chapter I, where we placed design and creativity together to examine their similarities and differences. The entire excursion could be regarded as a search for more understanding of these two dialectical concepts; the question remains the same in kind but is a book long in its asking: can design grasp the essence of the creative in each one of us?

I don't know any sensible response to this question, although I think the question itself is sensible. I could try the head-on approach of defining the illusive concepts that have crept into the Singerian design while I wasn't watching: hero, mood, tragedy, comedy, unique and

God, among others. Then I'd define design, and there we'd be. At least we'd be moving, processing. But my mood suggests another kind of adventure. Very often, I've found, in the tales, the hero spends an incredible amount of time just wandering around, apparently getting nowhere, or worse, being blown farther away from his quest. The approach is circumambulatory, a marvelously long word for a confusion. So in the remainder of this essay I'll walk around the issue of a meaning of design which could encompass the heroic mood and other aspects of the creative.