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Order or Chaos?

Can History Be A Science?

The spread of scientific method to field after field of investigation is the legitimate pride of the post-renaissance western world. The lusty, rising bourgeoisie had no use for the old "god-given" answers or pre-scientific theories of nature. The old myths, divorced from practice, were a barrier to the now-possible vast expansion of production and commerce.

Feudalism in turn recognized modern science as an enemy —that is, as the partner of a class hostile to feudalism— and fought science doggedly, especially through the church. Proposition after proposition which we take for granted today as obvious has a history of struggle against being condemned as heresy. We take natural science for granted only because we have a modern bourgeois education. But Newton, for example, dedicated great effort to harmonizing his conclusions with the teachings of his church. And Newton's predecessors include such as Galileo, who recanted his findings under threat of death, and philosopher Giordano Bruno, who had the misfortune to endorse Copernican astronomy at a time when the feudal church was strong enough to retaliate by burning him at the stake.

But things are different today, and free inquiry is the rule. True? Before we give too much credit to freedom of science under capitalism, let us note first that the discoveries of **natural** science have not, in the main, threatened bourgeois rule (they did threaten feudalism's god-ordained stability.) Therefore, a nation like the U.S. can encourage this boasted free inquiry—in certain areas of the natural sciences. But

the discoveries of **social** science can threaten bourgeois rule; and it is in this area that our freedom of education is put to the greater test and found completely wanting.

In the early, revolutionary days of bourgeoisdom, thinking men may have had a heady assurance that the more deeply they penetrated the laws of nature, the more they allied themselves with the rising cause of liberty, equality, and fraternity—that is, bourgeoisdom's liberty to buy and sell, equality under unequal laws, and patriotic fraternity in fighting bourgeois wars.

But this assurance, that the unearthing of scientific truth would in all cases be welcomed by the bourgeois ruling class, soon had to be replaced by a more conditional view. As the new proletarian class grew, new ideas forced themselves to the fore. Investigation freely and deeply pursued began to turn up evidence which called into question the eternal rightness of bourgeois rule. This was especially true as investigation approached the domain of human affairs—in the social sciences. Careful editing and interpretation—at the very least—became needed and were (and are) well paid for by the ruling class.

Biology is the natural science which acts as a bridge to social science, and it is no accident that Darwin's **Origin of Species** at first suffered bitter attack, and was finally crudely reduced—for popular consumption—to a proof that the most ferocious dog-eat-dog competition produces the most noble results. You know, just as in capitalism!

Of course, even superficially it makes more sense to read into Darwin's work the conclusion that any given species makes most progress by organizing within its ranks to cope with the outside environment. Dog-eat-dog hardly applies within the mammalian herd, school of fish, or insect colony. That is, a socialist message could more easily have been drawn—and it is hardly an accident that it wasn't. (Fascinating evidence of the effectiveness of this false-Darwinian brainwashing is found in the sharp dialogues of **The Sea Wolf**, by self-proclaimed socialist Jack London, who in this and other best-sellers also used Darwin to "prove" that it is natural for man to prey on his own species.)

Capitalism's partial support of free inquiry arises because capitalism displays a feature new in history: it depends for its very existence on its constant revolutionizing of productive methods, and thus of science and thought. In biology, for instance, capitalism cannot merely replace feudalism's eternal-species myth with an up-to-date pro-bourgeois myth and then forbid further inquiry, because there are commercial interests which depend for their profits upon effective biological theory. (For instance, effective disease-control opens up tropical areas for investment and colonizer-management.) There are always investors who must strive for progress in this science or face competitive ruin. The same applies of course to the other natural sciences.

Thus capitalism cannot imitate feudalism in trying to strangle practical inquiry. But what if a line of inquiry suggests conclusions non-productive and threatening for the ruling class in general? Then, while trying carefully to maintain the facade of free inquiry which it needs for its enlistment of brain-workers, the bourgeoisie brings out the heavy artillery: money and career promised to the hack revisors, ostracism and worse to threaten the stubborn independent inquirer. Most important, within the educational system the standard textbooks and standard lectures which introduce the new student generation to the subject are carefully designed to sidestep or obfuscate the area of trouble.

