Karl Popper – Introduction

Sir Karl Raimund Popper was born in Vienna on 28 July 1902. His rise from a modest background as an assistant cabinet maker and school teacher to one of the most influential theorists and leading philosophers was characteristically Austrian.

Popper commanded international audiences and conversation with him was an intellectual adventure - even if a little rough - animated by a myriad of philosophical problems. His intense desire to tear away at the veneer of falsity in pursuit of the truth lead him to contribute to a field of thought encompassing (among others) political theory, quantum mechanics, logic, scientific method and evolutionary theory.

Popper challenged some of the ruling orthodoxies of philosophy: logical positivism, Marxism, determinism and linguistic philosophy. He argued that there are no subject matters but only problems and our desire to solve them. He said that scientific theories cannot be verified but only tentatively refuted, and that the best philosophy is about profound problems, not word meanings.

Isaiah Berlin rightly said that Popper produced one of the most devastating refutations of Marxism. Through his ideas Popper promoted a critical ethos, a world in which the give and take of debate is highly esteemed in the precept that we are all infinitely ignorant, that we differ only in the little bits of knowledge that we do have, and that with some co-operative effort we may get nearer to the truth.

Nearly every first-year philosophy student knows that Popper regarded his solutions to the problems of induction and the demarcation of science from pseudo-science as his greatest contributions. So I would like to mention some other aspects of Popper's work that are sometimes neglected.

Popper's work is important not just to those who agree with his new bold solutions, but to everyone who recognizes the importance of the problems that Popper discovered, analysed and reformulated in a way that allows a solution. (Anyone who doubts the importance of "getting the question right", of revealing the web of sub-problems of a problem and their disparate connections to apparently unrelated domains, should consult the history of Andrew Wiles's proof of Fermat's last theorem.)

To take just three examples, the problems of verisimilitude, of probability (a life-long love of his), and of the relationship between the mind and body will never look the same now that Popper has made important progress in charting the intricate structure of these problems and in offering at least partial solutions. Yet there are books on the mind/body problem, for instance, that simply do not mention Popper's work (for more on this attempted "refutation by neglect", see the introductory reading list).

Popper was a Fellow of the Royal Society, Fellow of the British Academy, and Membre de l'Institute de France. He was an Honorary member of the Harvard Chapter of Phi Beta Kappa, and an Honorary Fellow of the London School of Economics, King's College London, and of Darwin College Cambridge. He was awarded prizes and honours throughout the world, including the Austrian Grand Decoration of Honour in Gold, the Lippincott Award of the American Political Science Association, and the Sonning Prize for merit in work which had furthered European civilization.

Karl Popper was knighted by Queen Elizabeth II in 1965 and invested by her with the Insignia of a Companion of Honour in 1982.

Sir Karl, who died on 17th September 1994, will continue to stimulate the best minds through his work, which now has a life of its own.

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The Separation of Science From Non-Science and Pseudo-Science and the General Problem of Rationality and Openness to Argument: A Critical Exposition

"I seem to have been only like a small boy playing on the sea-shore, diverting myself in now and then finding a smoother pebble or a prettier shell than the ordinary, whilst the great ocean of truth lay all undiscovered before me." Sir Isaac Newton.

1. The Problem of Induction & The Demarcation Problem

The universe is a place filled with wonderful but deeply mysterious structures and processes. Arguably, these can be understood as behaving in accord with universal laws. In any case, what makes for a scientific approach to delving into the mystery that surrounds us, and separates this from practises and theories that are not scientific? What makes Einstein's work scientific, but crystal ball gazing or tea-leaf interpretation unscientific? (The particular examples of pseudo-science that one might choose are irrelevant to the argument. A point missed by many commentators. Presumably there is such a thing as pseudo-science.)

Is there a criterion that we can apply to demarcate the scientific method from other approaches to knowledge, and that will help us to adjudicate between competing solutions to these mysteries? The question is not about which practise deserves the noble title "Science", but about the best method for promoting the growth of knowledge and the control of error. There may be a defensible argument that shows that tea-leaf interpretation or disciplined meditation on a candle-flame is the best method for discovering, say, the maximum radius of a black hole with a given mass, but I have yet to see one.

Before David Hume Treatise of Human Nature [1739], all approaches to knowledge had assumed that it was distinguishable from merely true opinion by the provision of some type of positive reason. They all assumed that the problem was to show that and how knowledge could be derived by a process of justification. The empiricists argued that all knowledge was derived from experience; while others argued that knowledge was derived from reason itself. But they all agreed that knowledge was Justified True Belief. The empiricists thought that our knowledge of the regularities and universal structures of the world were derived logically from experience or observations. But Hume pointed out that our experience is limited and that there is in fact no logical or even probabilistic connection between say, the number of times the sun has risen and whether it will rise tomorrow. His point was more general than that of the invalidity of inferring from past to future cases. His point was that one cannot sanction a logical or probable inference from observed cases to unobserved cases. Yet as an empiricist in the wider sense, one who advocates that our preference for a theory over another must take account of experience, Hume had revealed a profound problem with the usual account of how to obtain knowledge and its certification as knowledge. He had revealed a dramatic conflict between:

1. The assumption that there are universal laws and regularities and that we can know these.

2. There can be no valid reasons justifying our belief in a universal law other than those based on experience.

3. There is no valid inference from observed cases to unobserved cases. Yet, universal laws cover an infinite number of possible cases throughout the whole of space and time, and therefore necessarily go beyond all actual and possible experience.

