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IS THERE CAUSALITY IN HISTORY?

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My theme is that time acts as a condition limiting the possibilities of science and creating the absolute horizon of our ignorance, and this differs from science to science because of differences of time scale in the subject matter.

The philosophical work of Sir Karl Popper differs strikingly from others by its wideness of scope. It covers, among other things, the methodology of science, logic, political science, history, probability theory, psychology, and the histories of science and philosophy. Sir Karl has many followers working in very different disciplines who, consequently, do not always understand each other. What might be called "the Prague appreciation of Sir Karl" was initiated by medical doctors, with a weak philosophical background, who were interested primarily in his thoughts regarding the self and its brain. But analytical philosophers, mathematicians, sociologists, and political scientists in Prague were interested in what George Soros, in his address at the Central European University, called "a totally different aspect of his work."[1] But despite his wide-ranging philosophical interests, Sir Karl's thought shows considerable consistency, closely related to his "clarity, beauty and kindness." What is the reason for the *prima facie* thematic breadth of his work? In my opinion it is the inability of scholars like me to match his universality and his exceptional capacity to apply general ideas in seemingly independent areas. Let me share with you the rather private delight that I experienced in discovering a common denominator in Sir Karl's notes on induction and demarcation of science (Popper 1980; Popper and Eccles 1977) on the one hand, and his fight against historicism (Popper 1957) in political science on the other.

First, I will briefly describe the initial conditions of my hypothesis. Let us assume, in accordance with Popper's philosophy, that induction does not work and that it will lead, *sooner or later,* to a dead end. So general theories cannot be derived from individual events. But they can be refuted by individual events, because these can contradict the description of facts[2]. This implies that the predictive power of induction is time-limited. Popper's example with swans (Popper 1980) is a good illustration. Popper tried to find a demarcation line between science and pseudoscience, or, to put it differently, between critical thinking and dogmatism. He was inspired in this by Einstein, who stated at a lecture in Vienna in May 1919 that it would be necessary to forsake his theory of relativity if observation did not find the changes in the red shift that he predicted would be caused by gravity. That was Popper's stellar hour: science in fact puts forward hypotheses that it is possible to test. In Popper's terminology, "possible to test" means "possible to falsify," possible to disprove. If somebody says, for instance, that all swans are white, and I show him a black one, then he has two possibilities: either to correct his original statement, which represents the scientific approach, or to say that the black one is really not a swan.

Popper calls the latter response "the immunization of a hypothesis." One who immunizes a hypothesis against any kind of falsification can always claim to be "right," but this is why Popper cites Einstein's statement of how to refute his hypothesis as an example of the genuine

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[1] The Open Society Prize. The ceremony held at the CEU, Prague on 26 May 1994. In Memoriam Karl Popper in Prague. CEU&3.LFUK, Prague, 1995, p. 34.

[2] The theory always comes before the fact: the fact either disproves the theory or not. It never happens the other way round. Science always uses deduction.

scientific attitude. A scientist, for Popper, is someone who, like Einstein, is able and willing to give a description of circumstances in which his hypothesis would be refuted. For instance, psychoanalysis is an example of a pseudoscience. If you go to see a psychoanalyst, and she treats you and you then feel better, she will say: "You can see now that it works, you are feeling better already." But if you feel worse and do not want to continue the treatment, she will say: "Now you are in the expected stage of resistance and this proves that everything has worked as it should." Marxism also immunized itself in this way, remaining unshaken after *history disproved* its postulates one by one.[3]

Now I have italicized the temporal references printed here—*sooner or later* and *history disproved*—in order to emphasize that science always leaves a theory open for falsification in the future. That is why induction does not work on a long-range scale. It may seem obvious that the sun will rise tomorrow morning. But there is no guarantee that this is true for days $D_{(1, \ldots, n)}$, where $n=\infty$. Similarly, the hypothesis that all swans are white can be regarded as true *until* someone shows us a black one. This is why Popper argues that scientific method is a permanent confrontation of theories with facts. Science, in other words, works by permanent attempts at falsification. And falsification occurs as a result of deductive, and not inductive, inference. It occurs when the facts contradict the theory.

But now comes the crucial moment. Scientific trials arranged to falsify hypotheses are feasible only on a time scale that is comparable with a human life. If we accept Popper's rejection of induction as scientific method, then we have to conclude that the scientific approach is not feasible on very large time scales. Natural laws make it possible to predict events.[4] But where the falsification of theories is missing, it is also impossible to discover laws. This is the case with large time horizons. This is the reason why Darwin's evolutionary theory is not really a theory of biology, but rather a history of nature. Simply put, it has virtually no predictive power.[5] Astronomy is another example. It can test predictions only on a very limited time scale. Despite, or should I say due to, the incredible diflferences in the age of the light which draws in the sky the picture of a far-away universe, scientists can project time into one "current" moment or "cinema picture." But they cannot predict any significant new event in space, not even the appearance of a supernova or the extinction of a star. On the other hand, the gravitation laws enable us to predict short-term events, like the free fall of a stone, or tomorrow's sunrise. Time acts as a condition limiting the possibilities of science and creating the absolute horizon of our ignorance.