As the most obvious instance, when Adam Smith, Ricardo and other classical economists plunged into the scientific investigation of the capitalist economy, it was certainly not as enemies of the bourgeoisie. They rightly considered capitalism to be a progressive force as against feudalism, and offered policies to make it work better. But their researches contained hints that capitalism might possess some disturbing long-run instabilities—hints which were later reinforced, as depressions and mass poverty sharpened the class struggle under maturing capitalism.

> With the year 1830 came the decisive crisis. In France and England the bourgeoisie had conquered political power. Thenceforth, the class struggle, practically as well as theoretically, took on more and more outspoken and threatening forms. It sounded the knell of scientific bourgeois economy. It was thenceforth no longer a question whether this theorem or that was true, but

> whether it was useful to capital or harmful, expedient or inexpedient, politically dangerous or not. In place of disinterested enquirers, there were hired prizefighters; in place of genuine scientific research, the bad conscience and the evil intent of apologetic.
>
> (Karl Marx, preface to **Capital**)

When Karl Marx and Frederich Engels in the later 1800's pushed the scientific method to new frontiers in the investigation of human society, and demonstrated that the "ills" of alienation, poverty and war were an integral part of capitalism, the bourgeois iron curtain came down on all the sciences of society. History, economics, sociology, psychology—all such fields have been placed outside the generally accepted laws of scientific investigation and progress. In these areas bourgeois education waives a most important dialectical conclusion of the modern natural sciences: that the deepest understanding of a phenomenon is reached when it is understood as having a history, as a process, as a coming to be and a passing away.

What did it come from and what follows lawfully from it? When we know this about a planet or a particle, a mountain or a molecule, a mastodon or a microbe, then are we penetrating deeply into the realities of physics, chemistry, and biology. But U.S. education says that this question of process or long-term development is not central to the study of the march of human nature and behavior. History, economics, psychology, sociology—all such sciences of social man are thus castrated or totally destroyed by bourgeois education. Why? Because the long-term answers come out wrong... for capitalism. Feudal persecution of natural science is replaced by capitalist castration of social science.

No Science of History?

The modern method of castration is similar for most of the social fields: all investigation is channelled into the refinement of techniques which will help bourgeois-democratic capitalism to hang on to its rule. Since an intellectual can do a lot of challenging work on short-term, relatively superficial cause-and-effect relations in economics, sociology, or psychology while closing his eyes to the long-term, more fundamental evolutionary questions raised in the field, viable pseudo-sciences are flourishing in these areas. Their practice might be compared with that of early practical chemistry, for instance, which performed great service for industry (breweries and tanneries especially) though necessarily without using atomic theory. That is, the social sciences are practiced as infant sciences, without expressing broad hypotheses.

But theirs is a forced infancy, an eternal childhood enforced by the establishment's educational system. Some broad hypotheses which would begin to mature them have already been suggested —mainly by the untouchable Marxists. Thus the pseudo-scientists' greatest achievements resemble the prattlings of a very bright child—one who has indeed made an ingenious technical discovery but whose childish limitations show in its presentation—a complete blackout concerning its interrelation with already-known broader questions.

Now history, insofar as it interests the bourgeoisie as a science at all, is treated in like manner: it is searched for bits of data which might help the rulers. But since history is so essentially the study of change, it is well-nigh impossible to create a bourgeois pseudo-science of history which will hang together well enough to build up a discipline of intellectual followers. If you must deny the obvious facts that capitalism itself has a chronology of change, a bloody evolution, and a probable historical end in the offing, you can't build a viable pseudo-science. The main effort of bourgeois education, in regard to history, is therefore to establish the notion that **there cannot be a science of history.**

It is not difficult, provided you have the will of the dominant industrialists and ideologists behind you, to teach history in a manner which makes self-fulfilling the proposition that there cannot be a science of history. (As a matter of fact, as I will show, given the motive it also would not be difficult to teach the investigation of all natural-physical data in the same science-destroying manner.) Thus, history texts and teachers present facts in isolated grouplets, or stirred into a meaningless jumble. Flirtation with over-all theory is tolerated provided it is western-oriented and bourgeois-buttressing—but the facts won't support such theories, which necessarily degenerate into mysticism (a la Toynbee) and repel the thinking student. When the texts and teachers examine (briefly) the work of those who have developed a cogent theory of history—notably

Marxists—the small pieces which don't fit (inevitable in any science) are vastly magnified, and the revealed broad consistencies are denied or dismissed as commonplace. In sheer self-defense students desert the field or are driven back to infant pre-science, piling up any and all details in the pious hope that later some good will come of it (at least a grant!).