This is the notorious problem of induction.

Popper wished to provide a solution to this problem that retained the respect for experience as adjudicator between competing theories and the assumption that if the world contains universal laws and structures then we can discover what they are. He proposed the complete rejection of the search for justifications and replaced this quest with the search for truth alone by the method of bold conjecture and refutation. Whether intentional or not, his proposal revived a hint in Plato's Meno that the possession of merely true opinion would serve one just as well for the satisfaction of curiosity and all practical purposes as the possession of the ostensively more dignified or useful "knowledge". To elaborate his argument Popper focused on scientific knowledge as the problem could be stated more clearly for this type of knowledge. Popper expressed his wish to characterize a heroic conception of science, a conception that captured the spirit and method of great scientists such as Galileo, Kepler, Newton, Einstein and Bohr. (Popper, [1974], The Philosophy of Karl Popper, Bk.II, Sections 5-8 of Replies to my Critics.) It must be understood that Popper's main concern in his philosophy of science is to account for and to promote the growth of knowledge. So that we may be able to chart better at least the contours of that vast ocean of truth that Newton spoke of. It is Popper's idea that such men made possible a tremendous growth of knowledge by championing bold ideas and subjecting them to severe attempts at refutation. Popper's criterion of demarcation is the outcome of a logical/methodological analysis of what has counted as bold ideas and severe criticism, and thus of what promoted the growth of knowledge.

2. The Immunizing Stratagem

In 1919 Popper's was provoked to the analysis of this bold risky approach of those scientists who had expanded our knowledge by his first hand experience of approaches that did the exact opposite: Marxism, Freudianism and Adlerianism. When they encountered attempted sound criticism, these theories were always able to deflect it. Karl Popper originally used the term "conventionalist stratagem" to describe this type of response to criticism, but then adopted the term "immunizing stratagem" from Hans Albert.

Popper argued that Marxism, which originally was an empirically testable theory, had been recast in the form of empirically irrefutable metaphysics. This manoeuvre, Popper argued, saved Marxism from refutation and immunized it against further attacks. (Popper, [1976], Unended Quest: An Intellectual Autobiography, page 43.)

Freudianism and Adlerianism were, Popper says, irrefutable from the beginning. The basic theory of Freudianism or Adlerianism does not need any immunization to make it irrefutable. (Nevertheless, it does incorporate immunizing stratagems.) Popper was for a short time both a Marxist and an Adlerian. Popper was in fact one of Adler's assistants in

the social guidance clinics that Adler had set up in the poor districts of Vienna to help children and young people. But Popper was struck by how any piece of behaviour could be interpreted according to either Freud's or Adler's theories. There was no describable piece of behaviour that would logically contradict the theory. The same was true of Marxism, within in its domain. Verifications where everywhere. Popper illustrates this with two very different pieces of behaviour. A man pushes a child into water with the intention of drowning it. In the second case, the man jumps into the water to save a child. For a Freudian, the first man is suffering from the repression of some part of his Oedipus complex; the second man had achieved sublimation. For the Adlerian, the first man was trying to overcome his inferiority complex by daring himself to murder the child; the second man is also trying to overcome his inferiority complex by daring to save the child.

Popper contrasted these two theories with the theories of Newton and of Einstein which were full of testable (i.e. falsifiable) content. Thus the term "immunizing stratagem" arose in connection with Popper's attempt to solve the problem of distinguishing scientific from pseudo-scientific theories - the so-called demarcation problem. Popper's solution was the methodological rule to allow into science only empirically falsifiable hypotheses, and subject these to severe criticism. In addition, theory development was to proceed from less to more testable, i.e., more informative theories. If a theory is refuted and an alternative sought, it had to be more testable, not less, and the more testable the better. For to reduce testability is to reduce knowledge, but in science we desire the growth of knowledge. An immunizing stratagem is a development in theory that reduces testability.

Popper begins with a rough characterization of bold ideas: a theory is bold if it is a new, daring, hypothesis. It is daring if it takes a large risk in being false. Popper argues that this risk can be analysed ultimately in terms of the amount of possibilities that the idea excludes, the degree to which it forbids states of affairs. Severe attempts at refutation are severe critical discussions and severe empirical tests.

Popper illustrates these ideas by examining the development of cosmology, from the heliocentric theories of Aristarchus and Copernicus to Einstein's general theory of relativity. Popper argues that this development illustrates not only the growth of knowledge but an improvement in method, in which theories become ever more daring and subject to severer tests.

It becomes apparent that riskiness and testability are linked: the greater the former the greater the latter. Aristarchus and Copernicus conjectured that the sun sat at the centre of the universe, in opposition to the prevalent earth-centred view of their own times. The heliocentric theory was exceptionally bold because it clashed with both common sense and the prima facie evidence of the senses. It went beyond the appearances to posit an unobserved reality; the appearances were explained in terms of this unfamiliar reality. This was bold in itself, for it broke with the Aristotelian idea that to explain something is to reduce it to the familiar.

However, Popper says, neither Aristarchus nor Copernicus were fully scientific because neither of them was bold enough to predict new observable appearances and thereby expose their theories to new empirical tests. They explained the known appearances, but did not explicitly suggest the existence of unknown appearances, appearances that might decide between the heliocentric and earth-centred views. If they had made such predictions their theories would have been much more informative, and therefore have taken a larger risk of being false, but they would also have promoted the growth of knowledge.