The order of scientific disciplines sorted according to their achievements (practical applications, number of publications, progress over the centuries, etc.) correlates well with the size of the time scale with which they deal (see table 1). There are, however, some exceptions and complications, when, for example, rapid scientific achievements in technology can be applied to "long-time" disciplines like astronomy and geology. The speed of the processes that are studied also plays a role. The second important factor is the degree of complexity of the system that is studied. According to F.A.Hayek (Hayek 1952), there is no chance that the human brain[6] could understand a system that is more complex than itself. But human society represents

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[3] One little postscript to this: Popper distinguishes between honest and dishonest immunization. An honest immunization defends a theory by expectations that can themselves be falsified. When, for example, Newtonian physicists claimed that there must be another planet beyond Uranus because they could not explain the deviation of its course from Newton's calculation in any other way, they immunized their theory of the movement of cosmic matter. But this immunization was itself falsifiable. And when methods of observation improved, they were found to be right. Their immunization contributed to the search for and eventual discovery of Neptune. Dishonest immunization, on the other hand, makes it impossible to falsify any hypothesis. According to Popper, the unscientific is everything that is not falsifiable.

[4] The term "prediction" (to predict = to tell in advance) is related to "correlation," "causality," and "forecasting."

[5] Not one new species has been predicted since evolutionary theory was introduced.

[6] "If the human brain was so simple that we could understand it, we would be so simple that we could not." Emerson Pugh.

just such a system. And Hayek suggests that, in fact, the only way in which we can bring order into chaos is to let it arrange itself (Hayek 1990).

History, as a subject of scientific method, shares both of these handicaps. It studies an incredible complexity of billions of interactions among individuals. And it does so on a time scale that is too large to be studied using scientific trials. Popper's rejection of historicism[7] is therefore a logical consequence of his rejection of induction and of his demarcation of science from pseudoscience.

Table 1

Discipline (in order of progressiveness)	*Time scale of studied events*
Electronics	milliseconds
Nuclear physics	seconds
Chemistry	seconds
Biochemistry	seconds—minutes
Molecular biology	minutes
Physiology	minutes—hours
Pharmacology	hours—days
Biology	years
Medicine	lifetime
Humanities	tens—hundreds of years
Historical and political sciences	hundreds of years
Evolutionary biology	thousands of years
Geology	thousands of years

Finding a law that makes prediction possible may be closely connected with the discovery of a cause. And the presence or absence of a cause may have significant predictive power. But my question is: "Can there still be causes of historical events, if scientific method is not applicable in history, and there is, therefore, no possibility of predicting them?"

There is a well-known tendency to mistake prediction for causality in contemporary science, as predictors are often suspected of being the cause of the events that they predict. Causality means that all phenomena occur as consequences of other phenomena. But the relation of two or a few phenomena (their "correlation") is always a rough abstraction. There are at least two types of "causes": crucial stimuli and conditions. The influence of crucial stimuli in history is not falsifiable in properly designed trials because of the extremely large time periods to be tested. The conditions are permanently changing, so their influence can hardly be detected. Human and animal purposes complicate matters. Taking the subjectivity of animals into account, it is preferable to talk about a *reaction* rather than a consequence. And as the period of time between "cause" and "consequence" gets longer or irregular, the correlation often becomes fuzzy and difficult to find. Purpose, moreover, is an *important feature* complicating the one-way temporal direction of causality.

Aristotle in *The Physics* (1; 2, VII, 198a) saw four main kinds of causes: substantial (Latin *Causa materialis,* Greek AITIAI HYLÉ); formal (Latin *Causa formalis,* Greek AITIAI EIDOS); moving (Latin *Causa movens,* Greek AITIAI TO KINÉSAN); and purposeful (Latin *Causa finalis*, Greek AITIAI HU HÉNEKA). This understanding of order was replaced in the eighteenth century by the mechanistic materialists Holbach (Holbach 1770) and La Mettrie (La Mettrie 1747), who, following the discoveries of Galileo and Newton, understood causality in

[7] Historicism, according to Popper, says that we have a chance to discover laws that would enable us to predict history. Historicism, in other words, sees an analogy between historical and natural sciences.

the mathematical sense as a transfer of energy from one body to another. But this idea of causality is not applicable in history. And it was then criticized by the empiricists, who stressed that cause is nothing but habit. According to Hume, the only reason to infer causality between two events is their constant temporal conjunction. And were it so, causality could not be distinguished from correlation. But this kind of causality is also not applicable in history, since history emerges in singularities, and significant correlations are between typical or repeatable events. After Hume, Immanuel Kant (Kant 1912–23) postulated that things-in-themselves are in principle unknowable; that what we really study is nothing but the world of phenomena; that reality cannot be built on custom alone; that causality is one of the categories of our mind; that we tend to chain up events and to formulate laws; and that causality is valid only in the world of phenomena, as opposed to the world-in-itself. But were it so, there would not be causality in history but only phenomenological investigation. Positivists such as Auguste Comte and John Stuart Mill then formulated four methods for discovering causality:

1 the method of identity (e.g. of two phenomena)

2 the method of difference (missing phenomenon 1 accompanied by absence of phenomenon 2)

3 the method of grouped changes (if it is not possible to remove a phenomenon, the changes are correlated)

4 the method of residuals (stepwise exclusion of several phenomena; suspect cause can be hidden in the remaining ones).