The savants produced by such an educational process no doubt firmly believe that history is fundamentally different from the "exact" sciences, that there are special reasons (vastness of scope, non-reproducibility of experimental situations, human free will as an aberrant force, etc.) which make history a non-science. As we shall see, these "special" reasons arise in the mind of the history specialist only because of his narrow specialization; similar difficulties confront all the sciences.

The main effort of bourgeois education is to establish that there cannot be a science of history.

It would be perfectly possible, for instance, to teach any field of knowledge in such a manner as to destroy it as a science—and without lying too much, either. If the introductory physics courses denounced as meaningless the well-known historical whipsawing of physicists from one theory to its incompatible opposite; if they spent a disproportionate amount of time waxing sarcastic about the anomalies which theory has yet to resolve; and if, most important, they threw at the student **years and years of courses laden with unconnected facts before suggesting a theory frame** which could make sense of the jumble—if they taught that way the science would soon be wrecked and abandoned to the astrologers and alchemists. Of course, the establishment would need a powerful motive to do this—but they have this motive in the case of social science and Marxism.

If you think that the achievements of "real" science are so secure that no sane man could attack them the way the science of history is attacked, you might be surprised by a book called **Science is a Sacred Cow**, by Anthony Standen (Dutton Paperback D 16). Here is an author who has the needed powerful motive. He is afraid that, because of science, God is slipping. Though presumably a scientist himself, he snipes away at the scientific pretensions of all sciences so vigorously that one gets a taste of what the educational system would be like if feudalism were miraculously restored. A short sample may convince the reader that, given the will, the universities could make students feel just as contemptuous of the science of biology, for example, as most now are of the science of history:

> Evidently in biology there is the same tendency to utter pompous nonsense that characterizes scientists of all kinds. But does biology have the virtues of science? That is more questionable.
>
> A typical example of what passes as a theory in biology is the "cell theory." This usually rates a little potted history—"culture" again—and goes along these lines: In 1838 a German botanist named Schleiden had noticed that in a large number of plants the living tissues were always divided into cells. A year later a zoologist named Schwann made the same observation for animal tissue; the two scientists got together, and each was struck with the similarity of the discoveries that had been made in the two different fields. The theory that resulted from this is that the living tissue of **all** live organisms is divided into cells.
>
> "Today we know the cellular theory of living organisms to be a fact: it is no longer a theory." So what? Then the living tissue of all live organisms is divided into cells. This is not a theory, as the physical scientist understands theories, but a simple statement of observed fact.
>
> And yet, the biologist will candidly admit that there are some live organisms that don't have cells! They are degraded things

called slime molds. The biologists get around that by a typical scientists' quibble: all cells have nuclei (another statement of observed fact); the slime molds have a lot of nuclei, but instead of being separated from one another by neat cell walls they are scattered around like plums in a pudding; so it must be that these low organisms have degraded cells, the walls separating cell from cell having vanished away. So that quite strictly speaking, and scientists always insist that they do speak strictly, the theory (or rather the observation isn't true. (pp. 93-94)

The author sounds just like a Sidney Hook attacking the treacherous Marxists! And he could go on all day:

To pep it up a little, and to disguise the quibble, an official pronouncement may be made in some form that **sounds** as if it has a meaning, such as "The cell is the fundamental unit of all life." Anyone can learn and remember this statement, and if ever you undergo a quiz in biology, that is **the answer**, it is what you are supposed to write down. And yet what does it mean? If the cell is a unit, in the sense that bigger things are made up of it, this only means, all over again, that living organisms are made up of cells (except those that aren't). But if the cell is a **fundamental** unit, what does "fundamental" mean? Think about this as much as you like, or as much as you can, but if you are facing a quiz, do not worry about it, for you will never be asked what, if anything, is conveyed by the word "fundamental."