Kepler comes closer to Popper's idea of good science. Kepler had a bold theory of the world, but he also made detailed predictions of new appearances. Not only that, he abandoned many of his ideas in the light of the observations furnished him by Tycho Brahe. In accordance with a promise he had made Tycho, Kepler tried to fit Tycho's model of the solar system to these observations. Tycho accepted neither Copernicus's nor Ptolemy's model, but like all other astronomers Tycho took for granted their Aristotelian/Platonic assumption that orbits must be circular. Nevertheless, he subjected this idea to empirical testing. Kepler made seventy different trials to fit the model to the data and failed. He then took the bold step of proposing that the orbits of the planets were elliptical. The data fell snugly into place.

Kepler's three laws, though good approximations to the truth, have been refuted. But, Popper says, though false, Kepler's theory is regarded as scientific. Newton's theory is also regarded as false but scientific. Hence it is not truth which decides whether a theory is scientific. Why should this be? Each theory, though false, represented an attempt to increase knowledge, and did so because even though each was false, it had greater truth content than its predecessor and exposed itself to more tests. Popper's answer, then, is that it is a theory's openness to empirical refutation that makes it scientific. But more generally, it is whether the theory is an attempt to expand our knowledge, whether it represents an increase of information on the theory it replaces.

We may infer from this that Marxism or Freudianism would not be counted as unscientific simply because they have been refuted, but because of the way Marxists and Freudians have dealt with refutations. What is most important for the demarcation criterion is a critical attitude and the proposal of increasingly falsifiable theories in response to refutations. Kepler's elliptical orbit hypothesis represented just this sort of increase of information content in response to empirical refutation.

What impressed Popper most about the theory of relativity were the following characteristics:

1. Like Kepler's and Newton's theories, Einstein's theory was very bold, differing fundamentally from Newton's outlook.

2. Einstein derived from the theory three predictions of vastly different observable effects, two of which were radically new, all of which contradicted Newton's theory.1

3. Einstein explicitly declared in advance of the experimental tests of his theory, that they were crucial: if the results did not precisely match his predictions, he would abandon them as false.

4. Einstein regarded his theory as simply a better approximation to the truth. For a number of reasons he was convinced that it was false. He specified a number of characteristics that a true theory would have to satisfy. (Popper argued that Einstein's attitude to his theory clearly showed that belief in the truth of a theory was unnecessary to working on it as a promising candidate. It is worth noting, though, that Einstein believed that the theory was closer to the truth than its rivals; so it could not warrant the inference that belief is irrelevant to explaining why Einstein worked on the theory.)

Popper's proposal was that science was distinguished from pseudo-science by two things:

1. The boldness of predicting as yet unobserved phenomena; especially phenomena which will pit the theory against its competitors and allow us to decide between them. Einstein was acutely aware of the need to compare his theory with its competitors.

2. The boldness of looking for tests and refuting instances. (I would also add: the boldness of accepting refuting instances, which is not implied by the boldness of looking for them.)

We may generalize the methodological conclusions of Popper's investigation as follows:

1. Propound empirically testable theories;
2. Aim to refute them;
3. Given any theory T, aim to replace it by another theory T' which is more general and precise (i.e, has higher information content.2), one that explains the success of T, explains the refuting evidence of T and is moreover independently testable.
4. Popper later placed much more emphasis on the importance of non-empirical theories, while retaining empirical content as the ultimate goal of theory development. These are purely methodological rules. But there is also an historical thesis connected with it. It is Popper's conjecture that these ideals are responsible for some of the greatest leaps of man's scientific knowledge. Many commentators have confused Popper's methodological/normative analysis with his historical hypothesis. Kuhn is perhaps mostly responsible for this confusion, and others (for example, Boudon) have been lead astray by relying on secondary sources. Chalmers also makes this mistake.

It is worth emphasizing that there are two aspects to the demarcation criterion: one of attitude and one of pure logic. Firstly, the scientist must try to find falsifying instances to his theories. This is a matter of the correct attitude; the critical attitude. Secondly, the scientist must have at his disposal refutable theories. The possibility then arises of a scientist earnestly following the first injunction without realizing that the theory he is dealing with is empirically irrefutable. Equally, a body of theory may be logically capable of refutation, though its adherents have refused or neglected to look for refuting instances. Since Popper is interested in the growth of knowledge he is most concerned to discourage the use of immunizing stratagems that flout the demarcation criterion, effectively reducing the information content of our theories. (the term "information content" will be defined later.) Kepler, for instance, could have described the planets that did not fit his master's model as not really planets. After all, he might have said, planets do not behave like that: a planet is essentially an object with a circular orbit. This would have been an example of what Popper calls an immunizing stratagem. Such a manoeuvre, Popper would say, saves the theory but at the price of a reduction in information content. As we have seen Kepler's actual response greatly increased the informative content of astronomy, and is rightly admired for that.

