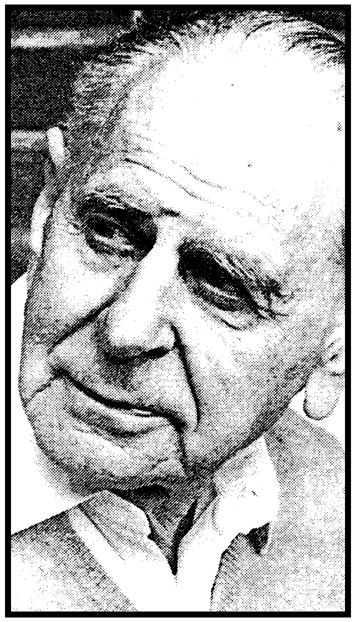
THE CRITICAL RATIONALISM OF KARL POPPER



KEVIN McFARLANE

Libertarian Alliance

Karl Popper is primarily a philosopher of science. That is, he is primarily interested in how our knowledge grows. He has a high regard for science and thinks that the best way to study the growth of knowledge is to study the growth of scientific knowledge.

His major interest in the philosophy of science started from his involvement with Marxism and psychoanalysis in his teens, and his discovery that Einstein's, then new, General Theory of Relativity had successfully predicted new phenomena which were not predicted by Newton's gravitation theory. It also turned out that general relativity could account for certain anomalies like the precession of Mercury's planetary orbit. What struck Popper was that a supposedly secure theory like Newtonian mechanics which had been "confirmed" millions of times over two and a half centuries had been overthrown by a new theory which could account for everything which Newton's did and more besides. Popper was impressed by two views of Einstein's. (1) Einstein regarded his theory as merely a step forward and one which would be replaced by a more comprehensive theory. (2) Einstein would regard his theory as refuted if it failed experimental tests. Popper was struck by the difference between Einstein's critical attitude and that of the Marx-ists and Freudians for whom every event was interpreted as being in accordance with their theories.

This led Popper to search for something which could be regarded as a defining or principal characteristic of science. As he saw it the scientific attitude was primarily the critical attitude. Scientific theories had to be subjected to or be subject to experimental tests which could refute the theory tested though they could never prove it. So he proposed falsifiability as a criterion of demarcation, initially, between science and pseudo-science and then, later, as a more general criterion between science and what he called "metaphysics". This is also related to Popper's solution of the problem of induction. So I will discuss this first, before coming back to the demarcation criterion.

INDUCTION

The problem of induction arises as the consequence of the fact that no number of singular observation statements can logically entail an unrestrictedly general statement. For example, no matter how many white swans I observe nothing can justify the conclusion that all swans are white. This is a fairly well accepted logical result. But what is perhaps not immediately apparent is that we cannot even say that *probably* all swans are white. This is because such a probability is always the ratio of a finite number of observations to an infinite number of observations (i.e. throughout all time and space).

Now science is primarily concerned with the discovery of universal laws with which we can explain existing facts and predict new ones. So if universal laws are unprovable and unprobabilifiable how can scientific knowledge progress? How can we weed out scientific theories which are unsatisfactory and how can we say which are the best ones? Popper's solution is to point to a logical asymmetry between verification and falsification. While no number of observations of white swans enables us to prove that all swans are white, a single observation of a black swan enables us to disprove it. Thus, while universal laws cannot be proved they can be disproved or falsified.

Philosophical Notes No. 16

ISSN 0267-7091 ISBN 1 85637 015 1

An occasional publication of the Libertarian Alliance, 25 Chapter Chambers, Esterbrooke Street, London SW1P 4NN
www.libertarian.co.uk email: admin@libertarian.co.uk

Kevin McFarlane is an engineer working in the offshore oil industry.

FOR LIFE, LIBERTY AND PROPERTY

THE DEMARCATION CRITERION

The logic of the situation shows that any empirically testable universal law is falsifiable. That is, experimental tests could possibly be at variance with it. But statements (such as: "It is raining or it is not raining") which, due to their syntactical form, are not falsifiable are not testable. Since scientific theories in the last resort do need to be tested (for they make assertions about the behaviour of the external world) Popper proposes falsifiability as a criterion of demarcation between science and non-science. (Historically, Popper wishes first to demarcate science from pseudoscience. But he later made his demarcation criterion more general by demarcating what he calls metaphysical theories from science. By Popper's definition mathematics also lies outside science.) The falsifiability criterion leads to the idea that science grows by a process of conjectures and refutations. Theories are proposed as solutions to existing problems. These theories are then rigorously tested. Those which fail the tests are refuted while those which pass the tests are "verified" or corroborated, that is, tentatively accepted until further tests cause us to revise our verdicts. While it cannot be said of a particular theory that it is true, it can be said that it is the best available, that it has stood up to all of its tests or that it has stood up to more of them than its rivals.