Another of the gloriously vague ideas of biology is "protoplasm." It is the "fundamental" living substance, the content of the cell. It, alone, is alive, and when it is dead it immediately starts to decompose, and is no longer protoplasm. There is no such thing as dead protoplasm. The chemical composition of protoplasm is excessively complicated, and is not the same in any two kinds of animals or plants, even closely related ones, and is probably not quite the same even in two individuals of the same species, but the biologists call it all "protoplasm," wherever it comes from. "Protoplasm" is a convenient word, so convenient that biologists are convinced that all that is called protoplasm is, in some mysterious way, the same, although it is different. In just what way it is all the same they are never able to explain, and so they take refuge in a high-sounding phrase, "all protoplasm is **essentially** alike." And nobody asks them what, under the sun, they really mean by this. Their meaning, in so far as they have one, is strictly mystical, or as they themselves would express it, "metaphysical."

The truth is that biologists don't think, at least not in the narrow sense of making formal conclusions, definitely arrived at from definite premises. Their mental processes go by analogy. (pp. 96-98)

If you're intrigued by that sort of thing, the whole book is full of it. And can you say he's lying? It's mostly a matter of emphasis, founded on one easy-to-sell false premise which is: unless a hypothesis is 100% proven, we have no right to use it as a stepping-stone to broader knowledge. This premise, if accepted, would destroy all science, since all data are connected to a reality which is infinite, and is never 100% known.

Biology's chief defense against such attacks is . . . to ignore them. Some day the science of history will be well enough established in the West to employ a similar defense. But that day is not yet. The following section of this article aims to strengthen the counterattack on behalf of the science of history by approaching it from a somewhat neglected angle, asking: what is a science, anyhow?

What is a "Science"?

A great deal of the success of U.S. educators in establishing history as a non-science comes from their technique of enforced narrow specialization. "Non-science" students have an extremely oversimplified notion of what characteristics a body of knowledge must display in order to be termed a science. In fact, science specialists aren't encouraged to think this through either.

What then is science; and can there be a science of society, a science of history?

An answer is suggested by J. Bronowski, an able and most widely-respected defender of bourgeois science, in his highly-praised (by C.P. Snow, Norbert Wiener, Julian Huxley, etc.) book **Science and Human Values** (Harper Torchbook TB 505G):

> To the literary man the question may seem merely silly. He has been taught that science is a large collection of facts; and if this is true, then the only seeing which scientists need do is, he supposes, seeing the facts. He pictures them, the colorless professionals of science, going off to work in the morning into the universe in a neutral, unexposed state. They then expose themselves like a photographic plate. And then in the darkroom or laboratory they develop the image, so that suddenly and startingly it appears, printed in capital letters, as a new formula for atomic energy.
>
> Men who have read Balzac and Zola are not deceived by the claims of these writers that they do no more than record the facts. The readers of Christopher Isherwood do not take him literally when he writes "I am a camera." Yet the same readers solemnly carry with them from their schooldays this foolish picture of the scientist fixing by some mechanical process the facts of nature. I have had of all people a historian tell me that science is a collection of facts, and his voice had not even the ironic rasp of one filing cabinet reproving another.
>
> It seems impossible that this historian had ever studied the beginnings of a scientific discovery. The Scientific Revolution can be held to begin in the year 1543 when there was brought to Copernicus, perhaps on his deathbed, the first printed copy of the book he had finished about a dozen years earlier. The thesis of this book is that the earth moves around the sun. When did Copernicus go out and record this fact with his camera? What appearance in nature prompted his outrageous guess? And in what odd sense is this guess to be called termed causal laws? (pp. 1-2)
>
> Less than a hundred years after Copernicus, Kepler published (between 1609 and 1619) the three laws which describe the paths of the planets. The work of Newton and with it most of our mechanics spring from these laws. They have a solid, matter-of-fact sound. For example, Kepler says that if one squares the year of a planet, one gets a number which is proportional to the cube of its average distance from the sun. Does anyone think that such a law is found by taking enough readings and then squaring and cubing everything in sight? If he does, then, as a scientist, he is doomed to a wasted life; he has as little prospect of making a scientific discovery as an electronic brain has. (pp. 10-11)

(Let that last sentence be a warning especially to the pseudo-scientists of economics and sociology who make such a virtue of "squaring and cubing everything in sight.")