Not all evasive moves are on the wrong side of the demarcation criterion. Some auxiliary hypotheses introduced to deflect a refutation from a valuable assumption have added greatly to our knowledge. One such auxiliary hypothesis was the prediction by Adams and Leverier of the existence of the planet Neptune. It had been observed that the orbit of the planet Uranus was not in accord with Newton's core theory (the laws of motion and the law of gravity) plus the then known initial conditions (ie assumptions about the gravitational influence of other planetary bodies). Newton's theory could have been regarded as

falsified by this anomaly. However, Adams and Leverier proposed the existence of a previously unknown planet to account for the failure of the predictions, thus saving Newton's theory. But this particular evasion brought increased information content to the Newtonian system as was clear from the fact that the hypothesis was empirically testable by independent means (i.e., not simply by checking whether the hypothesis agreed with the already observed perturbations of Uranus).

My point, contrary to Popper, is that "immunizing stratagems" are auxiliary hypotheses that are on the wrong side of the demarcation criterion and precisely those that while saving the original theory from refutation effectively abandon it, replacing it with another theory. In our hypothetical example, Kepler's redefinition of planets as essentially circular in orbit would introduce a radically new theory and jettison the original claim. I will expand on this point in a later section, after we have seen how Popper deals with the problem presented by metaphysical theories to his demarcation criterion.

3. Problems with the Demarcation Criterion and the Criticizability of Metaphysical Theories

Popper was from the beginning aware of several problems with his demarcation proposal, whose solution is very pertinent to the idea that ideologies such as Marxism and Freudianism are safe from empirical criticism. I argue that Marxism and Freudianism do not save themselves from empirical criticism by assuming metaphysical form, and that even in the absence of empirical criticism there is potential criticism from other metaphysical theories.

Popper realized as early as 1934, the year of the first edition of the Logic of Scientific Discovery, that a metaphysical idea can inspire the creation of an empirically testable theory. In that book he gave a number of examples, such as atomism (which inspired John Dalton's atomic theory which explained the regular proportions in which elements combine); the corpuscular theory of light (which inspired Planck's photon theory); and the theory of terrestrial motion. (Popper, [1934], Logic of Scientific Discovery, 9th impression, page 278.) However, Popper notes that he was not alive to the fact that metaphysical ideas are rationally arguable and in spite of being empirically irrefutable, criticizable. He refers the reader to the last section of his Postscript - The Open Universe - a fascinating elaboration of his metaphysical views. (cf. Ibid. page 206. footnote 2.) The boundary between science and non science is a vague one. More importantly for methodology, we may infer that a theory should not be discarded simply because it is metaphysical, for it may well inspire the formulation of a theory with more empirical content, one that can clash directly with experimental results. Many brilliant theories must begin their lives as half-baked, rough and ready formulations that flout the demarcation criterion. I infer from this that if the demarcation criterion were understood as a proscription on entertaining such ideas they would not have time to develop. I am unsure as to whether Popper would agree, but I suspect that the demarcation criterion is better understood as an ideal to strive for, simply because satisfying it brings more knowledge within our grasp.10

In 1957 Popper became very interested in the fact that Metaphysical theories could be not only inspiring, but also arguable and open to criticism. He argued that doctrines such as determinism that do not admit of empirical refutation are nevertheless open to criticism as to their effectiveness at solving the problem for which they were proposed. (Popper, [1958], "On the Status of Science and of Metaphysics", first published in Ratio 1, 1958, and is now chapter 8 of Conjectures and Refutations.)

In the light of this discussion I would like to suggest that the three methodological rules discussed in the previous section may be simplified by eliminating (1). Rule (3) takes into account the injunction to move from metaphysical speculations to empirically testable theories, as well as the injunction to move from less to more informative metaphysical theories. If it is accepted that what is important is the move from less to more informative theories, then interesting conclusions follow. For example, even if Marxism has been made into untestable metaphysics, it could be made testable again. Equally, Freudianism could be made testable. A Marxist or Freudian could be shown how their theories could be interpreted empirically and promptly refuted. This need not be as arbitrary as it seems. Even lovers of metaphysics are constrained in their speculations by a whole network of what they regard as background knowledge (which may consist of both empirical and metaphysical theories) and their problem situation.

Popper also realized that there is a rational function to resistance to criticism; one can be too sensitive to criticism. Clearly, if refutation is avoided at all cost, then one gives up science. But on the other hand, if a theory is abandoned too easily in the face of apparent refutation, then the theory has no opportunity to show its strengths, which may only become apparent later in the course of debate. Popper concludes that there is room in science for dogmatism, by which he means sticking to a theory even against very strong arguments. Moreover, it may require considerable debate to discover that what at first seemed purely metaphysical is actually empirical. The actual information and logical content of a theory is not only a conjectural matter, but is mostly unfathomable. The late physicist, Feynman, made a similar point when he stressed how difficult it is sometimes to work out how a new physical theory might be tested in the laboratory because it is often not even clear what, if any, empirical implications it has. Another example is Planck's reinterpretation of Kaufman's experiment of 1905, the result of which at the time was taken by everyone as bearing unfavorably on the Lorentz/Einstein theory and favorably on Abraham's classical theory of how an electron should behave in an electromagnetic field. Planck discovered that the failed Lorentz/Einstein prediction was no longer derivable from the theory if one were to reject an auxiliary assumption that both theories shared. We may draw the inference that the apparently "irrational" stubbornness of some ideologues may in some cases be scientifically rational. The refutation of a complex theory is not an obvious and mechanical procedure. Certainly, stubbornness per se is not irrational.