Another reason for the stress on falsifiability is that falsifiable statements possess informative content. A falsifiable statement rules out ways in which the universe could logically behave but does not. The statement "luck is possible in sporting speculation" is not falsifiable and does not tell us very much. Whereas "planets move in ellipses around the sun" is highly falsifiable, or testable, for it rules out orbits which are square or triangular. It also provides us with more information than the statement "planets move around the sun". The more falsifiable or testable a statement the more it prohibits or forbits and the more information it conveys. (Technically, Popper refers to degrees of testability, thus showing that, in practice, his demarcation criterion is more one of degree. Thus astrology is not completely untestable but its degree of testability is typically much less than that for ordinary scienfitic theories. Thus we could regard astrology and Freudian psychoanalysis as poor science rather than pseudo-science.)

Non-scientific theories are not meaningless nor uncriticisable. They may even be the precursors of scientific theories. Moreover, science makes use of metaphysical assumptions, e.g. determinism/indeterminism, neither of which concept is provable or disprovable though they may become so. For example, Bell's theorem in quantum mechanics rules out a certain class of deterministic theories. But it is unable to prohibit *all* deterministic theories.

Popper's concept of falsifiability can be developed into a more general approach which regards everything as criticisable, i.e., it holds that everything should be open to criticism. This is not the same as saying that everything can be *successfully* criticised. However, even statements which are technically irrefutable such as "it is raining or it is not raining" can nevertheless be criticised with regard to their suitability for solving whatever problems we may have. For example, if my problem is to find out what the weather will be like tomorrow then the statement "it is raining or it is not raining" can be criticised as a poor attempt at solving my problem.

A general reason for adopting this so-called "critical rationalist" approach is that we cannot know what we may have overlooked. Thus nobody should regard himself as infallible. If he does have the truth he should have nothing to fear from criticism. Though, psychologically, we have problems with admitting error.

EVOLUTIONISM AND THE GROWTH OF KNOWLEDGE

Popper regards the growth of knowledge as an evolutionary process and draws parallels with evolution by natural selection. In fact epistemological growth is an extension of this but occurring in World 3, the world of products of the human mind, rather than in World 1, the world of material objects, including living organisms. (World 2 is the world of conscious experiences.) Biological evolution works by trial and error. Animals evolve by adapting to their environment. They do this by, for example, developing new organs or by building structures outside their bodies. The evolution of consciousness can be seen as a way of minimising the costs of trial and error. The ability to reflect on possible courses of action enables us to reject certain possibilities without having physically to carry them out. Consciousness reduces the number of practical trials we need to make, thereby minimising the danger of our being physically destroyed. This ability is, of course, most highly developed in man. In developing a World 3 of objective criticisable theories we can allow our theories to die instead of us.

SOME CRITICISMS

Many critics find Popper's solution of the problem of induction unsatisfactory. They feel that in preferring an unrefuted theory to a refuted one for practical action we let in induction by the back door. They also feel that, as a matter of fact, some laws *are* arrived at by induction.

David Hume's postulation of the problem of induction has been devastating for philosophy. Just how devastating it has been can be seen in the fact that few philosophers think that it has been solved and probably most think that it is not solvable. There have been attempts at developing so-called "inductive logics" but these cannot escape the basic circularity involved in trying to give a "positive" solution to the problem of induction. "Positive", in this context, means trying to come up with some sort of probability of a universal law given the evidence. (Note that this procedure is perfectly satisfactory in finite sample spaces. For example, we are fully justified in assigning probabilities of various outcomes based on small samples in a finite outcome space, as is done in, say, opinion polls.)

Popper's solution, if it is a solution, is basically a *negative* solution from a purely epistemological point of view but it looks like a *positive* solution when it comes to practical action. And this is why it seems that he has not really solved it. Before examining whether this is really so it is worth describing Popper's methodology in more detail.

Popper's methodology originates from the logical truth that while no number of favourable observations can prove a universal statement true a single unfavourable observation is sufficient to refute it. However, the application of this principle in practice is not as simple as the principle itself suggests for the following reasons. In reality, observations are themselves theory-dependent and are not really "hard" facts. Experimental verdicts can be revoked by successfully criticising the theories upon which they are based. Also, the complexity of most theories precludes the *unequivocal* assignment of a falsifying statement to a specific part of a theory. This is why in Popper's methodology reference is made to the repeated testing of hypotheses and the decisions of scientists to "accept" (accept tentatively) certain statements as unproblematic.