Now this statement is not a bad start in correcting oversimplified notions of what science is. It reads well, and suggests a warm, human presence behind the pen. In the same engaging style Bronowski goes on to enthrone pragmatism as his philosophy, and arrives at the conclusion that the world would be a much better place if all its citizens were converted to the values of bourgeois scientists. As for a scientific investigation of history to determine whether this idealistic conversion is feasible—well, you can't be scientific about everything! But the book is just what the young atomic physicist needs to quell his doubts as he begins his U.S. career.

I do not want to discuss the theses of this book in detail, because I want to recommend it to the Marxist reader who might want to test himself or herself against an able defender of the status quo. Bronowski is no patsy. At the end of a careful reading of this short book, you will feel as if you have been swimming through miles of strawberry jam—which should be good for the mental muscles.

History as a Science

It is only one of the great merits of **Causality and Chance in Modern Physics**, by David Bohm (Harper Torchbook TB536) that it clarifies the meaning of scientific knowledge. Bohm rids us once and for all of the notions of "pure truth," "logical facts," "simple cause-and-

effect," and the like—criteria often raised to prove that history can't be a science. (How far it can and how far it can't is especially clearly shown in Bohm's treatment of geology, a science whose difficulties parallel some which face the science of history.) And unlike Bronowski, he replaces false criteria by clearly-expressed descriptions of just how scientific investigators improve their partial understanding of an infinite and ever-changing universe. That is, he spells out a modern theory of knowledge.

As I said before, this clarification is but one of the great merits of the book. Chapters 1, 2, and 5 (less than 100 pages) were purposefully and successfully planned by Bohm to stand alone as a physical philosophical treatise completely clear to the non-scientist. (Chapter 3 can also be valuably attempted, and even 4 can be skimmed.) He blithely and with dazzling clarity ticks off such topics as The Laws of Nature, Causal Laws and the Properties of Things, Contingency and Chance, The Philosophy of Mechanism, Qualitative and Quantitative Change (with a most superior presentation of the standard water-to-steam example). In a section entitled A New Point of View: Indeterminate Mechanism, the "modern" cynical philosophy (based on Heisenberg) of ultimate unknowability is paradoxically revealed as a new form of mechanical materialism. And Bohm's final chapter, simply headed A More General Concept of Natural Law, shows us what dialectical materialism means most broadly, in application to the general physical universe.

The words "dialectical materialism,' by the way, are never used in the book—and there is no reference to the scientific inquiries of Engels. But Bohm is a dialectical materialist—and better than most.

For those who are beginning or reinforcing a study of dialectics, Bohm serves as an admirable introduction to Mao Tse-tung's **On Practice** and **On Contradiction**. (I have so used it in classes, so I am not relying only upon a personal reaction in making the recommendation.) I know this sounds like a very hard sell, but this is one of those books that everyone is sorry he or she didn't read sooner.

To resume: What, then, is science; and can there be a science of society, a science of history? As a fresh starting-point for considering some of the common objections raised against social sciences, let us consider Bohm's opening paragraph:

> In nature nothing remains constant. Everything is in a perpetual state of transformation, motion, and change. However, we discover that nothing simply surges up out of nothing without having antecedents that existed before. Likewise, nothing ever disappears without a trace, in the sense that it gives rise to absolutely nothing existing at later times. This general characteristic of the world can be expressed in terms of a principle which summarizes an enormous domain of different kinds of experience and which has never yet been contradicted in any observation or experiment, scientific or otherwise; namely, everything comes from other things and gives rise to other things.

Now here is a scientist—who is by the way in the forefront of modern physics research—introducing a work on science. Yet at the outset he undermines the ideas of many about the supposedly solid foundations which set natural science off from less exact areas of investigation. Objectors to the science of history often cite the fact that society is always changing; you can't get a grip on it for study. But Bohm replies: **everything** is always changing. So the objection becomes at best one of degree—are some aspects of society, like some aspects of nature, just too hard to grasp by present techniques? Quite a different question from the easy categorical dismissal.

"Everything comes from other things and gives rise to other things." "But I thought," exclaims our laymen, "that science was scientific just because it reduced all complexities to the behavior of certain fundamental particles which just are."