4. Empirical versus Metaphysical Criticism

But more to the point, it does look as though the ideologies most infamous for their apparent obstinacy in the face of criticism, take on a metaphysical form. Marx held that for all economies based on wage labour and a market in factors of production (i.e. capitalism) there is a tendency for monopolization of factors to increase and for an expansion and integration of workers' organization. When monopolization had created one supreme world employer, the workers would take over its administration and institute communism. Apparently, Marx thought the revolution was imminent, certainly within his lifetime. The Marxist, however, can always say, it is often said, that communism will arrive eventually: the tendencies to monopolization, he might protest, have been temporarily countered by opposing tendencies. Other utopian systems can escape direct refutation by making their prophecies apply to some eventual future rather than by putting a definite date on the coming of the new era. Can they be criticised in that form without first interpreting them empirically?

To clarify the logic of the sorts of systems we are talking about and the possible empirical criticism to which they could be put, let us take an example from chemistry. A classic

metaphysical sentence is: gold has an acidic solvent. This is an irrefutable statement, for however far and wide one looks for such an acid without finding it, it is always possible to say that it exists at some other time or place. So is experience, our strongest critic, irrelevant to this type of statement? Professor John Watkins has pointed out that experience can be brought in as a critic here indirectly via a well tested scientific theory which is directly testable. (Watkins, [1958].) The metaphysical sentence in question is in fact incompatible with the well tested theory that gold has no acidic solvent.

But is such an analysis relevant to the Marxist's attempt to evade criticism? Yes, for like the spatio-temporally unrestricted singular statement about gold, the Marxist's apology is also a spatio-temporally unrestricted singular statement. Both would require a systematic search of the whole of space and time for a direct empirical refutation (or alleged "confirmation"), which is obviously impossible. (Of course, the Marxist's assertion covers only future time, though it might be made to cover the past if he were desperate enough.)

A Marxist is unlikely to adopt such an unrestricted prediction, at least not at the time of writing. Such a position might emerge after innumerable attempts to evade criticism, perhaps taking 50 to 100 years to evolve. By that stage the moral of the apologist may well have sunk to an unrecoverable low. But even if a Marxist did resort to this desperate manoeuvre, he would still be open to an indirect empirical refutation. Ludwig Von Mises argued that without a price system, which communism would eliminate, there is no even equally adequate way to allocate resources. (Mises, [1935], "The Impossibility of Economic Calculation in the Socialist Commonwealthquot; , Reprinted in F. A. Hayek, ed. Collective Economic Planning.) Against the desperate hope in the possibility of communism Mises pitted economic theory, a theory which makes many detailed empirical predictions.

One might argue that economics does not make predictions of the same empirical precision as does chemistry. One might even argue that economics is not empirical at all, but a very suggestive and true metaphysical theory. The analogy with chemistry would then be weakened. But we can certainly say that economics has greater informative content than the Marxist's unrestricted singular prediction, and may still undermine the Marxist's case.

It is easy to assume that empirical observation is the strongest critic. The implication would be that if a network of ideas succeeds in shielding itself from empirical counter-evidence, it will have evaded, if not all sorts of criticism, at least the most damaging both psychologically and logically. This may not be true. An interesting possibility is that perhaps opposing metaphysical theories are sometimes of greater weight than empirical observations. Watkins has shown how metaphysical theories serve to filter out some possible theories before they even enter the body of science; these theories do not even get discussed because they conflict with the prevalent metaphysical background assumptions.

Watkins' discussion of the influential role of metaphysical doctrines ('haunted universe doctrines) is highly suggestive in this context:

...what informs and integrates the heterogeneous ideas of Augustine, or Bossuet, or Condorcet, or Burke, or Comte, or Marx is in each case a distinctive view of history which both shapes each of their interpretations of historical facts and suggests a certain kind of moral and political outlook....the moral-political suggestiveness of haunted universe doctrines indicates that large clashes of belief in the moral-political sphere need not have their origin in disagreement over moral principles or over observable facts. They may be

generated, partly or wholly, by conflicting metaphysical interpretations of the world. (Watkins J. W. N. [1958], "Confirmable and Influential Metaphysics." Mind 68.)
There are other methods of criticism that can be applied to metaphysical theories. Galileo suggests a charming way to criticise doctrines that fail to exclude rivals by empirical test. Galileo was able to report that his telescope showed that the Moon was not a perfectly smooth sphere as the Aristotelians expected, but was instead marked by craters and mountains. One of Galileo's adversaries tried to defend the Aristotelian doctrine by suggesting that an invisible substance filled up the craters and covered the mountains so that the Moon was actually spherical. When Galileo asked him how the substance was detectable, he said it was undetectable. Galileo responded by saying that he was quite prepared to accept the hypothesis of the invisible substance, but insisted that it was in fact piled up high on the mountains of the Moon in such a way that the Moon was even more uneven than the telescope could reveal.

Galileo's rejoinder allows one to see the inadequacy of the immunizing move, of making empirical testing irrelevant. The same type of rebuttal can be applied to conspiratorial theories that have assumed an empirically untestable form. For example, suppose some cynic asserts that all the set-backs in the workers' movement are instigated by undetectable groups of capitalists operating behind the scenes. One could counter this by saying that the set-backs are real and there are conspiratorial capitalist groups working against the workers' movement. However, their efforts are always unsuccessful, because they are always thwarted by undetectable renegade workers' groups who are the actual cause of the set-backs in the workers' movement. If the conspiratorial theory is successful on account of its lack of empirical testability, then the propagandist is prompted by the logic of his situation to try to counter the rival conspiratorial theory. But he can do this only by augmenting his theory with testable content.