Following Imre Lakatos' terminology[1] we can define three types of scientific acceptability. We accept$_1$ a theory into the body of science if it is bold, i.e. if it has excess empirical content over a theory it challenges. This is equivalent to saying that it predicts novel facts. (Einstein's gravitational theory was bold with respect to Newton's because, for example, it predicted that light rays should be bent by the sun's gravitational field.) The empirical content of a theory is its set of potential falsifiers, that is, the set of states of affairs which it forbids. The larger this set is the greater is the information which a theory conveys. A theory is only testable if it asserts statements which could possibly be false. If a theory T_2 has excess empirical content over a theory T_1 then it conveys excess information and can be considered "bold". However, this is not an asymmetrical relationship. T_1 may also have excess empirical content over T_2. T_2 supersedes T_1 epistemologically if and only if T_2 has excess empirical content over T_1 but not *vice versa.*

We accept$_2$ a theory into the body of science if it has *corroborated* excess empirical content over a rival theory. This means that not only does the theory predict novel facts but that at least some of these predicitions are confirmed (i.e., that they survive attempted refutations). It should be noticed that $acceptance_1$ and $acceptance_2$ have nothing to do with our belief in a theory. They are an indication of its informative content and explanatory power. We can $accept_1$ and $accept_2$ a theory even when the theory is currently false, which demonstrates the absurdity of conflating acceptance with belief. We $accept_1$ a theory because it tells us something new in relation to the extant body of science. We then try to make it $acceptable_2$ by testing its predictions. If some of these predictions are falsified but others corroborated the theory is still $acceptable_2$ because we have learnt something new about the world from it.

Acceptability is a measure of the reliability of a theory. It can be related to the concept of verisimilitude which is defined as the difference between the truth content and falsity content of a theory. The higher the verisimilitude of a theory the closer it is to the truth. (Actually, the quantification of verisimilitude is problematic. But it seems clear to me that one can assert qualitatively that relativity is closer to the truth than Newtonian mechanics because the former works for high energy particles whereas the latter does not.)

Popper accepts the concept of verisimilitude but not, as far as I know, that of reliability. Probably because it smacks of inductivism. How do we construct the concept of $acceptability_3$? Lakatos proposes the following procedure:[2]

> "... we take the extant 'body of science' and replace each refuted theory in it by a weaker unrefuted version. Thus we increase the putative verisimilitude of each theory, and turn the inconsistent body of scientific theories ($accepted_1$ and $accepted_2$) into a consistent body of $accepted_3$ theories, which we may call, since they can be recommended for use in technology, the 'body of technological theories'. Of course, some $accepted_3$ theories will not be $acceptable_1$ or $acceptable_2$ since we arrived at them by content-reducing stratagems; but here we do not aim at scientific growth but at reliability.
>
> "This simple model is a rational reconstruction of the actual practice of choosing the most reliable theory."[3]

Our estimate of reliability is an ordinal estimate rather than a cardinal one, that is, we say that theory T_2 is *more reliable than* theory T_1 based on a comparison of how well they have stood up to tests. Concerning the "absolute" reliability of theory T_2 we can say nothing, if it has no falsity content. Thus $acceptability_3$ is derived from $acceptability_1$ and $acceptability_2$.

Now, if one regards science as a game whose objective is to construct theories of progressively greater content one can merely follow Popper's rules and no "problem of induction" need arise. We simply grade theories objectively according to how well they have stood up to tests (which is a measure of their degree of corroboration). Thus Popper *has* solved the epistemological problem of induction. If, however, one wishes to call the choice of the best corroborated theory in a *practical* situation "rational" we immediately have a problem. For this implies that if a theory has failed a test it is irrational to use the theory again under the conditions specified in that test. So instances of past failure are being used to infer future failure. This looks suspiciously like induction. This is the so-called practical problem of induction which, it is alleged, Popper has failed to solve. In fact, what happens is that we act on the assumption that there are universal laws. The question is - is this inductive? Popper has made remarks such as the following:

> "... in so far as we *have* to choose it will be 'rational' to choose the best tested theory."[4]

and

> "Admittedly it is perfectly reasonable to believe that ... well-tested laws will continue to hold (since we have no better assumption to act upon), but it is also reasonable to believe that such a course of action will lead us at times into severe trouble."[5]

Since we do not know and cannot know that there are laws, precisely because induction is not valid, Popper says that the choice of the best-tested theory is "risky but rational".