"Some scientists think that," says Bohm, "but it won't stand scrutiny." "That," of course, is the philosophy of mechanism, and since the book as a whole is a thorough refutation of deterministic and modern indeterministic mechanism, I will not weaken Bohm's arguments by excerpting. Suffice it to say that he demonstrates that science progresses without having found any absolutely basic things upon which it can take a firm grip and say "that's immutably established; all knowledge builds from there."

So, the frequent objection that society

is too "circular" for a scientific investigation—that there's nowhere to start, because everything depends upon everything else—is seen to apply to the purely physical world no less than to society. The problem becomes one of finding a starting-point which, for practical purposes and within the scope of the intended inquiry, can provisionally be treated as fundamental: sufficiently independent of other relevant factors so as not to significantly skew the results. In the science of history, the most accurate, fruitful and consistent results follow, as Marx and other investigators have found, when the productive process is taken as that starting-point.

The notion that an arbitrary factor of human will makes the science of history impossible also disappears if we accept the word of science that "everything comes from other things." The role of human will can become a subject for study, not an automatic barrier.

My favorite "refutation" of Marxism, by the way, is one which often pops up in discussions of free will: "If socialism is really inevitable, why do you bother fighting for it?" I can imagine the clever fellow who asks that question striking up a dialogue with a biologist: "Is the discovery of a cancer cure virtually inevitable?" (Yes.) "Will it eventually be found whether or not you continue your research?" (Yes.) "Than why do you bother?" (!) The concept that these "inevitabilities" are inevitable precisely because many men **will** bother—this is too complex a thought for these bright debaters.

What do we mean by historical inevitability or causality? How do we deduce, for instance, that the contradictions within feudalism cause a transition to capitalism? To pursue Bohm:

> To come to causality, the next step is then to note that as we study processes taking place under a wide range of conditions, we discover that inside of all the complexity of change and transformation there are **relationships** that remain effectively constant. Thus, objects released in mid-air under a wide range of conditions quite consistently fall to the ground.... From the extreme generality of this type of behavior, one begins to consider the possibility that in the processes by which one thing comes out of others, the constancy of certain relationships inside a wide variety of transformations and changes is no coincidence. Rather, we interpret this constancy as signifying that such relationships are **necessary**, in the sense that they could not be otherwise, because they are inherent and essential aspects of what things are. The necessary relationships between objects, events, conditions, or other things at a given time and those at later times are then termed **causal laws**.

Quite a far cry from iron laws and hard facts, is it not? Obviously the passage quoted would fit quite well a

nation-by-nation study of the transition from feudalism to capitalism, or other historical researches. The question again becomes one of degree: how many observations, of how much scope and accuracy, establish how high a probability that our brains have comprehended the essence of a necessary real-world relationship?*

> At this point, however, we meet a new problem. For the necessity of a causal law is never absolute. For example, let us consider the law that an object released in mid-air will fall. This in fact is usually what happens. But if the object is a piece of paper, and if "by chance" there is a strong breeze blowing, it may rise. Thus, we see that one must conceive of the law of nature as necessary only if one abstracts from **contingencies**, representing essentially independent factors . . . Hence, we conceive of the necessity of a law of nature as conditional, since it applies only to the extent that these contingencies may be neglected. In many cases they are indeed negligible . . . But in most other applications, contingency is evidently much more important. Even where contingencies are important, however, one may abstractly regard the causal law as something that would apply if the contingencies were not acting. (p. 2)

Horror upon horror! Broad causal laws don't always tell us exactly what is going to happen in every real case. Natural science is beginning to sound more and more like that non-scientific thing called history which we hear so much about.

Bohm goes on to explain that, of course, finer investigations and extended laws may successfully deal with more and more of the contingencies, but you can't treat them all, because reality is infinite.

> . . . every real causal relationship, which necessarily operates in a finite context, has been found to be subject to contingencies arising outside the context in question . . . . if, within the degree of approximation with which we are working, all failures of verification can be understood as the results of contingencies that it was not possible to avoid, then the hypothesis in question is accepted as an essentially correct one, which applies at least within the domain of phenomena that have been studied, as well as very probably in many new domains that have not yet been studies.** (pp. 3-5)

Approximations, contingencies, probabilities—these are just as much the stuff of science as necessities. They are Nature's other face, as the title and content of Bohm's book suggest. They do not bar successful predictions in new domains.