We may conclude that even if an ideology assumes the form of a metaphysical doctrine it may yet be criticised, not only by unproblematically empirical theories, but also by scientifically acceptable metaphysical assumptions. The Marxist's retreat to unrestricted prediction, does not save his position from criticism, but only creates other grounds for criticism.

5. Critical Rationalism

Karl Popper's systematic attempt to demarcate science from pseudo-science had led him not only to a general solution for this, but had also forced him to the general problem of what counted as rational. Popper's answer to this problem is Critical Rationalism, which he expounds beautifully clearly in The Open Society and its Enemies. At its broadest interpretation it is an attitude: the attitude that says

"You may be right and I may be wrong, and with a little effort we may get nearer to the truth"
This is much more than it looks at first glance. It is bold in that it presumes that there is absolute truth and humble in that it assumes the universal possibility of error and ignorance. But it is bold also in assuming that there is a possibility of at least approximating the truth. It also calls for both co-operation and competition. We must work together in the process of creating ideas and criticising without restraint. Popper also held that we are literally infinitely ignorant and only differ in the little bits of knowledge that we do have, and that this strengthens the case for co-operation in the advancement of knowledge. Many would see this without also seeing that it completely explodes the notion

of "authoritative" or "expert" sources of knowledge in the sense that they can be relied upon to decree what is true or false.

6. Problems with Critical Rationalism

Residual Dogmatism in Popper's Work

However, Popper immediately saw that although Critical rationalism was superior to its rivals, there were problems with Critical Rationalism, which he attempts to deal with in The Open Society and its Enemies. Nevertheless, they were not resolved until W.W. Bartley had convinced him of a more general solution.

Bartley's major contribution is his theory of comprehensively critical rationalism, which was meant to resolve some internal problems of Popper's position on openness to criticism. Popper had championed the critical attitude, but there were unintentional dogmatic elements in Popper's presentation that Bartley successfully showed to be unnecessary. Henceforth all positions were open to criticism. Bartley had made the notion of criticism comprehensive. It is my task to eliminate the remaining dogmatic elements in Bartley's and Popper's system. Let us first see how Popper allows a dogmatic element into his theory.

Popper has asserted that

..no rational argument will have a rational effect on a man who does not want to adopt a rational attitude.
(Popper, [1945], [reprint, 1974], The Open Society and its Enemies, page 231.)

Popper arrives at this pessimistic position through a discussion of the relative merits of uncritical (or comprehensive) rationalism, critical rationalism, and irrationalism. Uncritical rationalism is the doctrine that all and only those positions that can be supported by argument or evidence should be accepted, the rest rejected. Popper points out that uncritical rationalism is in fact self undermining, since it cannot itself be defended by argument or evidence. Moreover, uncritical rationalism can be defeated by its own weapon, argument.

Popper generalizes the argument. Since every argument makes an inference from assumptions, it is impossible that all assumptions be based on argument. The impossibility arises because we would be involved in an infinite regress: each argument for an assumption would have to have an argument for each of its own assumptions.

The demand raised by many philosophers that we should start with no assumption whatever and never assume anything without 'sufficient reason', and even the weaker demand that we should start with a very small set of assumptions ('categories'), are both in this form inconsistent. For they themselves rest upon the truly colossal assumption that it is possible to start without, or with only a few assumptions, and still to obtain results that are worthwhile. (Ibid. p. 230.)

How does this argument lead to Popper's pessimistic position on argument against someone who does not want to be influenced by argument? Popper applies this general point to the problem of adopting a rational attitude.

The rationalist attitude is characterized by the importance it attaches to argument and experience. But neither logical argument nor experience can establish the rationalist attitude; for only those who are ready to consider argument or experience, and who have therefore adopted this attitude already, will be impressed by them. That is to say a rationalist attitude must first be adopted if any argument or experience is to be effective, and it cannot therefore be based on argument or experience. (And this is quite

independent of the question whether or not there exist any convincing arguments which favour the adoption of the rationalist attitude.) We have to conclude from this that no rational argument will have a rational effect on a man who does not want to adopt a rational attitude. (Ibid. p. 230.)

The adoption of the critical attitude then must be an "irrational faith in reason".

From the above quotations it can be seen that there are two aspects to the dogmatic residue in Popper's account: a logical/methodological aspect, and psychological/sociological aspect. However, Popper does not consistently separate the two. Clearly, one can specify a methodological rule to the effect that one maintain one's position in the face of all argument. Such a rule is logically consistent, and if scrupulously applied would mean that all criticism is ineffective. But Popper seems to think that if irrationalism is logically tenable then it must be psychologically tenable. Popper first says that the rationalist attitude must be adopted to make criticism effective, but then immediately retracts this implicitly by saying that this is independent of whether there are any convincing arguments for adopting rationalism. Is Popper saying that a convincing argument can fail to convince? If there are arguments that can persuade one to adopt the rationalist attitude in general, then one can be affected by rational argument without having first adopted the rationalist attitude. Popper could mean that there might be arguments in favour of the rationalist attitude that can strengthen this attitude only after one has made the faithful leap in adopting rationalism. But this is unclear.