Science does operate with the metaphysical belief that there are regularities which we are trying to find. And indeed it can do no other than this. If our goal is to find true universal statements then we *are* obliged to reject those ones which fail practical tests. Now it could be that there are no true universal statements but we cannot act on any other assumption. If science is not about searching for universal laws what else can it be about? Because of the logical situation falsifiability is the only means of exercising control over universal statements.

Consider an example. Suppose we are studying high energy particles (i.e., particles with velocities close to the speed of light). We have two theories to analyse their behaviour - special relativity and Newtonian mechanics. Newtonian mechanics does not work for velocities near that of light, i.e., it has not worked up until the present. Epistemologically, special relativity is the better-corroborated theory. But it is only a conjecture. It may fail the next time it is used. The particles may follow the rules of Newtonian mechanics on the next occasion despite the fact that in all tests up to the present they have done otherwise. Or the particles may follow one of an infinite number of possible sets of rules. Now, if we choose to use Newtonian mechanics this would, in effect, mean that we are deciding not to search for universal laws. For we would be using Newtonian mechanics in the knowledge that tests have shown that it has not worked in the past and this means that it cannot be universally valid. In fact we would be no more justified in using Newtonian mechanics than in using pure guesswork. For we would be rejecting the possibility that there may be laws and that the unrefuted special relativity *might* encapsulate or approximate these laws. If we *are* searching for laws then special relativity is, so far, consistent with our aims. But Newtonian mechanics is not. It is, therefore, rational to prefer special relativity to Newtonian mechanics for analysing the behaviour of high energy particles. If some people choose to call this inductive, well, we just have to say that it's inductive and rational.

Now in using special relativity we do assume that it will continue to hold. But we are well aware (due to the failure of Newtonian mechanics, for example) that it may break down at some point in the future. If special relativity were to break down under some future circumstances we would want to know why it worked under the conditions it had hitherto done. And we would want some new theory to account for this just as special relativity accounted for the fact that Newtonian mechanics had worked for low velocities. In this way we can at least get a qualitative ordering of theories in terms of their verisimilitude. It *is* rational to use the best-tested theory and, in fact, evolution works on this principle when organisms adapt to their environment, i.e., they adapt to what seem to them to be regularities. When these regularities no longer hold they are forced to adapt again or perish. This is not a perfect analogy at the level of the gene since we cannot suppose that genes act purposefully. But, say, a bird does, and here the analogy is more sound. When a bird lands on the ground it does not assume that the land will suddenly turn to water. Consequently it does not start trying to swim! It follows what seems to it to be the truth, namely that the ground will remain solid. So it walks.

THE RELATIONSHIP OF POPPER TO LIBERTARIANISM

Popper is fairly popular among libertarians. There is a link between competition among theories and competition in the market. In science theories compete in terms of verisimilitude or closeness to the truth. In the market companies compete to satisfy the consumers in better and better ways. As in the market there is nothing wrong with "dominance" provided it is open to competition (i.e., freedom of entry is permitted), so in science there is nothing wrong with powerful and dominant theories such as quantum mechanics provided that they are open to criticism. Both in science and in the market knowledge grows by trial and error.

Both follow the cyclic pattern, problem - tentative solution - error elimination - new problem. This can be abbreviated to P1-TS-EE-P2.

In science we start with a problem - trying to understand or explain some phenomenon. A trial corresponds to a new theory. The error elimination phase comprises logical and experimental criticism leading to the modification or refutation of the theory.

In the market, as producers, we start with a problem - how to satisfy existing consumer needs or how to create new ones which people want satisfied. A trial corresponds to supplying a relevant commodity and its profitability provides us with information on how successful we've been in meeting consumer satisfaction. The error elimination phase manifests itself in falling profits or losses. This either forces us to change our business practices or forces us out of business altogether.

Though Popper's critique of Marxism provides another link to libertarianism I don't think this explains his appeal. It's his overall methodology of critical rationalism which is attractive. He takes things like reason and truth seriously and he thinks we can find out what's going on by using our reason. Unlike certain other modern philosophers who seem to find concepts like "truth" and "reason" to be fatally flawed. While many feel that the concept of truth is problematic Popper argues that it is very simple and is really just commonsense. He follows Tarski's correspondence theory of truth: "The statement 'Grass is green' is true if and only if grass is green". Or, more generally, "the statement 'x' is true if and only if x". The idea of truth is very simple. It is just a one-to-one correspondence between a statement of fact and the fact itself. It is *discovering* truth which is the problem. People often confuse these two issues.