Reality is Our Test

A most common objection levelled against the science of history is the impossibility of reproducible or controlled experiments. Now as a matter of fact socialist societies are actually conducting such large-scale controlled experiments—and, as socialism spreads and endures, more experimental data is emerging. Quite apart from this, Bohm disposes of such objections by a careful consideration of the science of geology:

> Even when reproducible and controlled experiments are not possible, and even when the conditions of the problem cannot be defined with precision, it is still often possible to find at least some (and in principle an arbitrarily large number) of the significant causes of a given set of phenomena. This can be done by trying to find out what past processes could have been responsible

*Compare Mao Tse-tung:

. . . The first step in the process of cognition is contact with the objects of the external world; this belongs to the stage of perception. The second step is to synthesize the data of perception by arranging and reconstructing them; this belongs to the stage of conception, judgement and inference. It is only when the data of perception are very rich (not fragmentary) and correspond to reality (are not illusory) that they can be the basis for forming correct concepts and theories. (*On Practive*, p. 11)

**Compare Lenin:

The standpoint of life, of practice, should be first and fundamental in the theory of knowledge. And it inevitably leads to materialism, sweeping aside the endless fabrications of professorial scholasticism. Of course, we must not forget that the criterion of practice can never, in the nature of things, either confirm or refute any human idea *completely*. This criterion too is sufficiently "indefinite" not to allow human knowledge to become "absolute" . . . . (*Materialism and Empirio-Criticism*: Collected Works: Moscow, 1962. pp. 143-143)

for the observed relationships that now exist among these phenomena.

A very well-known example of a science in which reproducible and controlled experiments are impossible (at least with methods available at present), and in which the conditions of the problem cannot be defined very well, is geology .... "What could have caused these present structures to be what they are?" ... Although (one) explanation seems very plausible, there is clearly no way to prove it by controlled and reproducible experiments. Moreover ... the number of geological formations available for study is limited, and ... each formation has so many individual peculiarities that it is, to some extent, a problem in itself .... (pp. 10-11)

The parallel with the science of history is obvious—in fact, history would seem to have somewhat the best of the comparison!

> Does this mean that there is no way to verify hypotheses concerning the causes of geological formations? Clearly not. First of all, there is the general consistency with which a very wide body of data can be explained ... Still more support can be obtained if the theories will correctly predict new discoveries ...
>
> Of course, hypotheses of the type that we have discussed above will, in general, be subject to corrections, modifications and extensions, which may have to be made later when new data become available. In this respect, however, the situation in geology is not basically different from that in fields where reproducible experiments and observations can be done .... For example, even Newton's laws of motion, which for over two hundred years were regarded as absolutely correct expressions of the most fundamental and universal laws of physics, and which had behind them the support of an enormous number of reproducible and very precise experiments and observations carried out under well-defined conditions, were ultimately found to be only an approximation. (pp. 11-12)

In other words, and this is a point which Bohm develops at length elsewhere, approximate or limited knowledge is not worthless knowledge. We don't have to know everything before we can know—or do—anything. Reality is infinite and ever-changing and never fully knowable.

> In the last analysis, then, the problem of finding the causal laws that apply in a given field reduces to finding an answer to the question, "Where do the relationships among the phenomena that we are studying come from?" .. Whether experiments are available or not, hypotheses can always be verified by seeing the extent to which they explain correctly the relevant facts that are known in the field in question, and the extent to which they permit correct predictions when the theory is applied to new phenomena. And as long as these possibilities exist, progress can always be made in any science towards obtaining progressively better understanding of the causal laws that apply in the field under investigation in the science in question. (p. 12)

I won't try to improve on that statement as a defense of the science of history. Read the book. All the quotes are from the first twelve pages of this rich work; Bohm here has hardly gotten into his subject, which is much broader than the portion I have chosen to dwell upon.

Bohm's closing sentence is:

> The essential character of scientific research is, then, that it moves toward the absolute by studying the relative, in its inexhaustable multiplicity and diversity.

Bohm himself has illuminated that diversity and furthered that move by writing this book which, as one of its many accomplishments, reinforces a positive answer to the question: "Can History Be a Science?"