7. The Deluxe Almost-Bug-Free Model: W. W. Bartley III and Comprehensively Critical Rationalism

Bartley wanted to develop a methodology that kept Popper's emphasis on the critical attitude, but which did not have to rely on Popper's "irrational faith" in reason. More generally, Bartley wanted a critical rationalism that avoided Fries's trilemma:

(1) infinite regress;
(2) vicious circularity;
(3) dogmatism.
Bartley showed that Fries's Trilemma is only a fatal problem for justificationism. Bartley successfully solved this logical/methodological problem by his arguments for comprehensively critical rationalism. Bartley's solution was to clearly distinguish between justificationism and criticism. Traditionally, criticism had been defined implicitly as an attempt to show that some position was unjustified. But, Bartley says, if justification is impossible and our primary interest is, and always has been, truth then it would make sense to define criticism with respect to the truth, not justification. We can then go on to define the rational attitude in a coherent manner that avoids (1) to (3). We may not be able to prove or justify our positions or our methodology itself, but we can nonetheless diligently search for the truth by keeping our positions as much open to criticism as possible. In response, Popper rejected his call for an "irrational faith" in reason. This was no longer necessary. (Popper's acceptance of Bartley's argument is recorded in his book Realism and the Aim of Science.) Thus, methodologically there was then no dogmatism in Popper's position. However, both Bartley and Popper have retained the psychological/sociological aspect of their residual dogmatism. There have been attempts to undermine Bartley's generalization at the logical level. However, see Miller's Critical Rationalism: A Re-Statement and Defence for a systematic rebuttal of all the main sorties.

8. Percival's General Patch: Residual Dogmatism in Bartley's Work.

The problem with rationality is presented for illustration by Bartley as an unresolved crisis of identity in contemporary rationalism that can be clearly analysed in terms of contemporary Protestant theological thought. Bartley argues that the Christian intellectual reaction to the failure of Protestant Liberalism is able to defend its retreat to commitment, its use of unargued faith, only because rationalism, with which it identifies itself, has admitted that it must itself appeal to unargued, unjustified assumptions. Bartley pictures the Christian saying to his conventional rationalist critic: why should I be moved by your demonstration that my faith cannot be justified; after all, you yourself must dogmatically accept some starting point. The fault as Bartley sees it, lies in the ubiquitous adherence to what he calls a justificationist metacontext. Argument and even criticism itself is generally understood as dependent on justifying some position. A criticism in this context is an attempt to show that a position cannot be justified. Bartley's proposed solution is to separate criticism from justification. In this way Fries's trilemma is avoided. All we need for rational argument is a willingness to keep our positions, all our positions, open to criticism. This method, of course, applies to itself. But this self applicability does not suffer the same problems that Popper attributes to uncritical rationalism. Neither does it suffer, like critical rationalism, from the need to rely on an ultimate terminus in argument. I would not want to suggest that Bartley's comprehensively critical rationalism is without its critics; it is in fact the subject of considerable debate, in which the principle figures have been Watkins and Post.

Bartley's analysis of the reaction to the failure of Protestant Liberalism serves to illustrate his answer to the main problem of his book:

"...what can be done to (systems of ideas), how can one tinker with them, to enhance or reduce their criticizability. In particular, the book is concerned with how men use ideas to protect ideas from competition, to remove them from the selective process that is the heart of criticism."
(Bartley, [1962/1984], The Retreat to Commitment, 2nd. edition. page xix.)
Bartley's general position on psychological/sociological openness to criticism is that

"ideologies are retained regardless of the facts; they are not abandoned when they clash with the facts; rather they die out or are eliminated, if at all, together with their carriers..."
(Ibid. pxvii.)
The claim is that there are networks of theories making certain claims about the world whose proponents continue to maintain and propagate them whatever facts are presented against them. This view is reminiscent of Planck's view of science. Planck held that new theories in science become accepted only because the proponents of the old theories die off, leaving it to the young generation of scientists to adopt and develop the new theories.

Bartley takes this as a rough and ready distinction that can easily be expanded to treat the main case study of his book, Protestantism and its successors. But this qualification does not repudiate the implication that humans are irrational. Indeed, Bartley begins with the assumption that humans are irrational:

"I do not for a moment believe that man is a rational animal, let alone that men are born with a 'faculty' of reason. Rather, rationality, like consciousness itself, is a comparatively late, and still rather rare, and, where it exists, fragile development. Most individuals exist in a troubled, slumbering fantasy world, and, when most awake, are bound by rigid habits

and unconscious patterns of behaviour. Comparatively few persons enjoy the give and take of criticism or think to any purpose other than to dominate."
(Ibid. page xxi.)
The rise of science on this view is a puzzle. Bartley recognizes this and attributes it to the influence of competition and imitation through the rise of open markets. It paid individuals to copy the exploratory, entrepreneurial behaviour of their more successful competitors in the provision of commodities. Reflecting critically on one's own behaviour to eliminate unsuccessful trials also allowed one to shift one's energies more quickly to meet consumer demand. These attitudes of exploration and self criticism became generalized, making science possible. This is what Popper and Bartley would call a situational analysis of the market and the rise of science. Bartley does not consider the possibility that the situational logic of the market may have been part of the genetic selection pressure acting on our ancestors; if he had he may not have dismissed so quickly the existence of a rational faculty. In any case, the same sort of analysis that Bartley applies to the emergence of rationality can be applied to ideologies to show that they are more open to criticism than Bartley or Popper suppose.

To see the "Percival's Patch" you will have to read my PhD thesis Openness To Argument,[1991] . I hope this adaptation has wetted your appetite for more.