PRAXEOLOGY

Is Popperian empirical falsifiability applicable to economics? There is certainly no conflict with the *general* as opposed to the empirical critical rationalist approach. For, as Ludwig von Mises writes:[6]

> "There is no such thing as perfection in human knowledge ... The most elaborate theory that seems to satisfy completely our search for knowledge may one day be amended or supplanted by a new theory. Science does not give us absolute and final certainty. It only gives us assurance within the limits of our mental abilities and the prevailing state of scientific thought. A scientific system is but one station in an endlessly progressing search for knowledge."

But according to Mises economics can be constructed deductively from a handful of self-evident axioms pertaining to human action. Eamonn Butler provides a concise account in his review of Mises' thought.

> "The logical category of action, this idea of action by which the mind brings order to a certain part of our world, is the self-evident axiom from which a very considerable body of knowledge can be deduced. Once we have the concept of action, which is automarically built into our mental structure, we must have concepts of time (for action takes time), value (for actions aims at substituting one state for a preferred one), ends and means (for we may be prepared to sacrifice one thing in order to gain something we value more), success and failure (for the desired end may not be achieved), profit and loss (for what is gained may or may not be valued more than what is given up), regularity (we must have an idea that a certain action will be likely to achieve the desired end), of costs and marginal costs, and much more."[7]

We can certainly agree with Mises that eocnomics is predominantly a deductive system. However, it is not necessary to assume that what we regard as self-evident is immutable. We might be wrong about what we think is self-evident. The notion of absolute time seemed and probably seems to most people to be self-evident and yet it has been refuted by relativity. If we take the primary self-evident fact for economics, namely that man acts, it is conceivable that this could be otherwise. We could conceive of some technology which stops men from from acting and turns him into an automaton. If we tried to analyse a group of such men using economic theory we might find it to be inadequate. It should also be noted that we often have to make much more specific assumptions about a particular situation when we are applying some economic theory and we may be wrong about these auxiliary assumptions. Thomas Sowell provides a good illustration of this point in his book, *Markets and Minorities*.

> "In the case of British government regulation of voyage conditions among poor Irish immigrants in the 1840s, the 'law' improving voyage conditions was passed in 1847 ... If they [the immigrants] preferred the better conditions, at a higher fare entailed by the costs of creating improvements, then the volume of immigration immediately before the law went into effect would be expected to decline and to increase immediately afterward, as some immigrants rescheduled their voyages to acquire their preferred option ... If the immigrants preferred the lower fares to the improvement, then the volume of immigration immediately before the law went into effect would be expected to increase, and then to decline immediately afterward, as immigrants rescheduled their voyages to leave earlier and avoid the 'benefits' the government had created for them. This last pattern was what was in fact observed."[8]

This is a particularly good example from Sowell for it illuminates the assumptions we have to make about human purposes but which we often explicitly ignore. Although economic analysis is essentially as Mises describes it we can nevertheless use observations to tell us that something is wrong with the theory. If observations contradict the theory this might be because the logic is faulty or because the assumptions are. Now we often cannot see these faults until after some observations have been made, especially when the reasoning has been complex. Mathematics provides a good analogy here. In performing an abstract mathematical analysis we often substitute specific numbers for our general variables. The ensuing nonsensical results may then help us to see what is wrong with our analysis.

So there is some scope for an interplay between logical and empirical analysis in economics, certainly as regards checking the assumptions operative in particular instances. But here I have only just skimmed the surface. Hopefully others will be able to, or already have, shed some more light on this matter.

NOTES

1. See "Changes in the Problem of Inductive Logic" in Imre Lakatos, *Mathematics, Science and Epistemology*, Philosophical Papers, Volume 2, John Worrall and Gregory Currie (eds.), Cambridge University Press, 1980.
2. Ibid., p. 183.
3. In those cases where we use a false theory we do so where there is negligible difference, for practical purposes, between using the false theory and the best theory.
4. K. R. Popper, *Objective Knowledge*, Clarendon Press, Oxford, 1972, ch. 1.
5. K. R. Popper, *Conjectures and Refutations*, Routledge and Kegan Paul, London, 1963, p. 56.
6. Ludwig von Mises, *Human Action*, Third Edition, Contemporary Books, Chicago, 1963, p. 7.
7. Eamonn Butler, *Ludwig von Mises: Fountainhead of the Modern Microeconomics Revolution*, Gower, Aldershot and Brookfield, Vermont, 1988, p. 313.
8. Thomas Sowell, *Markets and Minorities*, Basil Blackwell, Oxford, 1981, p. 57.