But the crisis of modern science warns us not to overestimate this understanding of causality. It makes us aware of the limits of reductionism even in natural science: we can search for causal relationships at certain levels of knowledge, but we are not able to find them among different levels, e.g. the psychological (mind), the biological (body), and the historical (society).

That is why contemporary science is openly searching for “markers,” as opposed to causes. Markers have predictive rather than explanatory power. Four main types of prediction can be seen to emerge:

1 a tautological (for example, “duration and severity of illness” predicts “bad prognosis”)

2 a heuristic (“fishing”; it often emerges as a “correlation” on endless sheets of print-out, with multiple regression analyses not primarily testing a specific hypothesis; it is characterized by the stateraent “we have also found…” which can be also understood as “we have caught…”)

3 a logical (models; e.g. the prediction of steady-state plasma drug concentrations accomplished by obtaining two blood samples after a single test dose)

4 an irrelevant one (mistakes; errors, e.g. when measuring normal volunteers using tools pertinent for pathology).

But tautological predictors are not causes. And heuristic predictions need an amount of data that is not, because of the time required, obtainable in the study of history. In addition, heuristic power does not prove causality. And logical models are not applicable in history. So I am afraid that the only type of prediction frequently used in history (4) is the irrelevant one.

We can, I think, conclude that since the methods used in natural science do not apply to the study of history, historical prediction is in practice far less reliable than in natural science. If there is causality in history, we have no tools to discover it.

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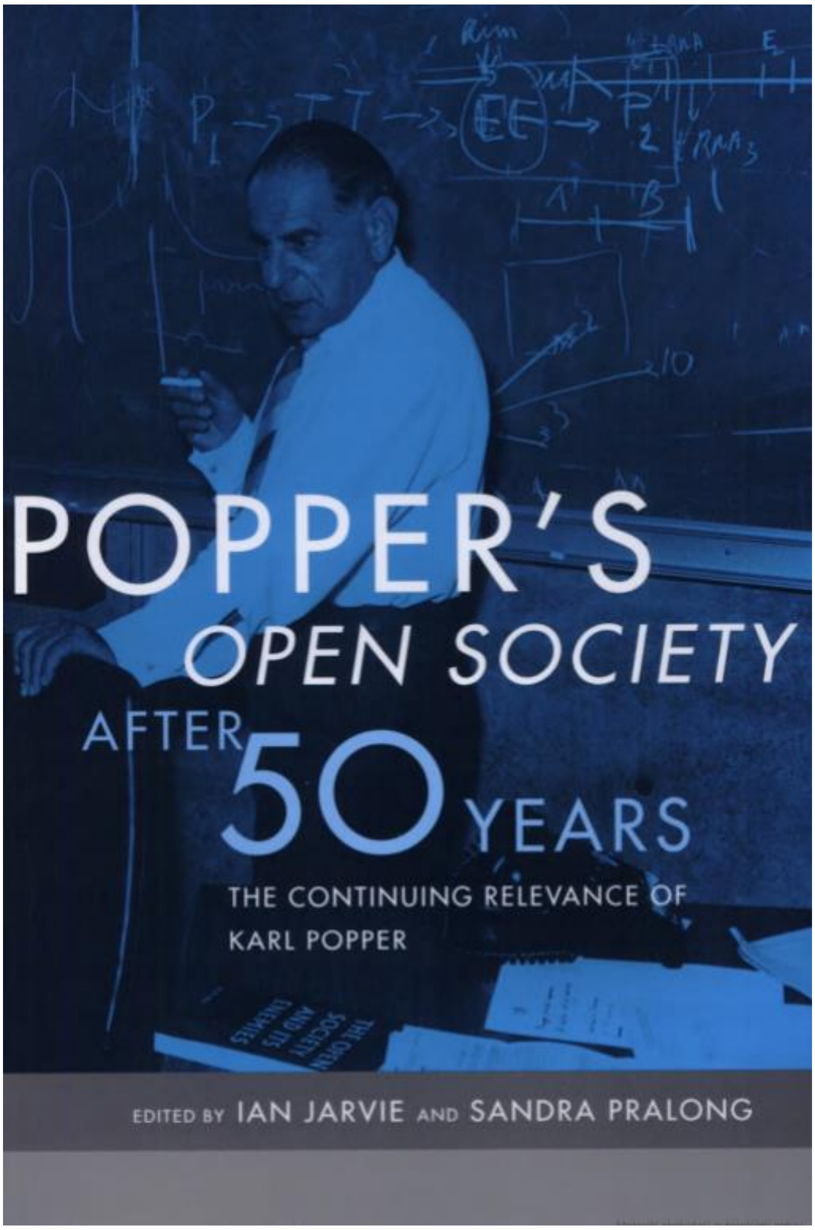

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