9. Main Criticisms of Comprehensively Critical Rationalism and their Demolition

The following highly effective defusings and contained explosions of anti-CCR missiles are due to David Miller of the University of Warwick. Since Miller had already cleared the battlefield of all other dangers, in my PhD Thesis I focused my critical efforts on the last type of missile, Reinforced Dogmatisms.

The intitial exchanges of Bartley, Post and Watkins are usefully published in Bartley, [1987], Evolutionary Epistemology, Rationality, and the Sociology of Knowledge, eds. bartley and Radnitzky.
The main criticisms of C.C.R. are

(i) Trivial synthetic truths and tautologies are uncriticizable;
(ii) C.C.R. is paradoxical;
(iii) C.C.R. is committed to logic, which is uncriticizable;
(iv) Some doctrines are deliberately constructed so as to be uncriticizable (reinforced dogmatisms).
(i) Watkins contends that the statement "There exists at least one sentence written in English prior to the year two thousand that consists of precisely twenty two words." is uncriticizable because of its obvious truth. Another example is "I am more than 2 years old" said by a thirty year old man. Bartley's response to this is to claim that all he needs for his thesis is that it is logically possible to criticise any position. A clearer response is that of Miller, who argues that C.C.R. no more requires that any position be successfully criticizable than Popper's demarcation criterion demands that every scientific theory be successfully falsified. We have systematic methods of checking different sorts of claim; the fact that these methods apply to both difficult and easy cases is a consequence of the systematic nature of the methods and is no argument against their applicability. For example, that fact that the arithmetic sum "2+2=4" is easily checked is not a fault of the methods of arithmetic checks. I would add to Miller's point that the attempt to exclude trivial cases in a systematic would not only be impracticable but way may not even be possible; certainly, Watkins supplies no example of such methods. Besides, such methods would make Watkins's point self-undermining.

(ii) Both Watkins and Post have produced arguments in an attempt to show that C.C.R. is paradoxical. Both Post and Watkins's claim not that C.C.R. is not criticizable, but that the statement that C.C.R. is criticizable is not criticizable. Thus they show that a consequence of C.C.R. is uncriticizable. This latter statement is known as the C.C.R. generalization. Watkins's argument proceeds as follows.
(1) All propositions that are rationally acceptable are criticizable. (The C.C.R. generalization.)
C.C.R. is meant to be acceptable, so we also have
(2) (1) is rationally acceptable. Therefore (3) (1) is criticizable.

Suppose we have shown that (3) is false; then, given (2), we would have shown that (1) is false. This would amount to a criticism of (1). But since this is what (3) asserts, (3) would be true. Thus our initial assumption that (3) is false leads to absurdity, and therefore there is no valid argument that (3) is false, and so it must be analytic. (Watkins, [1971].)

Bartley responded by contending that C.C.R., properly interpreted, applies to people not statements alone. (Bartley, "The alleged Refutation of Pancritical Rationalism", Proceedings of the Eleventh International Conference on the unity of the Sciences, 1983, Vol.II, page 1158.) Watkins then devised another version taking this in to account, but he gave the argument a psychological twist: he took Bartley to be asserting that people are psychologically open to the criticism of any position. (Watkins, [1987], page 273.) Contrary to Watkins, it can be argued that Bartley's point is methodological.

A sustainable interpretation of Bartley's position is that given any problem and the position that is meant to be a solution to that problem, one can always develop a method for checking whether it is in fact a solution, without falling into inconsistency, vicious circularity, infinite regress, or dogmatism.

Post's argument is similar but uses only (1) and (3). The following is a compressed version of Post's argument, highlighting its general structure. Post argue that every criticism of (3) is a criticism of (1) - because (1) implies (3). But no criticism of (1) is a criticism of (3) because a criticism of (1) would verify (3). Thus every criticism of (3) is a non-criticism of (1); there is no criticism of (3). (Post, [1983].)

One response to both Post and Watkins, due to Miller, is to argue that a Comprehensively Critical Rationalist needs to assert that all positions are open to criticism, but he need not assert that they are open to criticism in every way. C.C.R. is not obliged to hold that every consequence of a criticizable position is itself criticizable. Miller draws an analogy with Popper's requirement that all scientific statements be potentially falsifiable. All empirically falsifiable statements are not made unfalsifiable by having unfalsifiable consequences. To expand on this, I would Admit that a theory may contain metaphysical elements that reduce the theory's overall falsifiability, but our methodology can without difficulty require that such elements be removed.

(iii) It might be thought that in order for C.C.R. to be applied at all it presupposes logic, and so is committed to logic in the sense that it holds logic above criticism. Bartley himself accepts this. I would argue that even if one requires logic to carry through an argument, this does not mean that one presupposes it. One might be trying to show that logic is faulty by actually using it, as one might try to test a machine or a programme by using it. (There are software packages that test an operating system, but that need the operating system to run. If there were only one way in which the operating system might fail and when it did

it always failed completely, such test-programs would tell you little. But like logic, an operating system can fail in many independent ways and not all of them are catastrophic failures.) If logic were faulty, which it is not, one might obtain from analogous tests (say, running attempted proofs in mathematics) a good hint as to exactly what rules of logic are leading us into error. (iv) The question of reinforced dogmatisms I partially dealt with above. For more see my PhD Thesis.

An Adaptation from my PhD Thesis. [1991], Dr Ray Scott Percival